# REPORTABLE CREATION

## Value, performance and risk measurement in financial reporting

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*Reportable Creation*
*Value, performance and risk measurement in financial reporting*

*Bericht over waardecreatie*
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To Ab de Jager,
who told me about windmills and more.

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# 1 Introduction

The future is in the present of financial reporting practices and it is there to stay. To attribute relevance to a financial report, the inclusion of estimates and other future-oriented information, and the relating infringement of reliability, are unavoidable. While estimates and other future-oriented information should be unbiased and based on enterprises' best beliefs, a sufficient basis for belief by investors and other users of financial statements should also be created and maintained.

The decrease in investor confidence in recent years that was related to financial reporting and to which standard setters and supervisory agents reacted with a mass of rules has many different roots. Some of those roots relate to astonishing and brutal misbehaviour, fraud and poor accounting processes, while others relate to situations where projections were not fulfilled and there were insufficient reserves to survive the disappointment.

The Enron case in 2001 is interesting to review in this respect. After having reported a loss for the third quarter of 2001 of USD 618 million, Enron announced a restatement of their financial statements for the period 1997 – 2000 and for the first two quarters of 2001. According to this restatement, the net income for 2000 should have been USD 847 million instead of USD 979 million (difference: 13%). Total assets at the end of 2000 should have been USD 64,775 million instead of USD 65,503 million (difference: 1%). Shareholders' equity at the end of 2000 should have been USD 10,306 million (ratio to total assets: 16%) instead of USD 11,470 million (ratio to total assets: 18%; difference: 10%). These downward adjustments are serious, but do not look lethal at first sight. Nevertheless, the dependence of Enron on its debt rating in order to have sufficient liquidity for doing business, combined with the reaction of the financial markets to the restatements and other facts revealed, made them file for voluntary bankruptcy under Chapter 11 of the US Bankruptcy Code in December 2001, after the intended takeover by Dynegy had failed. An important fact was that the greater part of the downward restatements was caused by Special Purpose Entities, for which Enron was not supposed (at least reported as such) to stand at risk for. This gave investors another perception view of Enron's risk profile in a market that was already troubled by so many dramatic events. Another five months later, the company reported an indicative loss in book value of USD 24 billion. This included an amount of about USD 14 billion that was attributed to the commencement of the Chapter 11 cases, causing reduced expected sales value, reduced expected value of assets and decisions to sell. The remainder related to downward price-risk adjustments, etc. In relation to these frightening amounts, it is interesting to know that Enron used a Value At Risk approach to manage and measure their risks. According to their external filing for 2000, there was a 5% probability that Enron would lose more than USD 66 million in one day because of movements in commodity prices. Likewise, there was a 5% probability of losing more than USD 59 million in one day because of movements in the value of merchant investments.

Really frightening in this story is the speed of the plunge. After filing the third quarter figures and the restatements, the company had no liquidity or solvency buffers to continue its business and the financial markets punished Enron severely for misrepresenting value and risk. Consequently, they were no longer prepared to supply Enron with the funds necessary to continue doing business. This made the measurement of balance sheet items such as investments, goodwill and property, plant and equipment no longer true, and thus destroyed the value that such assets had on a going concern basis. But the largest problem was that Enron had risk exposures that exceeded the financial strength of the company by far and that the magnitude of this problem (only partly caused by the fact that certain exposures were erroneously kept off balance for accounting purposes) became visible at the moment when the losses on these exposures were measured. In this respect, risk management focused to a large extent on “looking good in financial reporting” rather than on economic positions. This sends a message about management’s attitude, but also about rule-based (or better said incident-based) financial reporting.

Furthermore, the total losses in relation to the Value at Risk (VAR) metrics raise a question: was a one-day VAR inadequate because the nature of the exposures made it impossible to close them within one day or was the cash to close the positions unavailable and did Enron become a rudderless ship in the turmoil of that time?

So in summary: a restatement of the financial statements with an impact on shareholders’ equity of USD 1.2 billion and a loss in book value within 5 months of USD 24 billion (i.e. 20 times the restatement). The question of whether the value that had been forfeited in April 2002 was already non-existent by November 2001 or might have been preserved if confidence could have been restored by clearly demonstrating the still existing value in relation to the factual risks and volatility cannot be answered. This is highly unsatisfactory. No doubt, management behaviour contributed to the lack of investor confidence. However, much has been said and written on this subject; I want to set it aside for this study and focus on the ability and inherent limitations of financial reporting to demonstrate value and changes therein, or at least to provide value-relevant information.

Before proceeding, it is useful to address some concepts that are needed to explain the definition of the problem that I intend to discuss.

- Value: for the purpose of this study, I consider *value* to be a function of future cash flows. Chapters 2 and 3 further elaborate on why and under what conditions this is a reasonable proxy.
- Projection: since future cash flows are unknown, *projections* are made to support value measurements (either implicitly by the market or explicitly by analysts or valuators).
- Estimate: such cash flow projections may support the value of an enterprise, but also the *estimates* of certain balances (such as the fair value of an asset) in the financial statements of an enterprise.
- Volatility: since value is based on uncertain future developments, it may not develop as expected and it may not produce the expected yield. The tendency of value to rise and fall, respectively the variance in returns, is called *volatility*. Volatility is often measured as the standard deviation of observed values or yields.
- Variability: accounting estimates are often presented in financial statements as one single value. However, because eventually they are based on future cash flow projections, a range of acceptable values can be specified. The wider this range, the greater the *variability* of the accounting estimate.

Financial reporting is primarily a communication vehicle between the management of an enterprise (the agent) and users, who often have some (financial) interest in the enterprise. It is interesting to know how the relationship between enterprise and users of financial reports evolved over time. The first four research questions relate to this subject.

Somewhere back in time, people or institutions must have started to keep valuable assets in custody for other people or institutions.

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|---|---|
| 1 | What need for information is created by entrusting values to another party and how did the recording and providing of information develop? |

In addition, somewhere back in time, people or institutions must have started to use resources supplied by other people or institutions in order to meet a certain objective, or to create value for the benefit of those people or institutions.

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|---|---|
| 2 | What additional need for information was created by the use of values entrusted by another party to meet a certain objective, or to create value, and how did the recording and providing of the information in question develop? |

The words "to meet some objective, respectively to create value" unveil two dimensions. The first is value.

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| 3 | How did thinking about (reportable) value develop in relation to the dimension of risk and uncertainty? |

The second is uncertainty. Resources are made available at a certain moment. The objective to be met and the value to be created are in the future and consequently are surrounded by uncertainty. Volatility and variability are a consequence of uncertainty as defined above.

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| 4 | How did mankind deal with uncertainty in decision-making and how was information about this uncertainty recorded and provided? |

Looking at present-day financial reporting, two additional questions can be raised.

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| 5 | What value-relevant and volatility-relevant information has present-days financial reporting to offer? |

In present-day financial reporting, there is often a tension between relevance and reliability of information that will be further explained in chapter 2.

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| 6 | What effect does the often-made trade-off between relevance and reliability of information have on the demonstration of value and volatility by the enterprise? |

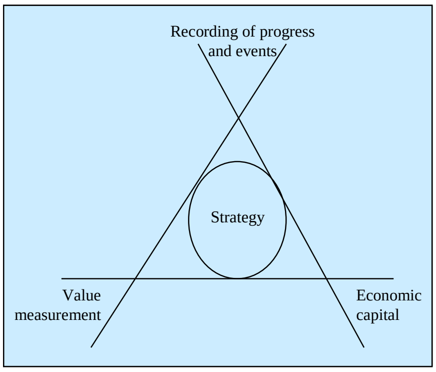
All these questions can be directed to the following central theme:

*How can financial reporting help to understand the variability of financial statement measurements and the volatility of future cash flow projections, and how could it help with forming conclusions on the financial position of an enterprise in relation to this variability and volatility.*

This theme is discussed with the aid of analyses, structured models and examples, as well as some limited empirical illustrations.

My starting point is a single-frame financial reporting triplet[1] shown in Figure 1-1, that is driven by the enterprise's strategy. This one-framework approach means that there is no separate framework for internal management information, external reporting and solvency evaluation (which may be required for regulatory purposes or for capital protection).

**Figure 1-1: Financial reporting triplet**




The key to this financial reporting triplet for generating relevant financial information can be captured in one sentence:

*Believe in your own strategy with all your heart, translate it into currency, measure and report this currency at each stage of completion of your strategy and gather sufficient resources to meet your commitments, even under stressful circumstances.*

At first sight, this approach appears to be naïve as regards external financial reporting, because of its high level of subjectivity. But is it? The best management's best estimates in financial reporting are the ones that originate from the enterprise's strategy and intentions, because they are driven by processes that have been designed to convert strategy into reality. Given proper gauges within those processes, the stage of completion of meeting the strategy can be measured objectively, and the credibility of earlier estimates can be demonstrated. Finally, the level of economic capital that is sufficient to meet an enterprise's commitments under most circumstances tells something about the downward risk in management's best estimates, i.e. about reliability. If reliability could be reported objectively and in a way that the user of financial statements understood, a trade-off between relevance and reliability would no longer be necessary; reliability would be a reporting object in itself. This raises the two final questions that drive this study.

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| 7 | What systems can be developed to record value in a systematic way? |

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|---|---|
| 8 | What systems can be developed to record risk in a systematic way? |

The challenge is to develop systems that make value and risk/volatility subject to the discipline of an accounting system that is fed from an enterprise's business processes and that has the checks and balances that are regularly embedded in accounting systems. The purpose of such systems is to improve the quality of reporting on value and risk/volatility and to reduce subjectivity.

Three concepts are described and analysed in this study.

- The first basically consists of the best that present day financial reporting rules have to offer, i.e.:

[1] The word "triplet" in the context of a simple single-frame like this was first used by R. Cooper in: When Lean Enterprises Collide (survival triplet).

    - The robustness and objectivity of *recorded* historical events and transactions, based on cash flows or cash flows that are adjusted for operating noise. They should be presented in a prescribed format that is consistent with the format of disclosures on future projections.
    - The addition of relevance to this historical record by an *explanation* of trends, deviations from earlier estimates, etc., for the purpose of providing insight into the performance of operations, credibility of earlier projections and volatility of the cash flows from operations.
    - *Projections* (of cash flows, revenues, expenses) that are relevant to the user of financial statements, with both the value and the volatility element as reporting topics. These projections could form part of the disclosures, be used in measurement considerations (e.g. impairment of assets) or be directly used in accounting estimates (e.g. provisions, lifetime of tangible assets).

  I christen this concept financial REPorting, where the R, E and P stand for Record, Explain and Project respectively, as described above. Basically, there are no elements in this concept that do not currently exist in financial reporting. However, the separation of information that is relevant to stewardship (how have stakeholder contributions been spent, what is the stage of completion of earlier reported strategy and intentions) from future-oriented, value-relevant information, as well as a more prominent place for information on risk/volatility, increases transparency and puts the user in a better position to attach his own belief to projections and to involve his own attitude to risk.
- The second supports the permanent recording of value in order to support the explanation of the movement in value projections from one period to another. This recording concept has great similarities with the way inventories are accounted for, where each transaction and event is recorded on a consistent basis (purchases, sales, loss, obsolescence, etc.). Hence, the movements in inventories are explained down to the smallest detail, which leads to better control and adds to the reliability of financial reporting. I analyse the possibility to record value by considering it as a stock of future cash flows. By analogy with the expression *perpetual inventory* recording method (Anthony 1970, p. 71) with respect to inventories, I christen the permanent recording of stocks of future cash flows *perpetual value* recording method.
- Future cash flows can only be estimated with a certain degree of precision; the degree of precision is relevant to the user of financial statements. In order to provide a robust underpinning of this information for the user, I analyse the possibility to record (in addition to event-by-event recording of the stock of estimated cash flows) the development of the risk and volatility dimension of the future cash flow estimates on an event-by-event and transaction-by-transaction basis. Such a *perpetual risk* recording method helps with analysing the causes of movements in the size of risk and volatility indicators and may improve the disclosures of risk and volatility. Such an improvement may diminish the gap between the user's perception of risk and volatility and the picture that is justified by the facts. Under certain circumstances, this gap is value-destructive.

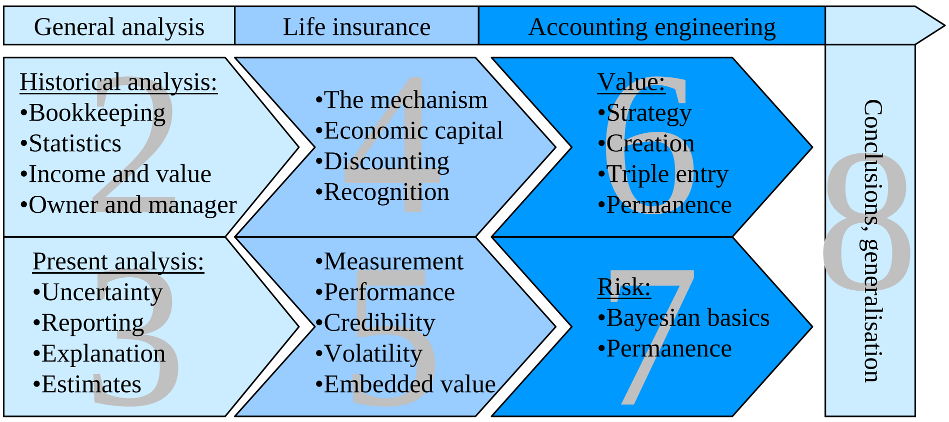
The detailed analyses in this study focus on the life insurance industry. More than other industries, the insurance industry has a tradition of dealing with complex financial reporting estimates that are based on cash flow projections (often long-term ones). Furthermore, this industry has a tradition of measuring risk exposures and taking into account the consequences of solvency requirements in order to protect the interests of stakeholders. Initiatives such as

Solvency II for insurance enterprises by the European Union seek more and more solvency measures that are based on holistic risk considerations, are sufficiently related to an enterprise's risk management and control system, and are subject to market discipline because of the requirement to make public disclosures. In the same timeframe in which Solvency II will be developed, the International Accounting Standards Board (IASB) is designing measurement rules for assets and liabilities relating to insurance contracts. These developments taken together present both a need and an opportunity to direct the theme of this study to insurance enterprises and to investigate the extent to which financial reporting measurements that are based on future cash flow estimates and the variability of those estimates fit in one reporting framework.

Life insurance has been chosen above other forms of insurance because the basic model (life or death) is simpler than any other business model and because methods to estimate and evaluate future cash flows (e.g. embedded value) already exist to some extent.

Figure 1-2 shows the outline of this study. It addresses bookkeeping/accounting, because this is historically the basis for financial reporting. It also addresses certain mathematical/statistical aspects of predicting and valuing future events that are necessary to understand future cash flow projections. The challenge is to combine the robustness of the bookkeeping systems that have been developed throughout the centuries with the relevance of mathematical/statistical projection models.

**Figure 1-2: Outline of the study**




**Chapters 2 and 3** are general inquiries and analyses.

*Chapter 2* is primarily about history. It describes the development in the relationship between business partners and between agent and principal. It also describes the development in recording historical events with a quantitative or financial consequence for the bookkeeping methods we know today. Chapter 2 addresses Pacioli's *Summa*, the border-crossing renaissance work on bookkeeping and mathematics. Since bookkeeping supports the reporting of historical events and financial mathematics support estimates of future developments (e.g. cash flows), it is worthwhile examining to what extent Pacioli's treatise has eventually lead to the concepts and principles underlying contemporary financial reporting. The developments in bookkeeping (section 2.1) and the relevant mathematics for future estimates (section 2.2), including the effect that utility may have, are both followed over time.

Pacioli's Summa was written at a time when most ventures were initiated for one occasion. At the start, parties invested cash; at the end, they distributed the cash available at the time. The difference from the original investment has been described by Schmalenbach as *totalgewinn* or lifetime profit[2]. In such a situation, no regard has to be paid to the measurement of assets and liabilities at a certain date or to the value of the venture (e.g. when ownership has to be transferred). This changed when ventures were initiated for an indefinite period. Thinking about value and (period) income then developed. Section 2.3 describes this. In this section, a purified value concept is described by assuming perfect foresight. Section 2.4 describes the example of the Vereenigde Oostindische Compagnie (United East India Company) for the purpose of investigating how the measurement and estimation problem was dealt with in period financial reporting.

Because it is reasonable to assume that the application of financial mathematics for solving measurement problems in financial reporting were first applied in the insurance business, section 2.5 briefly describes early risk management, accounting and reporting methods in insurance.

Finally, section 2.6 addresses the "why" behind financial reporting from the perspective of the agent that is accountable to its principal, and the developments in thinking about financial reporting concepts and rules.

Cash flow and *lifetime profit,* which are inherently unambiguous concepts, and value, which is an unambiguous concept given perfect foresight, are dealt with in *chapter 3*. A structured case study is used to investigate the influence of uncertainty. I use this analysis to search for the reasons why financial reporting has developed from the recording of historical events that are supplemented by measurements subject to uncertainty, rather than a development from the analysis of future events that is supplemented by validation from experience.

Special attention is paid to the influence of price fluctuations, because its treatment had a prominent place in the previous century's literature on financial reporting. The question is whether price fluctuations need separate treatment in a financial reporting framework or whether they are just one of the factors that could influence value and volatility.
In this chapter, I also investigate whether the present practices of reporting on historical events, disclosures and explanations can be structured to form one harmonised financial reporting concept.

**Chapters 4 and 5** focus specifically on life insurance.

*Chapter 4* explains how life insurance works, again by using a structured example. Although this example is highly simplified, it is good enough to explain the main issues that life insurance enterprises face. It addresses the application of the law of large numbers that enables insurers to

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2 G.W. Murphy and K.S. Most (1980) translated *totalgewinn* as total accounting (of results). In my opinion, lifetime profit reflects the meaning of the word *totalgewinn* better.

“manufacture” individually unacceptable risks into a combined acceptable and manageable risk, but also describes the effect of trends (in survival probabilities).
Chapter 4 additionally explains why options and guarantees within insurance products that have only a downside for the enterprise are costs rather than only a source of risk. Section 4.2 shows the effect of risk positions and hedging on the required economic capital.
Furthermore, the chapter deals with the issue of allocating the results relating to an insurance contract (which often has a lifetime of several decades during which the knowledge about the actual result is limited) to a single financial period. This has two dimensions. The first is the question of whether life insurance liabilities should include a prudence margin and, if so, how should such a margin be estimated (section 4.5). The second concerns profit recognition. Is there a reason to treat this for life insurance enterprises differently from all other enterprises (section 4.6)?

*Chapter 5* describes life insurance in real life. It analyses the present practices of recognition and measurement applying to life insurance contracts (section 5.1) and highlights the main issues in the development of rethinking recognition and measurement by the IASB. Again, it searches for an answer to the question of how to deal with risk/profit margins that are included in the premium for a life insurance contract.
Via the present practices of performance disclosure, credibility of estimates and volatility to external influences (section 5.2), as well as the projection of future cash flows relating to “policies in stock” (embedded value: section 5.3), this chapter attempts to find an application for the general concept of seamlessly recording, explaining and projecting defined in chapter 3.

**Chapters 6 and 7** address the accounting engineering relating to the financial REPorting concept designed in chapters 3 and 5. Accounting engineering encompasses the models and methods that are used to record, classify and group transactions and events that have a value and/or risk impact, in order to make them reportable in a sufficiently robust way.

*Chapter 6* starts with strategy and the way this can be translated for life insurance enterprises into key performance indicators (section 6.1). Strategy is about adding sustainable (shareholder) value. As it is found in the previous chapters, that value is related to the future (i.e. future cash flows) rather than to past developments, I looked for a recording concept that addresses the future and I found this in Ijiri’s triple entry accounting (section 6.2). In section 6.3, I modify Ijiri’s concept to bring embedded value into the planning, recording and control cycle of a life insurance enterprise. Again using a structured example, I investigate the possibilities of treating the future cash flows that underpin embedded value as stock and of creating a “sub-ledger” that treats each unique cash flow as a separate stock item. Each event relating to the purchase, creation, use, loss or revaluation of a stock item can then be recorded. Such a *perpetual value* recording method leads to better control, better analysis and better learning to support future cash flow projections.

Although *chapter 7* describes just an explorative desk study, it is perhaps the most challenging chapter. It attempts to create a *perpetual risk* recording method in addition to *perpetual value recording* designed in chapter 6. Such a method would systematically record and gauge all transactions and events that affect the risk profile of an enterprise and the related volatility. With a method like this, there would be permanent insight into the economic capital required and knowledge about which transactions and events lead to creation, mitigation or re-measurement of

risk. It would also finally eliminate any need for the trade-off between reliability and relevance in financial reporting; reliability itself would be a reportable measure.
Chapter 7 uses Bayesian statistics, because it looks like bookkeeping. It evaluates the impact of each transaction or event in order to restate the probability of a certain event (or a certain value range). The chapter provides an illustration by using a Bayesian model originating from statistical sampling in auditing (the Felix & Grimlund model) and issues a challenge to researchers into accounting and financial mathematics to investigate this area further.

**Chapter 8** summarises and evaluates the previous chapters and briefly discusses the potential and the need to apply the developed concepts of *Financial REPorting*, *perpetual value recording* and *perpetual risk recording* to other types of enterprises.

# 2 An inquiry into the history of bookkeeping, guessing and financial reporting

Many writers on financial reporting have started their treatise with a historical overview. For example, E. Schmalenbach (1926) in his work *Dynamische Bilanz* has provided a robust historical underpinning for his theory, going back to the 15th century, when reporting on financial events became important in Western Europe for the first time.

A very high level look from ancient history to early twenty-first century financial reporting shows the development from records that were no more than a description of historical facts, unvalued and not totalled, to complex records translating all elements to one (monetary) value base and summarising them to equity and result. It shows the development from ancient ledgers, which were sufficient to contain the transactions for several decades to masses of daily transactions, which cannot be kept in any manual record anymore.

The most intriguing development is that an element of future prediction of cash flows in addition to a historical description of financial facts has gradually slipped into financial reporting. This has to be ascribed to the needs of the user of financial information to support his economic decisions in a more and more dynamic environment. The Framework for the Preparation and Presentation of Financial Statements (Framework) of the International Accounting Standards Board (IASB) states following about this:

The economic decisions that are taken by users of financial statements require an evaluation of the ability of an enterprise to generate cash and cash equivalents and of the timing and uncertainty of their generation.

N. Mottershead (2002) states in his draft for a (FASB) principles-based approach to US standard setting:

The lifeblood of the United States capital markets is financial information that is:

1 comparable from firm to firm;
2 relevant to investment and financial decisions;
3 a reliable and faithful depiction of economic reality; and:
4 neutral, favouring neither supplier nor user of capital; neither buyer nor seller of securities.

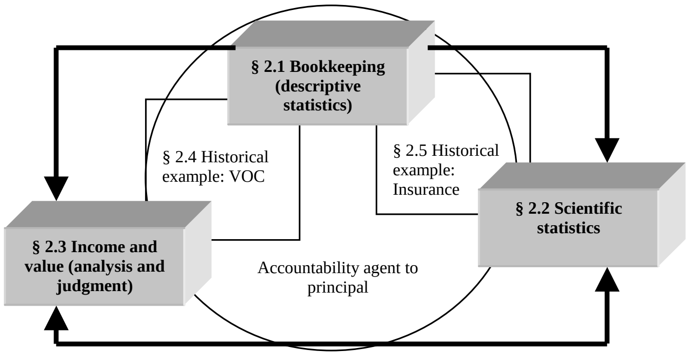
The main purpose of my historical inquiry is to investigate how and where future estimates formally became an element of financial reporting. The following three questions are relevant:

1 How did bookkeeping develop over time?
2 How did mankind develop its views on uncertainty over time?
3 Was financial reporting ever formally invented? If so, when?

In order to distinguish financial reporting from bookkeeping, it is interesting to look at the description given by J.G. Stridiron (1943), who describes bookkeeping as the systematic, routine-based recording of financial events in accordance with predetermined rules and schedules. In fact, as he states on page 31 of his *Handboek der Bedrijfseconomische Statistiek*, creativity and improvising skills are often redundant for bookkeepers “as the accountant adds the real creative element". Stridiron's book is a treatise on statistics rather than financial reporting. However, his definition of descriptive statistics, being "the collection of the original measurements and the presentation thereon", is very similar to his vision of bookkeeping. In fact, bookkeeping is a well-developed system of descriptive statistics, largely due to its built-in checks and balances.

The relationship between theoretical statistics (Stridiron describes this as the ordering of the descriptive statistics, the explanation of trends and relations and the statistical projections) and financial reporting has never been made very explicit. "Why not?" is a question that can be added to the ones stated above.

The road map of this chapter can be sketched as follows:




In section 2.1 a brief historical overview is given of the history of the use of systematic financial records.

Section 2.2 discusses the development in the way people treated and experienced aleatory arrangements, the attempts to measure risk and elements of utility of risk.

In section 2.3, income and value are defined.

In section 2.4, the financial records of the United East Indian Company are described as a historical example of bookkeeping, and in section 2.5, a brief description of the development of insurance business is given as a historical example of bookkeeping and risk measurement in practice.

Section 2.6 presents some thinking that has developed in the past century about the relationship between the principal (who entrusts his values) and the agent (who manages these values, often in an enterprise).

## 2.1 Prologue

It seems that accounting records already existed before formal script and numerical systems existed. Mattessich (1995, page 16) describes a method applied around 8000 BC in the area of the Euphrates and the Tigris, where the physical reality of goods (such as sheep, grain, oil, etc.) were symbolised by hardened clay tokens. Different shapes of token were used for different goods. Obviously, such tokens were used in situations where goods were entrusted by the owner/principal to an agent (e.g. a temple complex entrusting a flock of livestock to a shepherd).

Later (around 3250 BC), such tokens were kept in a sealed clay envelope, with the contents of the envelope imprinted on the exterior. Hence, the exterior of the envelope summarised the ownership claim (social reality) to the various types of assets, whilst the symbol of the physical reality of the goods was inside the envelope.

In later eras, people started to record transactions. However, the very ancient accounting records (on clay or papyrus) were no more than historical memos. They were stories of what had happened to a certain amount of money or a certain quantity of goods. They were recorded seriatim and no calculations were made to establish value or additions. The Romans had some sort of bookkeeping system in which budget was compared with real expenditure. As another example, in an old German account book (1329 - 1360) kept by two German brothers, the ledger was a notebook, with household matters mixed up with business transactions.

Numbers did not seem to bother people very much. On many occasions, they used a description rather than a number. By way of illustration, in the records of the Chamberlain of the City of London (1334) dates of transactions and events were not presented in a numeric format, showing the day, month and year. Instead, the time of an event or transaction was described, for example, as “the morrow of the Exaltation of the Holy Cross”.

Sometimes, people were primarily concerned with the religious or ethical significance of numbers. An example of this can be found in *De Civitate Dei* of St. Augustine, where he states “God created the world in six days because of the perfection of the number six”. Indeed, six is a perfect number (or as Pythagoras called it *arithmos teleios*, closed number), which is defined as a number equal to the sum of its divisors. The number six can be divided by one, two and three; adding these numbers gives six. The next perfect number is 28 (which is equal to the sum of its divisors one, two, four, seven and 14), which was associated with the number of days the moon needs to circle the earth.

The general formula for a perfect number, pn, is:

$$pn = 2^{p-1}\left(2^{p}-1\right) \text{ provided that } \left(2^{p}-1\right) \text{ is a prime number.}$$

Hence, the next perfect number after 28 is 496 (for p=5). The perfect number thereafter is 8,128 (for p=7) and thereafter that, 2,096,128 (for p=11).

The accounts of the City of London mentioned above, as well as the household roll of Eleanor, Countess of Leicester (1265) were one of the first records with a separate number column.

Nowadays, this may seem trivial, but it was a major innovation, because it facilitated totalling and balancing.

The development in systematic bookkeeping is closely related to information needs of users. Frères Bonis of Montauban in France kept books from 1345 to 1359 and used their books to compile a list of debtors and creditors. As was usual in those days, these accounts were kept open for a long time. They were closed in 1358 when a state of affairs was drawn up.

Historically, books were kept more comprehensively when more partnerships in business were established and account had to be given between partners. Moreover, as the number of transactions in business and in partnerships increased, so did the need for their orderly recording and checking for accuracy and completeness. Human memory and informal notes no longer served the purpose.

The first evidence of double entry bookkeeping was found in fragments of the accounting records of a Florentine banker in 1211 and in the municipal records of Genoa around 1340. Double entry bookkeeping is a system where each transaction is recorded as a debit and as a credit. This system, which is still the basis for almost all modern bookkeeping systems, enhances the control over accurate and complete recording of transactions. As Schmalenbach (1926, page 56) states, double entry bookkeeping originally served the need for accurate recording of the credit business, which was inherent to Medieval trading activities. It is primarily a remedy against the danger of double payment of debts or uncollected receivables, because the double entry links the recorded cash outflow and inflow with the recorded decrease in debts and receivables respectively. Schmalenbach further states that “Italian bookkeeping” did not originate from the objective to quantify the wealth of a person, a business or a partnership at a certain moment in time. He uses this as corroborative evidence for his dynamic accounting theory and this is supported by the case of the Brothers Soranzo in Florence in 1434, among others. The brothers kept house[3] together and wanted to separate their affairs. In the court case, which eventually led to the division of wealth between the brothers, the available books and records were hardly taken into account.

Early writers on double entry bookkeeping were Benedetto Cotrugli (Della Mercatora et del Mercatore Perfetto) and Brother Lucas de Burgo, better known as Luca Pacioli. The latter deserves a more elaborate treatment, not only because he is most cited as the author of the first published text on the idea of double entry bookkeeping, but also because he embedded his treatise in a book on mathematics.

Before going further into this subject, it is worthwhile to pay some attention to numerals. Until the late Middle Ages, the use of Roman numerals was customary. The introduction of Arabic ciphers was obstructed for many centuries for religious reasons and because of their sensitivity to fraud (a “1” can easily be changed into a “4” or a “7”). Arabic ciphers are associated with the Arab scientist Al-Khowârizmî, who neatly lent his name to the modern word *algorithm.* In Western Europe, the use of Arabic ciphers was first formally promoted in Liber Abacci, written in 1202 by Leonardo di Pisa (the son of Bonifacio di Pisa and therefore known as Fibonacci). In performing manual calculations, the Arabic system has considerable advantages over the Roman one, as the following simple example shows.

---

3 Private and business matters were often not separated for recording receipts and disbursements.

**Table 2-1: Arabic ciphers versus Roman numerals**

| | | |
|---|---|---|
| Item a | 351 | CCCLI |
| Item b | 1,511 | MDXI |
| Item c | 88 | LXXXVIII |
| Total | 1,950 | MCML |

The Arabic numbers can be easily summed manually, simply by adding up the digit columns from right to left. Adding up the Roman numbers is far less easy.

Luca Pacioli wrote his *Summa de Arithmetica, Geometrica, Proportioni et Proportionalita* in 1494. The book has 298 pages; one part of it, *Particularis de Computis et Scripturis*, relates to double entry bookkeeping. Other parts of the *Summa* are also relevant to the merchant, the bookkeeper and the accountant, because they relate to practical arithmetic operations such as multiplication, division, calculation of interest, foreign currency conversion, determination of profits and losses on merchandises, allocation of travelling and transport costs to merchandise and currencies, measurement of barrels and estimating contents, etc.

In other words, the book gives comprehensive guidance to the merchant who measures all goods and transactions and converts them into a uniform unit of value, enters them in a double entry bookkeeping system and finally summarises them in the form of a trial balance. Pacioli gives extended descriptions of control procedures (using various check marks) to ensure that all journal entries have been accurately entered into the *quaderno* (ledger). Ventures (such as sea voyages) and transactions (such as the purchase and sale of a consignment of merchandise) were kept in separate accounts and when completed, they were squared off and the balance was taken to the profit and loss account. Partnerships were usually set up for one occasion (e.g. a single sea voyage) only and were thus limited in time. At the end of the partnership, there was no valuation issue, as all merchandise, etc. had been sold and only cash had to be divided. Consequently, Pacioli does not give any guidance for valuation. Only when describing the procedures for the opening balance, does he recommend valuation criteria:

Set the price higher ("fatter") rather than lower ("leaner"), so that if you believe it is worth 20, attribute 24 etc. so that you can more easily obtain a profit.

This quote (from R.H. Macve, 1996, page 7) suggests Pacioli's early introduction of target costing. Schmalenbach (1926, page 62) suggested the same.

Pacioli does recommend regular closing, especially in the case of a partnership (*ragion spessa amista longa*, or regular stewardship establishes long friendship: chapter 29 of De Scripturis), but for reasons of stewardship and not for measurement of capital. Closing was often for the purpose of clearing the books or transferring the totals to a new ledger when the old one was full.

Heinrich Schreiber, alias Henricus Grammateus (Ayn new künstliches Buch, 1521), was the first person to formally introduce annual settlement (period accounting) as opposed to lot accounting, which is applicable to single ventures. He states that the closing inventory should be valued at purchase price. Then, the balance of the disbursements from purchases on the one hand and the proceeds from sales and the closing inventory on the other is profit or loss[4]. Simon Stevin further developed this concept at the beginning of the 17th century, at a time when the first partnerships for an indefinite period arose (see section 2.4).

Apart from recording historical facts, a bookkeeping system has significance for making decisions. Mellis (1588, A Brief Instruction and manner how to keep books of accounts, chapter 16) was one of the first to formally address the issue of product pricing. Lloyd (2002, page 15) mentions the following useful tools considered by Mellis:

- A pricing technique that contains the basic element of the cost-volume-profit technique is still applied by many firms today.
- Elaborate methods for apportioning the gains from partnership enterprises.
- The use of weighted averages as a pricing tool.
- The solving of problems where one or two relevant variables are unknown.

The concept of double entry bookkeeping was improved over the centuries. Charts of accounts became more predefined and unambiguous. In the 17th century, Nicolas Petri (*Practiquen om te leeren rekenen, cypheren ende boeckhouden*) was the first person to group similar transactions (e.g. expenses) in a separate record and enter the monthly totals in the journal, rather than recording all transactions seriatim. This improvement allowed more bookkeepers to work simultaneously in one accounting system and to formalise segregation of duties, which enhances the effectiveness of the controls embedded in double entry bookkeeping. And so double entry bookkeeping evolved over time into a powerful method for descriptive financial statistics with a very important merit: **it balances**. However, the system in itself does not provide any ordering, explanation of trends or prediction and is in the words of Stridiron a descriptive rather than a scientific system of statistics. Yamey writes about this (Macve, 1996: page 7):

The calculation of profit and loss in early account books is more a by-product of the accounting requirement to balance the ledger than a prime objective and output of the system.

And Macve himself states (1996, page 21):

Not only is double entry bookkeeping not necessary (though highly convenient) for the calculation of income, it is not sufficient. Determining income requires decisions on how assets are to be valued and how much of the change in their value is to be treated as income. The double-entry method imposes no restriction on these choices and the history of financial reporting shows that a variety of valuation methods has been employed in preparing accounts.

As already remarked, the valuation of assets was not that important in the early days, because single ventures (parties of merchandise, sea voyages, etc.) were accounted for. At the end of the venture, no assets but only cash was left to be distributed. In that case, profit consists of receipts less disbursements during the total lifetime of the venture. The consequent definition of profit as the balance of receipts and disbursements neatly matches Schmalenbach's definition of *totalgewinn* or *lifetime profit* (Schmalenbach, 1926, page 96). *Lifetime profit* involves the total

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4 The original text fragment (Schmalenbach, 1926, page 62) reads: "so schetz es auff sein wert im kauffen, thue sein geldt zu dem andern/Gehe darnach in des kauffenn des geldt/also hastu zwo Zahl/als ayne auss de verkauffen die ander auss dem kauffen/zeuch ayne von der anderen so bleybt verlust oder gewyn".

balance of receipts and disbursements of an enterprise after all transactions have been settled and all positions liquidated. While no one could ever disagree with this definition of profit in the case of a venture with a limited lifetime, it is a kind of “flat earth theory”, in which developments have a beginning and an end. In real life, even the final and complete liquidation of a venture is just a moment in a value cycle, and the merchant has to make decisions about the amount he has available for consumption, given his aspirations to remain “in business” (or conversely, his potential to remain “in business”, given his consumption aspirations).

Thus, in briefly describing the historical development of bookkeeping, a method that in itself is designed only to record historical (financial) events, we encountered three reasons for looking at the future and dealing with the uncertainty inherent to this.

1. Period accounting as opposed to lot accounting raises questions about the (minimum or real) value at which stocks of goods will be sold, receivables will be settled, etc.
2. As enterprises are set up for an indefinite period of time rather than for a single venture, Schmalenbach’s *lifetime profit* cannot be assessed and a concept of profit is needed to assess the profit to be attributed to a financial reporting period. The question is whether this can be done without looking ahead to the gains and losses to be attributed to future periods.
3. The function of bookkeeping is not restricted to a historical description but is extended to the support of management decisions, product pricing being an early example of this.

## 2.2 The settlement of a bet and the dawn of risk measurement

One of the most challenging parts of Pacioli's Summa is folio 197[5], where he describes the settlement of a game. He states that the procedure for dividing the stake in case of an interrupted ball game is similar to the appropriation of profits of a trading company. The example is as follows:

A and B play a ball game. 10 points are awarded for each successful round. The player who first earns 60 points wins the game. A and B each put in 10 ducats. Whoever wins the game, wins the stake. Due to circumstances, they have to terminate the game when A has 50 points and B 20. The question Pacioli poses is: "How should the stake be divided between A and B?" He writes that he has found different proposed solutions, but the only method he considers properly, is the one he describes in folio 197. His procedure is as follows:

First, he determines the maximum number of rounds that parties can play altogether. This maximum is 11, because one of the parties must have then earned 60 points. Then, he allocates a share of 5/11 to A and 2/11 to B. He equates the total of 7/11 to the stake of 10 ducats and consequently allocates $7\ ^1/_7$ ducats to A and $2\ ^6/_7$ ducats to B.

He also describes a "short cut", where 70 points correspond with 10 ducats. A is then entitled to 50/70 of 10 ducats and B to 20/70 of 10 ducats. Not surprisingly, this gives the same answer. What is surprising is the fact that Pacioli acknowledges that, when ending the game as originally posited, a maximum 4 rounds must still be played, but subsequently eliminates the possible influence of these rounds in his calculation and the related uncertainty about the outcome. Pacioli does give a sign of a sense of awareness about the uncertainty in the environment of merchants (and players), as revealed by the following statement in chapter 36 of De Scripturis:

Business dealings occur in an uncertain environment and it is necessary to be prepared to cope with that uncertainty.

Pacioli's ball game has been a source of discussion and has initiated a quest for the "real solution" by serious mathematicians such as Fermat and Pascal and gamblers such as Cardano and De Méré. This has been extensively described in Against the Gods: the remarkable story of risk (Bernstein, 1996).

Let us change the problem slightly. The game is not terminated, but continued (as in real business). A withdraws from the game and wants to transfer his share in the game to C. What is a fair transfer price?

What data do we need to solve this? First, we have to find the definition of a "fair bet". Christiaan Huygens gave a definition in the 17th century (*De Ratiociniis in Ludo Aleae*, or treatise on calculations in games of chance, 1660): A bet is fair when the stake equals the expected value of the gains.

The expected value is the probability-weighted average of all possible results.

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5 Folio 197 has been translated by R. Pulskamp. I found this translation on the internet, at www.terravista.pt.

Let us accept this definition for the time being.

Secondly, we need to know the probability for C to win a round. Let us assume that there is no significant difference in skill regarding the ball game between A and B or between B and C. So the probability is 0.5.

And thirdly, we need a calculation method. C will win the stake if he wins at least 1 round out of the remaining maximum of 4 rounds. He has 4 possibilities to win 1 round: the first round, the second round, the third round or the fourth round. Equally, (if the game were to continue after achieving 60 points), he would have 4 possibilities to win 3 rounds. This can be easily seen in Table 2-2.

**Table 2-2: Scenarios where C wins one or three rounds**

| Winning 1 round | | | | Winning 3 rounds | | | |
|---|---|---|---|---|---|---|---|
| Round | | | | Round | | | |
| 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |

C would have 6 possibilities to win 2 rounds (if the game were to continue after 60 points), as Table 2-3 shows.

**Table 2-3: Scenarios where C wins 2 rounds**

| Round | | | |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 0 |

These tables represent the variants in which an outcome with the same value may occur, or the permutations. The method for determining these permutations has been generalised by Blaise Pascal in the form of Pascal's triangle, also known as the Precious Mirror of the four Elements by Chu Shi-chieh[6] (China, 1303). The triangle shows that the number of possible results increases when the number of rounds increases, in accordance with the pattern shown in Figure 2-1.

As can be seen, each number is the sum of the numbers left and right above. For example, the number 6 in row 4 is the sum of 3 and 3, which are left and right above respectively.

In fact, this triangle says that when (for example) playing 4 rounds, there are 16 possible combinations of outcomes. In the Pacioli example, C wins the stake in 15 of the 16 combinations.

6 The concept is said to be described even earlier by, among others. Chia Hsien in 1050 and by Omar Kayyam around the same time.

Having said that the probability of C winning a round is 0.50, the probability of winning the stake is 15/16, or 93.75%. Given the definition of a "fair bet", the purchase price of this bet would be 9.375 ducats.

**Figure 2-1: Pascal's triangle**

| Rounds | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | 1 | | | | | | |
| 1 | | | | | | 1 | | 1 | | | | | |
| 2 | | | | | 1 | | 2 | | 1 | | | | |
| 3 | | | | 1 | | 3 | | 3 | | 1 | | | |
| 4 | | | 1 | | 4 | | 6 | | 4 | | 1 | | |
| 5 | | 1 | | 5 | | 10 | | 10 | | 5 | | 1 | |
| 6 | 1 | | 6 | | 15 | | 20 | | 15 | | 6 | | 1 |

Finally, the problem can be generalised as the formula for the binomial distribution:

$$\mathrm{P}_x = \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x}$$

where:
- $\mathrm{P}_x$ is the probability of x successes;
- n is the number of rounds;
- x is the number of successes;
- p is the (independent) probability of one success.

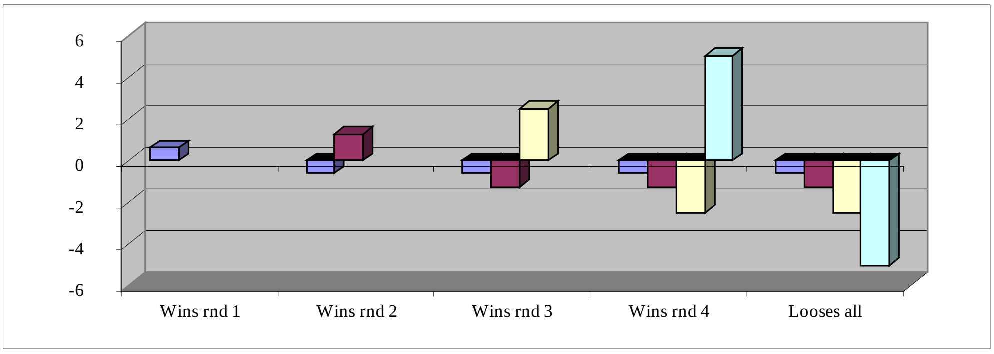
Accepting Huygens' definition of a fair bet and interpreting rounds as (financial reporting) periods, the possible developments in the fair value of C's bet are summarised in Table 2-4.

**Table 2-4: Development in the fair value of C's bet**

| | Purchase price | End of round 1 | End of round 2 | End of round 3 | End of round 4 |
|---|---|---|---|---|---|
| Wins round 1 | 9 3/8 | 10 | | | |
| Wins round 2 | 9 3/8 | 8 3/4 | 10 | | |
| Wins round 3 | 9 3/8 | 8 3/4 | 7 1/2 | 10 | |
| Wins round 4 | 9 3/8 | 8 3/4 | 7 1/2 | 5 | 10 |
| Looses all rounds | 9 3/8 | 8 3/4 | 7 1/2 | 5 | 0 |

If we consider profit or loss the difference between the fair values at the end and the beginning of a round, the various possible scenarios can be seen in Figure 2-2. This figure clearly shows the volatility in earnings, which increases as the "expiration of the bet" nears. Yet the expected value of all results (the probability-weighted average) is zero, as follows from Huygens' definition of a fair bet. End of all discussion on Pacioli's terminated bet?

**Figure 2-2: Development in C's results in the various scenarios**




Following this analysis, I wish to address two subjects in this section. The first refers to the probability of winning or losing, which in Pacioli's example is set to 0.50. However, if it were .80, the "fair value" of the bet as defined above would be 9.984 ducats, and if the probability of winning were 0.20, the answer would be 5.904 ducats. The second concerns the question of how fair would the players experience the value of the bet as calculated above in relation to a certain amount of cash of 9,375.

### *2.2.1 Measuring frequencies of events*

Around the beginning of the 18th century, Jacob Bernoulli introduced the law of large numbers. The definition of this law (Collins English dictionary[7]) is:

The fundamental statistical result that the average of a sequence of *n* identically distributed independent random variables tends to their **common mean** as *n* tends to infinity, whence the **frequency** of the occurrence of an event in *n* independent repetitions of an experiment tends to its **probability**.

In Bernoulli's *Ars Conjectandi*[8], probability (P) is stated as follows:

$$P\left(\left|\frac{k}{n}-p\right|<\varepsilon\right)\rightarrow 1 \text{ as } n\rightarrow\infty$$

Where:
k is the actual number of times an event of a certain type occurs.
n is the number of trials.
p is the probability that the event occurs.
ε is a sufficiently small number.

7 © 2000 HarperCollins Publishers.
8 Jacob Bernoulli's work that was been published by Nicholas Bernoulli eight years after Jacob's death.

Bernoulli illustrated his law by an example of a jar with a large number of white and black pebbles. The contents of the jar consisted of 60% white pebbles and 40% black. Bernoulli calculated that if he took a sample of 25,500 randomly selected elements, he could expect this sample to contain 15,300 white pebbles; with the probability of a deviation of more than 2% (i.e. less than 14,994 white pebbles or more than 15,606 white pebbles) being less than 1 in a thousand.

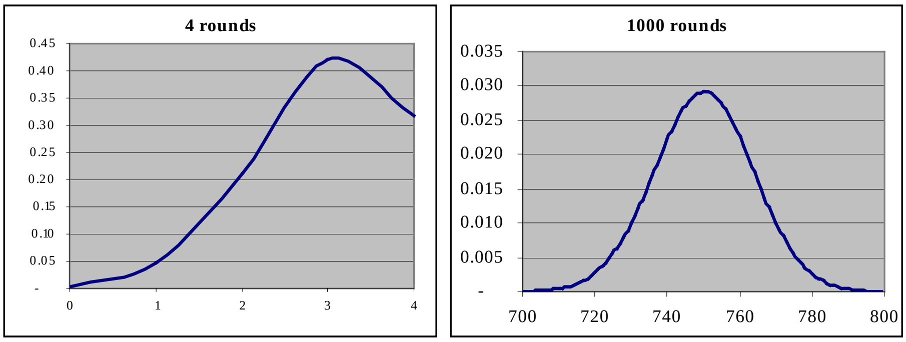
He used his law to derive a probability from the frequency in a sample of randomly selected mutually independent elements. So in the case of Pacioli's ball game, he could derive the probability of C winning a round from a sufficiently large number of historical observations.

Jacob Bernoulli took it as given that nature has certain patterns according to which events repeat themselves. He therefore considered it valid to assume that probabilities derived from historical samples would also apply to the future. Gottfried Wilhelm von Leibniz warned Bernoulli that this repetition is imperfect and that therefore future events may deviate from historically observed patterns.

Despite this warning, the law of large numbers inspired many people to observe and measure historical events in order to explain or predict events or results. John Graunt was a pioneer in studying mortality. His statistics were used by Huygens to calculate probabilities for mortality. Huygens estimated that he would die at age of 55. That was not quite true; Huygens died at age of 66. On his own, he did not obey the law of large numbers. However, for a sufficiently large number of people, future mortality can to some extent (historical patterns do not resemble future patterns perfectly) be predicted from the historical observation of mortality derived from a sufficiently large sample. In essence, this approach is still taken in the life assurance industry.
From empirical observations, Abraham de Moivre and later Georg Friedrich Gauss found an interesting pattern in the distribution of their observations. This can best be explained by the next example.

Suppose, the probability of C winning a round in Pacioli's ball game is 0.75.

**Figure 2-3: Probability distribution for four and 1000 rounds of Pacioli's ball game.**




When four rounds are played the expected number of wins by C is three. As can be seen from Figure 2-3, the probability distribution of the possible number of wins is very skew in this case.

The same figure shows that the probability distribution for 1,000 rounds is symmetric and bell-shaped.

This phenomenon has been generalised as the central limit theorem, which says that the probability distribution for a number of mutually independent experiments approaches the above-mentioned pattern for a sufficiently large number of experiments.

The curve shown in Figure 2-3 represents the Normal Distribution or Gauss curve and is a function of the mean (in our example 0.75) and the standard deviation.

In summary, we may say that it is beneficial to keep a systematic record of historical (financial or other) events in order to estimate probabilities (Bernoulli), but that account should be given to the imperfections in the pattern of repetition of historical events in the future (Leibniz).

Although the shape of a probability distribution always converges to a Normal Distribution for a sufficiently large number of independent experiments, we do not know exactly what number is large enough.

### *2.2.2 Turning the question around*

The previous section shows how the frequency of events is observed and accounted for, and how it is supposed to obey the law of large numbers, provided that the number of observations is large enough. The observed frequency then converges to a probability which, assuming that historical patterns repeat in the future, is used to predict the outcome of future observations. Practical applications often ask another question, such as:

*Given:* the number of times in which an unknown event has happened and failed:
*Required:* the chance that the probability of its happening in a single trial lies somewhere between any two degrees of probability that can be named.

This is the question Thomas Bayes poses at the start of his article *Essay Towards Solving a Problem in the Doctrine of Chances* (Philosophical Transactions of the Royal Society of London **53** (1763), 370–418). The question is a mirror to the answer that Bernoulli's Law of Large Numbers (further developed by De Moivre in his Doctrine of Chances) gives. Charles Price writes in his cover letter to the Royal Society:

Mr. De Moivre, indeed, the great improver of this part of mathematics, has in his *Laws of chance*, after Bernoulli, and to a greater degree of exactness, given rules to find the probability there is, that if a very great number of trials be made concerning any event, the proportion of the number of times it will happen, to the number of times it will fail in those trials, should differ less than by small assigned limits from the proportion of its failing in one single trial. But I know of no person who has shown how to deduce the solution of the converse problem to this; namely, "the number of times an unknown event has happened and failed being given, to find the chance that the probability of its happening should lie somewhere between any two named degrees of probability."

The answer to this question can best be demonstrated by the example used by Bernstein (1996, page 159). An enterprise has two factories that manufacture needles. A generates 40% of the total production and B 60%. Because A is an old factory, it produces twice as many inadequate needles as factory B. The question is now:

*Given:* A customer has complained about inadequate products.
*Required:* Which plant has caused this problem.

We have prior knowledge that any product has a 40% probability of coming from plant A, i.e.:

$$P(A) = 0.4$$

We also know that the odds of plant A producing an inadequate product compared with plant B is 2:1, i.e.:

$$\frac{P(S \mid A)}{P(S \mid B)} = \frac{2}{1}$$

We want to know the posterior odds (given the fact that an inadequate product has been found) of the product coming from plant A compared with plant B, i.e.:

$$\frac{P(A \mid S)}{P(B \mid S)} = \frac{P(S \mid A).P(A)}{P(S \mid B).P(B)} = 2 \times \frac{0.40}{0.60} = \frac{8}{6}$$

This means that the odds of an inadequate product coming from plant A compared with plant B is 8 to 6. The probability that the product comes from plant A is then:

$$\frac{8}{8+6} = 57.1\%$$

This is basically how Bayes' theorem works. It adds information from a certain observation to a prior probability and merges them to find a posterior probability, given that the observation (in this example an inadequate product) has occurred. Bayes' theorem is particularly attractive in expert systems because it enables them to add experience sequentially and recalculate the posterior odds. In this respect, it is the first step in "bookkeeping for risk".

### *2.2.3 Tasting uncertainty*

Let us have a look at a curiosity found by Nicolaus Bernoulli at the beginning of the $18^{th}$ century, known as the St. Petersburg Paradox (G. Jorland, 1990, page 157). A and B play "heads or tails". They agree that B receives 1 ducat when the first flip of the coin results in "tails", two ducats, when this happens the second time, four ducats when it happens the third time and subsequently double the amount of ducats for each successive round. The game stops at the first round when "heads" occurs. The question is: For what amount would a reasonable person be prepared to buy this bet. The formula (for n rounds) is as follows:

$$FV = \sum_{x=1}^{n} \frac{1}{2^x} 2^{x-1} = \frac{1}{2} n$$

As n approaches infinity, the "fair value" (FV) of the bet would approach infinity. In addition to Bernoulli's example, this is not only true for a probability (p) of 0.50 but for all situations where p.x = 1 (x being the multiplier of the payout between rounds). The general formula is:

$$FV = \sum_{n=1}^{\infty} p^n x^{n-1} \rightarrow \frac{p}{1-px}$$

Bernoulli did some simple empirical observations by simply asking people how much they would be willing to pay for such a bet (without giving any mathematical background). Even the greatest optimist offered no more than 20 ducats (for a wager where the "fair value" based upon a fair bet as defined above is infinitively high). This inspired Bernoulli to look into two qualitative aspects of the paradox.

The first is the introduction of moral certitude (a probability which is so close to 1 that there is hardly any doubt left) and moral impossibility (a probability which is so close to zero that there is hardly any possibility left). If one were to regard all probabilities of 0.001 and lower to be morally impossible, the expected value of the game described would be only 4.5 ducats. The reason is that the probability of the game lasting more than 9 rounds is less than 0.001.

The second is utility. After a certain number of rounds, the gambler is so wealthy that he will loose his interest for further gains. Pascal has informally introduced utility in the following reasoning.

Whether God exists or not, we don't know, so we can attribute a probability to God's existence of 0.50. The one who believes that God exists, will live virtuous, which will be in vain if at the end God appears not to exist. The one who believes that God does not exist will live riotous and will burn in hell if at the end God appears to exist. I would choose the first.

Pascal's choice is a risk adverse one. Risk aversion is the rationale that Laplace and later Fourier gave for insurance. Indeed, the expected value of a loss (probability multiplied by the value of the lost object) is equal for the insurance company and for the insured, but the impact for the insured is often fatal whilst the insurance company spreads the loss over the premiums received for many policies.

But people do not always act risk averse. Back in 1771, the members of the British insurance syndicate Lloyds (the "Names") put their entire wealth at stake as a guarantee for the claims incurring during a certain underwriting period. Obviously, the "Names" considered the probability of a total loss of their wealth morally impossible, because such a situation had not (recently) been observed.

Daniel Kahneman and Amos Tversky have conducted extended research into the behaviour of people towards risk. They developed their Prospect Theory. The relationship between the name and the content of the theory is tenuous. The authors stated they simply chose a name that would be easily remembered (Bernstein, 1996, page 310). One of their experiments is as follows:

A peer group of persons has the choice to either play in a game, which gives 80% chance of an amount of US$ 4,000 and 20% chance of receiving nothing (expected value US$ 3,200) or to receive a certain amount of US$ 3000. 80% of the respondents chose the certain amount, although this is lower than the expected value of the gamble. People thus act risk averse.
Then the group was asked to choose between a game, which gives 80% chance to loose US$ 4000, and 20% chance of breaking even at one hand, and a certain loss of US$ 3,000 at the other hand. In this case, 92% chose for the gamble although the expected loss (US$ 3,200) exceeds the loss of the certain scenario.

Kahneman and Tversky explain this asymmetric attitude towards risk by the fact that people do not primarily seek to avoid risk, but merely seek to avoid losses. But even the attitude towards losses shows a lack of invariance[9], as appears from their following example.

A group of people were asked about a situation where they bought a ticket of US$ 60, which they lost on their way to the theatre. Would they be willing to buy a new ticket?
Another group of people were asked about a situation where they lost an amount of US$ 60 on their way to the theatre. Would they still be willing to buy a ticket for an amount of US$ 60?
Apparently, more people who lost the money would be willing to buy a (new) ticket than people who lost their ticket, although for both groups, the total of loss and cost of the ticket would be US$ 120.

Going back to our Mr C, who opted to buy the bet on the Pacioli game, would he really be willing to pay 9.375 ducats in order to obtain a large probability of a modest profit (0.675 ducats) and accept some chance of a significant loss, equal to the purchase price of the bet? This would fully depend upon the attitude of C towards risk, which may depend upon his character, his earlier experiences (has he been unsuccessful in earlier bets), and the meaning of the profit or loss for his total wealth. Attitude towards risk may even change from time to time, for individuals as well as for groups of people.

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9 Invariance means that the decision-maker are not influenced by the way that alternatives are presented if the mathematical outcomes are identical.

## 2.3 Income and value

Unintentionally, some concepts of value and income have entered into the previous sections on bookkeeping and uncertainty.

When discussing the bookkeeping of a single venture, we found the ancestor of all profit concepts, i.e. the balance of receipts and disbursements at the end of the operation, when all assets and liabilities have been settled. This is equal to Schmalenbach's concept of *lifetime profit*, the profit over the total lifetime of an activity.

Grammateus describes profit in the case of the annual closure of the books when part of the stocks is still unsold as:

Profit or Loss = sales revenues + unsold stocks at purchase price – purchase costs

When elaborating on Pacioli's ball game, we derived a "fair value" of a bet from Huygens' definition of a fair bet and we took the liberty of giving the name "earnings" to the difference between "fair values" in subsequent rounds.

We also found that human beings or groups of human beings hardly behave consistently towards Huygens' definition of a fair bet, because of their approach towards taking risk, their personal attitude, their personal belief, their wealth, etc. We also found that their attitude towards risk may change from time to time.

This section summarises some views on profit and value.

### *2.3.1 Profit*

In practice, we have to abandon Schmalenbach's concept of lifetime profit, because business activities are in most cases designed for a long or indefinite period and there is a need for information about profit or loss for a certain period. And when we do, we find many concepts of profit, which all serve different purposes.

Basically, the ancient works on bookkeeping did not show much interest in measuring profits. They focused more on stewardship i.e. how the money and the other assets (such as stocks) were used and how much money and other assets were present at the end of the reporting period.

The main purposes for the information needed about period profit can be described as follows (see also Burgert, 1967, p. 188):

1 The need for information about the performance of an enterprise. This information may be needed for the assessment of rewards for the responsible management of an enterprise, for future investment selection or for assessing the credibility of projected future income (the latter is related to the concept of value as we will see in section 2.3.2).
2 The need for information about the value created within an enterprise during a certain period. In order to assess this, it is necessary to know the total value of an enterprise at the

beginning and at the end of a period, and the direct transactions with the owners (capital increases and dividends).

3 The need for information about the amount that is available for consumption. This cannot be isolated from the question of what funds are needed to generate sufficient future amounts for consumption. Based on the needs of the beneficiaries for such amounts, this purpose has more than one variant.

Schmalenbach (1926, page 87) mentions (with reference to Bauckner: *Der privatwirtschaftliche Einkommensbegriff*, 1921) the following definitions of income, and tests them for usefulness as a definition of an enterprise's profit. I mention the most important ones.

1 The *Konsumptionsfondstheorie* or consumable fund theory (Schmoller). Income is the amount that can be spent. J.R. Hicks (Value and Capital, 1953, referred to in Burgert, 1967, page 166) adds the dimension of wealth of the beneficiary of income:

> The purpose of income calculations in practical affairs is to give people an indication of the amount they can consume without impoverishing themselves. Following out this idea, it would seem that we ought to define a man's income as the maximum value that he can consume during a week, and still expect to be as well off at the end of the week as he was at the beginning.

Schmalenbach rejects this definition because it focuses on the distribution and the use of income and not to the generation of it.

2 The *Periodizitätstheorie* or periodicity theory (Wagner). The recurrence of the amounts received is the major characteristic for such amounts to qualify as income. This definition is closely related to the *Quellentheorie* (source theory), which requires that income should have a certain source (such as labour, interest, entrepreneur's premium, etc.).

Schmalenbach rejects these definitions as well, because they do not include all components, in other words, the sum of all income over the lifetime of an enterprise does not add up to results according to lifetime profit.

3 *Reinvermögenszugangstheorie* or net increase in capital theory (Schanz). Income is the growth in wealth during a period. Although Schmalenbach has a positive attitude towards this concept, he thinks it is impossible to reach. The main reason is that, in his opinion, the system of double entry accounting cannot provide both income and the value of capital. He defines the value of capital as the value of the complex of assets and liabilities in an enterprise (which is not equal to the sum of the separate values of such assets and liabilities) as the present value of all future profits. Profit for a certain period is then nothing but the interest on the capital value at the beginning of the period. This is similar to the definition of *anticipated subjective profit* (Edwards & Bell, 1961, page 43). Schmalenbach deems it unworkable to define the profit for the present financial reporting period from unknown future profits.

Schmalenbach then develops a concept of profit which primarily focuses on presenting the earning capacity of an enterprise. Being a *monist*, he thinks it is impossible to present both earning capacity and capital value in one closed circuit of balance sheet and profit and loss account and “sacrifices” the balance sheet, which is in his theory no more than a waiting room for receipts which are not yet income and disbursements which are not yet expenses. His basic principles:

- Result for a financial reporting period should be measured in a way that the sum of the results of all periods during the lifetime of an enterprise equals Lifetime Profit.
- Comparability between periods and between similar enterprises. This means among other things that principles of valuation and measuring results should be applied consistently.
- The profit and loss account should be objectively stated, neutral, without any bias and be verifiable. Schmalenbach (1926, page 109) permits estimates as far as these cannot materially affect the presented result. In situations where uncertainty and/or inaccuracy become large, the conceptually correct, but uncertain estimate is substituted by a less correct, but reliable method, where both reader and user should be aware of the bias caused by this method of substitution. Schmalenbach mentions the realisation principle here, in which profits are recorded at the moment of a sales transaction. Apparently, Schmalenbach uses the realisation principle as a practical solution for situations where created value cannot be accurately measured, instead of a principle (without trade no profit) like Limperg does (1979, page 133).
- The concept of prudence should be applied. Here, Schmalenbach has to admit that assets and liabilities, even in the dynamic balance sheet as defined by him, unavoidably include values that depend upon future realisation. For stocks, it is not certain that they will be sold for a price that is higher than the book value. Even with respect to debtors, there is no full certainty about the future cash inflows in relation to their book value. As a consequence, he applies the principle of cost or lower realisable value and other prudence margins (e.g. in depreciation rates on tangible fixed assets).

Clearly, Schmalenbach’s profit concept is primarily meant to serve the purpose of measuring performance. On page 109, he describes the information need of the entrepreneur as an *Erfolgsrechnung*. As he does not use the word *Gewinn- und Verlustkonto*, which he uses elsewhere in his book, I assume he means *performance statement*. Due to uncertainty about future developments, performance cannot be measured in a theoretically correct way.

First, as mentioned above, there are situations in which correct, but inaccurate methods of measurements have to be substituted by less correct methods that relate to more certain documented events, such as the realisation of a transaction or eventually the receipt of an amount. Second, the above-mentioned prudence concept, being an answer to uncertainty about the future cash flows arising from balance sheet items, may result in a poorer performance measurement.
To give the measured performance a proper dimension, Schmalenbach introduces the principle of comparability with other periods and with similar enterprises. In my opinion, one important comparison should be added to measure performance: comparison with the entrepreneur’s own intentions and forecasts.

Until now, we have only discussed one purpose, i.e. measuring the performance of an enterprise. The second purpose, i.e. the change in value during a financial reporting period, cannot be properly discussed without discussing the value concept, which I deal with in the next section.

The third purpose, assessing the amount available for consumption, is related to the value that has to remain after withdrawal of the amount for consumption. Burgert (1967, page 188) mentions the following reasons for preserving value.

1. The nominal capital has to remain intact.
2. The real value of assets has to remain intact.
3. The capital adjusted for (general) changes in purchasing power has to remain intact.
4. The enterprise as a source of income has to remain intact.

This cannot be properly discussed without first discussing value.

### *2.3.2 Value*

When discussing the value of capital, including movements, Schmalenbach (1926, page 101) gives the following formula to assess it.

$$S = \frac{G_1}{(1+z)} + \frac{G_2}{(1+z)^2} + \frac{G_3}{(1+z)^3} + \frac{G_4}{(1+z)^4} + \ldots\ldots + \frac{G_n}{(1+z)^n} + \frac{E}{(1+z)^n}$$

In this formula, G is the array of future profits for years 1 to n, E is the value at which assets and liabilities can be settled at the end of the enterprise's life and z is the interest rate. Unfortunately, Schmalenbach does not give the definition underlying the profits in this formula. Probably this is irrelevant to him, because his does not advocate this approach. He only wants to demonstrate that value is the present value of uncertain future items (whether these are profits or cash flows is not relevant to his example). Defining profit as the change in the present values of two subsequent periods only leads to useless cyclical reasoning.

Edwards & Bell (1961, page 37) define the subjective value of an enterprise as the present value of the future *dividends* i.e. the profits available to the owner. In my opinion, this is the correct approach, because for the owner, who has to be rewarded for refraining from consumption now and investing his funds in the enterprise, the only relevant moment is the moment when the created value becomes available to him for use at his free choice.

In order to calculate the subjective value of capital objectively and accurately, it would be necessary to have perfect foresight about amounts and timing of future cash flows. This implies that an investor or an entrepreneur needs to have information on the development of technology, consumers' preferences, cost of raw materials, labour and capital goods, interest rates, etc. Let us consider an example assuming such perfect foresight.

One night, a man wakes up with a brilliant idea. All of a sudden he has the recipe for a brand new liqueur. As raw materials and consumables, he needs sugar, fruit, yeast, bottles and labels. He knows that the total cost per bottle of final product for such goods amounts to € 3, which will remain constant over the lifetime of his enterprise.

Currently, the man has a full time job and earns an annual salary of € 100,000, which he needs for consumption. The brilliant idea and the development of his skills for setting up and managing an enterprise increase his "market value" to € 250,000 a year. We will call the additional € 150,000 that the man “sacrifices” when he works out his ideas in a new enterprise, the cost of the “concept”.

The optimal mix between sales price accepted by the market and quantity sold is 30,000 bottles annually at a price per unit of € 20. Consequently, he needs a plant with a capacity of 30,000 units. It will cost about 2.5 years to design and build this and the investment will be € 150,000 in year 1 and € 550,000 in year 2. Sitting Duck Distillery plc. becomes operational in year 3.

The man knows that the competition will be able to build a more efficient installation in year 8 and will be able to enter the market in year 9. This will have a negative effect on both the optimal quantity to be produced and sold (decreases to 20,000 units) and on the sales price per unit (decreases to € 17.50). He also knows that, after year 10, consumers’ preference will change to another type of liqueur and consequently his product will have reached the end of its lifetime. The installation cannot be used for other purposes and the scrap value equals the removal costs.

The man has € 100,000 available to invest in the enterprise. All other funds needed will be granted as a loan to be repaid in seven equal instalments, starting in year 4. Interest amounts to 4% annually (needless to say, this is the risk-free rate).

The enterprise has a stock of raw material equal to 10% of the annual consumption. Products are directly sold, so there are no stocks of products and no debtors.

No yield curve is assumed and since perfect foresight implies no risk, the discount rate can be set to 4%.
I ignore corporate income tax because it is irrelevant for this illustration.

The cash flows resulting from this enterprise are summarised in Table 2-5. These cash flows are supposed to be distributed to the owner; the negative cash flow in year 1 represents the equity supplied by the owner.

**Table 2-5: Summary of cash flows**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sales revenue | - | - | 349,813 | 600,000 | 600,000 | 600,000 | 600,000 | 600,000 | 350,000 | 350,000 |
| Purchases | - | (5,247) | (56,225) | (90,000) | (90,000) | (90,000) | (90,000) | (87,000) | (60,000) | (54,000) |
| Investments | (150,000) | (550,000) | - | - | - | - | - | - | - | - |
| Salary | (100,000) | (100,000) | (100,000) | (100,000) | (100,000) | (100,000) | (100,000) | (100,000) | (100,000) | (100,000) |
| Capital | | | | | | | | | | |
| Interest | | (6,000) | (32,450) | (32,450) | (27,814) | (23,178) | (18,543) | (13,907) | (9,271) | (4,636) |
| Loan | 150,000 | 661,247 | | (115,892) | (115,892) | (115,892) | (115,892) | (115,892) | (115,892) | (115,892) |
| Cash flow | (100,000) | - | 161,138 | 261,658 | 266,293 | 270,929 | 275,565 | 283,200 | 64,836 | 75,472 |

The present value of all cash flows amounts to € 1,216,634. The development of this present value, the subjective value according to Edwards & Bell (assuming that all cash flows can be distributed to the owner), is summarised in Table 2-6.

The subjective profit is the required yield of 4% on the subjective value, as can be expected and as defined as such by Edwards & Bell. If we express the subjective value at the beginning of the enterprise (i.e. € 1,216,634) as a 10-year 4% annuity, the result is € 150,000. This is exactly equal to the increase in salary our man could realise with his newly discovered talents and which he "sacrifices" for being an entrepreneur (further referred to as the "value of the concept").

**Table 2-6: Development in subjective value**

| Subjective value: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Start of period | 1,216,634 | 1,365,299 | 1,419,911 | 1,315,569 | 1,106,535 | 884,503 | 648,954 | 399,347 | 132,120 | 72,569 |
| Subjective profit | 48,665 | 54,612 | 56,796 | 52,623 | 44,261 | 35,380 | 25,958 | 15,974 | 5,285 | 2,903 |
| Dividends/capital | 100,000 | - | (161,138) | (261,658) | (266,293) | (270,929) | (275,565) | (283,200) | (64,836) | (75,472) |
| End of period | 1,365,299 | 1,419,911 | 1,315,569 | 1,106,535 | 884,503 | 648,954 | 399,347 | 132,120 | 72,569 | - |

The question might then be: "Where is the profit?" Remember that we have a situation with perfect foresight. This implies that the discovery of the new product cannot be a surprise to the business environment and those markets of all input variables (raw materials, building contractors for installations, etc.) are already aligned to this event. In a situation of perfect foresight, an event such as the discovery of a new product cannot get markets out of their equilibrium and consequently the value created cannot differ from the inputs sacrificed.

It is time to revisit some thinking about the drivers of value in the real world. In 1892, Eugen von Böhm-Bawerk published his Value, Cost and Marginal Utility. This work has been translated into English by Georg Reisman, PhD of Pepperdine University. To obtain information on Böhm-Bawerks theory, I used this English translation. The essay is primarily a reaction to the work of Heinrich Dietzel (*Die klassische Werttheorie und die Theorie vom Grenznützen*).

Dietzel advocates the theory that explains the value of a good for the seller from the cost of the inputs that are necessary to reproduce the good in question. In his opinion, the cost standard is more convenient, more complete and more exact. In comparison with the vague fluctuating valuation according to marginal utility, valuing according to cost has an enormous advantage. In our example, assuming perfect foresight, the value can be exactly explained from the (opportunity) costs of the inputs. The development is shown in Table 2-7.

**Table 2-7: Development in (opportunity) costs per production unit.**

| Cost per unit: | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|
| Raw materials | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Wages | 4.99 | 4.99 | 4.99 | 4.99 | 4.99 | 4.99 | 4.99 | 4.99 |
| Use of tangible fixed assets | 4.46 | 4.46 | 4.46 | 4.46 | 4.46 | 4.46 | 1.96 | 1.96 |
| Interest | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| | 12.46 | 12.46 | 12.46 | 12.46 | 12.46 | 12.46 | 9.96 | 9.96 |
| ***Concept premium*** | ***7.54*** | ***7.54*** | ***7.54*** | ***7.54*** | ***7.54*** | ***7.54*** | ***7.54*** | ***7.54*** |
| | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 17.50 | 17.50 |

The table includes the "production goods" sacrificed by the entrepreneur, i.e. the concept premium (which in total amounts to € 150,000 annually, but which is distributed differently over the lifetime of the enterprise) and the yield on invested equity, which has been absorbed in the annuity of tangible assets.

The costs for the use of tangible fixed assets are related to the production realised. Furthermore, the decrease in sales price from year 9 onwards has been fully attributed to tangible fixed assets because it is caused by a technological innovation that enables competitors to enter the market, depressing the sales price. Depreciation has been calculated on the basis of an annuity; the total of depreciation and cost of capital per production unit remains constant. The costs of the tangible fixed assets include the interest paid during the development phase.

As regards wages, an approach has been applied that would be somewhat unusual in real life. I assumed that there is a labour contract for the total lifetime of the enterprise and that wages are included in the profit and loss account as a function of the units produced. Effectively, this means that in the first years an intangible asset exists relating to the years the enterprise is developed and that at the end an accrual is formed in order to achieve a constant amount per production unit. Both are depreciated on the basis of an annuity in order to keep the annual costs per unit constant. Further details with respect to this example are given in Appendix 2-I.

Summarising the limitations of costs to explain the drivers behind value:

- In year 9, the cost per unit of tangible fixed assets decreases because of a technological innovation without directly affecting the utility of the finished goods for the consumer. However, because of the technological innovation, there is an upward pressure on supply of products, which decreases the marginal utility for the consumer and thus depresses the price.
- We are forced to apply accrual accounting in order to keep the labour cost per unit constant. There would be no way to explain a higher labour cost per unit in year 9 and 10.
- After year 10, the utility of the products for the consumer decreases without any change in the production costs.

These phenomena are what the members of the Austrian school of economics or the marginal-value theorists try to explain. Böhm-Bawerk uses a number of examples and analogies to support this theory.

*Cyclical reasoning in using costs as an explanation for value*

If the value of a good were explained by the cost of the inputs (the cost goods), the value of these cost goods would have to be explained by the cost of its inputs, and so on. In the end, there would be a good that cannot be reproduced at will (minerals, patented tools, etc.) and thus could be valued at the cost of replacing it.

Labour is a special input variable. If we were try to explain the value of labour from its costs, we would have to look at the worker’s means such as bread, meat, clothing, shoes, etc. (Böhm-Bawerk, 1892, page 333). But these goods are finished goods and if we try to explain their value from the costs, we end up in a vicious circle of reasoning.

*Explanation of the marginal value concept*

Böhm-Bawerk illustrates his marginal value theory with an example of a pioneer farmer with five sacks of grain (Reisman, 2002, page xii). He labels the sacks in accordance with his needs, in descending order of importance. The first is earmarked for getting through the winter without starving. The second enables him to survive in good health. The third enables him to eat to the point he feels satisfied. The fourth is reserved for producing brandy and the fifth is set aside to feed his parrot.

Now, imagine that the first sack (the one labelled for survival; i.e. the need which is highest in rank) is destroyed. In that case, the farmer will not die, but the parrot will not be fed (the need, lowest in rank or the marginal utility). Consequently, the marginal value is the loss for the farmer. Generally speaking, the value of a good is determined by the utility of the unit consumed last (the marginal utility).

*Forces driving values of goods and costs of goods*

Böhm-Bawerk uses an illustration for explaining the forces on value and costs. At the time he wrote his treatise, Joannisberg was a prestigious, well-appreciated and desirable wine. One of the input variables is the Joannisberg vineyard. This input variable is expensive, because it is scarce. However, if someone else were to discover how to produce wine in large quantities at an alternative location, the supply of high quality wine would increase and the marginal utility decrease, which would ultimately lead to a decrease in the value of the vineyard (and the cost of the vineyard as an input variable for the wine).

Alternatively, if consumers' preferences were to change and the Joannisberg wine were no longer appreciated, the price of the wine would fall too, which would ultimately have a downward impact on the value of the vineyard.

On the other hand, if the land of the vineyard was useable for real estate development and this was more profitable for the owner, this would lead to upward pressure on the value of the vineyard and thus on the cost of the wine. Downward pressure on the quantity produced would (given the same consumers' preferences) lead to a higher price per unit.

Böhm-Bawerk compares this process to a locomotive with a number of carriages. The locomotive represents the (marginal) utility, i.e. the demand for a product. The first carriage is the finished good, the second the cost goods of the finished good, the third the cost goods of those, and so on. The stronger the locomotive (the desire, such as for the Joannisberg wine), the faster the train moves. The heavier a carriage (i.e. the costs), the slower the train moves. Now, some of the carriages can be pulled by another locomotive (they are common cost goods or marginal products, such as wood, which can also be used in another finished product). This slows down the speed of the first train, i.e. increases the costs and decreases the quantity produced.

To this example, I would add that the value chain, as described by the train in the example, does not necessarily have to consist of production processes. A link to the value chain can also be a bridge between the purchase market and the sales market, because the purchase market cannot be accessed by the end user. In fact, the dynamics described above are a major limitation to the assumption of perfect foresight in the example used above.

The invention of the new liqueur by our entrepreneur is an unexpected event with unexpected effects on consumers' preferences and common cost goods (fruit, etc.). This creates the opportunity for the entrepreneur to make a profit that is not driven by society's view of a fair reward in an equilibrium situation. Moreover, technological improvements can happen at an unexpected moment. So in practice, the entrepreneur makes a "risky choice" when he decides to invest in the enterprise described in our example.

On the other hand, consumers' preferences do not necessarily behave as expected, and projected quantities and prices are not necessarily realised. Even the decision to consume now or save his money to generate future income (see Hick's definition of income, described in section 2.3.1) may differ over time and by individual, because of uncertainty regarding being "as well off at the end of the period as the consumer was at the beginning of the period". The accompanying uncertainty makes consumption a risky choice, too, and it is affected by the consumers' attitudes towards risk.

Hence, if one purchases goods (takes a long position in goods), preferences can change during the production and sale period, which may cause a loss in value of the goods purchased. If one purchases an installation (takes a long position in production units), preferences and the replacement costs of the production units can both change, which may cause a loss in the value of the "stock of production units".

As already mentioned in section 2.3.1, Schmalenbach observed that uncertainty in financial reporting could lead to the substitution of correct but inexact methods by less correct but more exact methods. In chapter 3, I will use the example in this section to further analyse this observation.

In the next section, the substitution of accounting methods (intuitively or deliberately) is shown in a historical example, that of the Netherlands United East India Company.

## 2.4 A historical example of bookkeeping: the VOC

The Verenigde Oostindische Compagnie (United East India Company: VOC) was one of the first (shareholder-owned) companies to be founded for an indefinite period. Founded in a period of great uncertainty at a time when the Dutch were still in the middle of the war of independence against Spain, it grew into the largest multinational in its era, with 30,000 employees (Gaastra, 2002, page 11). How did this company deal with the great uncertainty in its financial reporting during the first years of its existence? To answer this question briefly: it didn't. Founded in 1602, the first financial report dates from 1643. Yet the company managed to pay the first dividend in 1612.

This section analyses the financial data of the VOC during the period 1602 to 1780. The VOC went bankrupt in 1796. However, in its final 16 years the transformation of the VOC from a trading company to a colonial government activity, which had silently started in the decades before, occurred at an accelerated speed.

My analysis is based to a large extent on J.P. de Korte's *De jaarlijkse verantwoording van de VOC*.

### *2.4.1 General*

The VOC was founded in 1602. It was the result of the efforts by the young Netherlands Republic to concentrate the East Indian trading activities in one company with substantial capital and substance. All previous companies and initiatives (which were ventures for one sea voyage) were concentrated in this company.

The government of the Republic granted a monopoly to the VOC to sail and trade in the East Indian waters. Furthermore, the VOC received the authority to fulfil certain government tasks such as foreclosing treaties, entering into alliances, building fortresses and other infrastructures, and hiring military and public servants. This monopoly was granted for 21 years and the government charged an amount of ƒ 25,000.

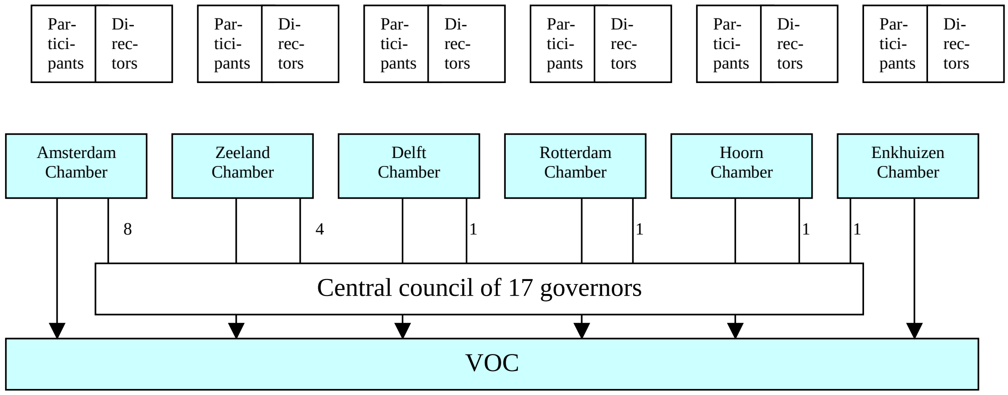
### *2.4.2 Organisation*

The already existing initiatives for trading with the East Indies were united in the VOC. The monopoly granted to the VOC proscribed all citizens of the Republic from sailing and trading in the East Indian waters. On the other hand, each citizen could participate in the VOC for an amount at his discretion. The shares in the VOC had no fixed par value. Participations were made indirectly via the chambers, who were the successors of the early East India trading ventures. The total capital amounted to ƒ 6,440,000. The organisation chart is shown in Figure 2-4.

The members of the central college of 17 governors (*Heeren Zeventien*) were elected from the directors of the various chambers. 16 seats were permanently allocated to the chambers; the allocation of the 17$^{th}$ seat changed each period.

The procedure for the election of new directors for each chamber involved the major participants, the acting directors and the municipal government of the city where the respective chamber was seated.

**Figure 2-4: Organisation chart of the VOC**




### *2.4.3 Major principles of valuation*

In 1609, an accounting instruction was issued for the properties in the East Indies. Cash, debtors, creditors and trading stock should be accounted for.

For the general account of the VOC in the home country, the accounting principles were as follows:

- Stocks of spices were carried at prices to be assessed annually by the Central Council;
- Other stocks were carried at purchase price;
- Only performing debtors were carried in the general account; doubtful debtors were carried off-balance-sheet;
- Buildings were carried at their appraised value for a certain time ; from 1718, buildings were left off the general balance sheet;
- Ships, furniture, as well as cash and trading cargo sent to the East Indies, were recorded as expenses.
- The net assets in the East Indies were not recognised.

In the tradition of the single ventures until that time, all investments in (tangible) fixed assets were treated as an expense and income was recorded partly when the return cargoes were stored in the warehouses and partly when they were sold.

During its existence, the VOC never recognised its ships, fortresses and other capital goods as tangible fixed assets in its balance sheet. Although this seems an (overly) prudent accounting approach, we will see later in this section that it concealed a problem that eventually became fatal.

### *2.4.4 The monopoly*

The monopoly position was initially granted by the State for a period of 21 years. It was agreed that every 10 years, accounts for the VOC would be prepared. For the first decade, the accounts were suspended due to the great uncertainties. This also suspended the right of participants to withdraw their capital. However, the participation rights were very soon being traded above par.

The monopoly was extended until 1642. The conditions were amended in a way that the power of the directors was somewhat limited and an audit commission (comprising nine major participants and two members of parliament) was installed.

The second extension was until 1672 at a fee of ƒ 1.5 million, payable in 5 equal instalments. Despite the rules, which obliged the directors to render account to the participants, this was never done and all financial reporting was kept secret.

The third extension until 1700 was free of charge to the VOC. However, the VOC supported the war with England and a tribute of 1/33 of total dividends paid was granted to the Prince of Orange. Both cash outflows were recorded as expenses.

For the fourth extension, a total amount of ƒ 3 million (ƒ 1.2 million in 1696, ƒ 1 million in 1697 and ƒ 0.8 million in 1698) was paid.

The fifth extension was until 1754, at a fee of 3% of dividends paid.

The sixth extension was until 1776 for a fee of ƒ 1.2 million (of which ƒ 0.6 million in nitre).
The final extension was until 1796 at 3% of dividends paid.

After 1796, the VOC activities were continued under the responsibility of the Dutch state and the amounts paid-in by the participations were never returned.

### *2.4.5 Analysis of the accounts of the VOC*

Many of the historical financial data of the VOC are available thanks to Pieter van Dam, adviser of the VOC, who finalised a fairly comprehensive description of the financial history of the VOC until the end of the 17th century. The work was kept for the eyes of the directors only.

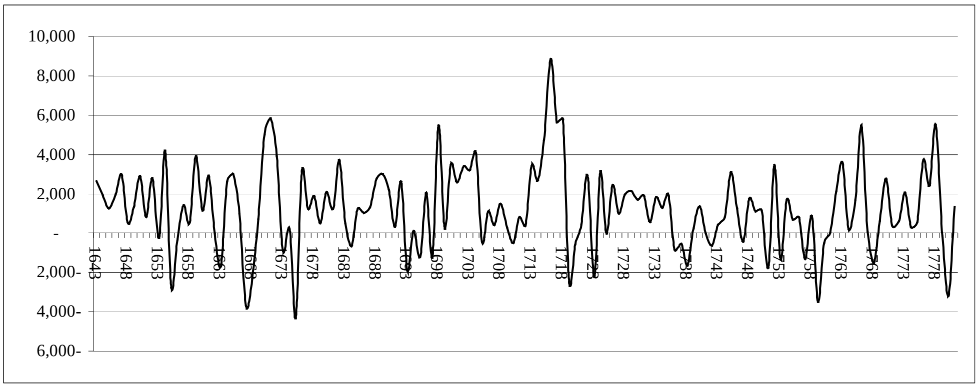
A comprehensive series of “general accounts” (balance sheets and profit and loss accounts) is available from 1642. These general accounts were in fact a combination of the accounts of the separate chambers. All the initial capital was used for the equipage of the first maritime expeditions (vessels, trading cargo, gold and silver) and does not appear on the reported balance sheets; neither do vessels and trading cargo. Vessels, equipment and trading cargo were recognised as expenses when disbursed and the trading cargoes of the return vessels were recognised when stored in the warehouses in the home country. In contemporary financial reporting, vessels, equipment and cargo would be considered assets and transaction results would be recorded at the effective date of the trading transaction. However, consider the IASB requirement for recognising an asset:

An asset is not recognised in the balance sheet when expenditure has been incurred for which it is considered improbable that economic benefits will flow to the enterprise beyond the current financial reporting period.

In the early days of the VOC, the gateway to the East Indies was hardly accessible to their vessels and the expeditions fraught with hazards. Later on, the situation stabilised somewhat and the VOC even managed to raise loans against the anticipated revenue of the return cargoes on the high seas, which enabled the payment of dividends. This type of liability was recorded by the VOC for the first time in 1676, increased to a multiple of annual trading volume and finally converted into perpetual, state guaranteed bonds in 1791. However, the VOC never recorded the value in their books of the assets backing the debt entered.

The graph in Figure 2-5 summarises the reported earnings for the period 1643 to 1780.

**Figure 2-5: Reported earnings VOC 1643 – 1780**



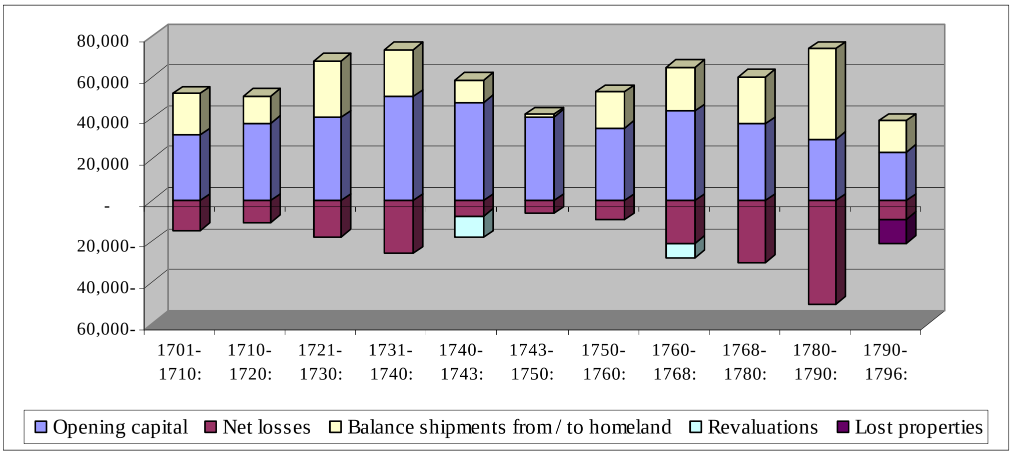

The volatility in reported earnings (i.e. the standard deviation) is 167% and no doubt this will have been influenced by:

- Years when substantial reinvestments in the fleet took place.
- Years when substantial trading cargoes were sent to the East Indies.
- Years when substantial return cargoes were stored in the warehouses in the home country.
- Years when the prices per unit for the stocks of spices were substantially modified. Note that the prices per unit were established by the directors of the VOC and did not necessarily have any relationship with the purchase price (a fair transfer price between the East Indies and the home country was not carried) or with the sales price.

No trend in the earnings until 1780 can be recognised. This is different for the period after 1780, when heavy losses were reported and, as mentioned earlier, I omitted the period after 1780 from my analysis. A tendency that was concealed in the financial figures until that time became visible. After 1692, the balance between the returns from and the shipments to the East Indies was never positive. One cause of this was harmless, but it distorted a true and fair view: the transfer price set for returns from the East Indies was too low and the East Indies were subsequently “subsidised” to finance their losses. The other tendency was that the activities in the East Indies gradually changed from trading to occupying colonies, which in fact required a different type of funding, another reason why I skipped the period after 1780.

Figure 2-6 shows the development in the balance between value transferred from and to the East Indies. The revaluations in this figure are due to restatements of the Indian currency against the Netherlands currency. In the beginning, it was assumed that silver (including coins) had a higher value in Asia than in Europe. Consequently, the cash received from the home country was adjusted by 25%. This surcharge was reversed in 1743. In 1768, a final revaluation against the Dutch Florin was performed.

**Figure 2-6: Development in the capital invested by the VOC in the East Indies**




The lost properties refer to the settlements conquered by the British. In the decade 1780 to 1790, heavy losses were suffered due to the war with England. These losses were to a large extent financed from the home country, where the trade in returning cargo collapsed as a result of the above-mentioned war. The consequences were aggravated by the fact that the VOC neglected its fleet and fortresses during the greater part of the 18th century.

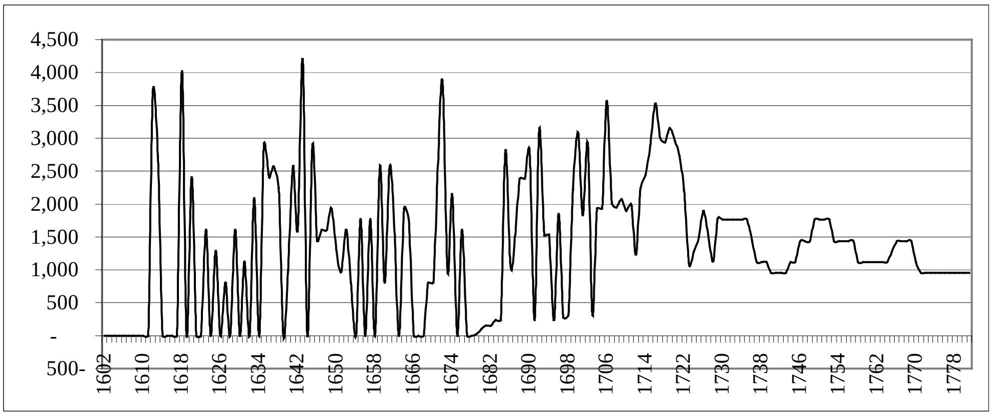
Finally, the VOC could not finance the protection of its properties anymore (actually a government task) which lead to its collapse in 1796. It is fair to say that from 1780, the VOC was in fact not a maritime and trading company, but acted as a government body.

### *2.4.6 Analysis of the value of the VOC*

For an analysis of the value of the participations in the VOC and the value of the intangible asset (the monopoly) granted to the VOC by the government, I made use of the cash flows to the participants. These cash flows were dividends (paid in 1612 for the first time), but consideration has to be given to the fact that in certain years the dividends have been granted in the form of interest bearing bonds. In my analysis, these dividends have been replaced by the interest and redemptions of such bonds in later years.

The adjusted cash flows to the participants described above are summarised in Figure 2-7.

**Figure 2-7: Adjusted cash flows to the participants between 1602 and 1780**




It is striking that the total average dividend reported (ƒ 1,329,000) exceeded average reported earnings (ƒ 1,260,000). However, this might be explained by the time lag in reporting earnings, so that the dividends paid to the participants may properly reflect the company's performance throughout the period 1602 to 1780.

Taking into account the initial (and only) investment by the participants of ƒ 6.4 million, the internal rate of return for the participants amounted to 8.46%. Taking into account a risk-free interest rate of between 3% and 4% (the interest rate on bonds with a government guarantee), this is just a fair return on an equity instrument (compare this with the average return of 7.7% on S&P 500 stocks during the period 1926 to 1995; see Bernstein, 1996, p. 175). So what about the value of the intangible asset (the monopoly)? Well, in fact, this was a genuine Dutch treat, because the government had nothing to give by that time: the VOC had to relinquish its position to the Spanish and the Portuguese and later on consolidate it with the English and the French. During the first 10 years of the VOC, the participations produced no yield at all.

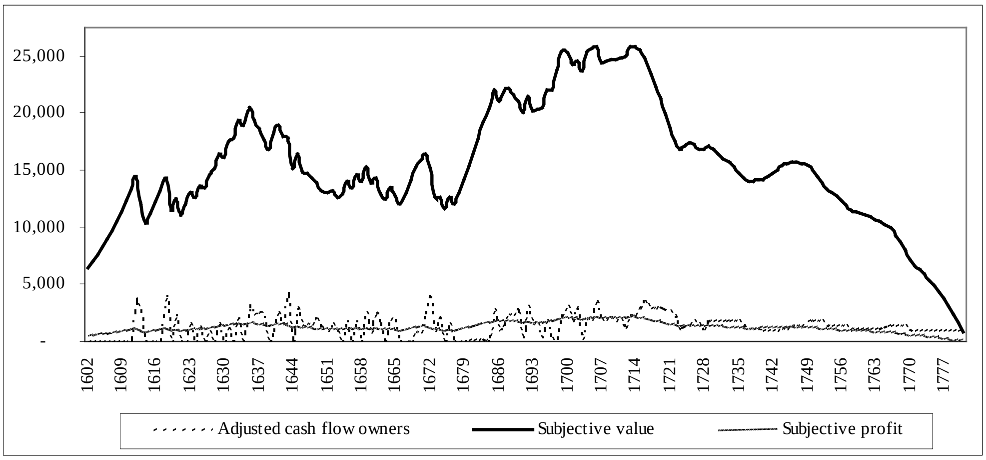
**Table 2-8: Development in discounted cash flows of participations in VOC during the 17th century (thousands of Dutch florins)**

| | |
|---|---|
| Net present value 1602 | 6,440 |
| Net present value 1612 | 14,510 |
| Net present value 1622 | 12,055 |
| Net present value 1632 | 17,870 |
| Net present value 1642 | 17,903 |
| Net present value 1652 | 13,166 |
| Net present value 1662 | 12,964 |
| Net present value 1672 | 15,174 |
| Net present value 1682 | 17,808 |
| Net present value 1692 | 21,498 |
| Net present value 1702 | 24,552 |

If we calculate the economic value of the participations at various times, using the internal rate of return and taking into account our "hindsight perfect foresight" of cash flows, the subjective value develops as summarised in Table 2-8.

If we estimate the subjective profit (i.e. the required rate of return on investments) and set the required rate of return equal to the internal rate of return, the development in the subjective value (i.e. the discounted value of future cash flows) develops as shown in Figure 2-8.

**Figure 2-8: The development in subjective value of the VOC**




Between 1780 and 1796, an annual dividend was paid of 12.5%. However, the structural negative results did not justify such a dividend anymore. The dividend was financed by a state guaranteed loan. In fact, the VOC was already controlled by the state in this period. I therefore considered it justifiable to skip this period in the analysis of subjective profit and subjective value.

### *2.4.7 Conclusions on the VOC financials*

The participants in the VOC had to wait for 10 years to receive their first dividends. Financial information was never officially given to them. Even the directors were never presented with a reasonably accurate consolidated position until decades had passed. Nevertheless, the participations were traded above par, which indicates that the market considered the informal information adequate to create a belief in future benefits (which was a correct belief during a very long period; no timely signal was given when the belief became incorrect, however).

The directors of the VOC accounted for uncertainty by simply not recognising the items they felt uncertain about. Vessels, cargoes and even cash were recorded as expenses when they left the Dutch shores. A return cargo was only recognised as an asset when it reached the Dutch shores (often years after the vessels had left), and valued at very prudent prices per unit. Profit was recognised after sale. In other words, in a value chain lasting many years, a value decrease was recorded only at the beginning of the chain and a value increase only at the end.

Recording vessels and equipment as expenses rather than as assets seems to be prudent. In fact, it turned out to be imprudent because the lack of proper investments during decades of the $18^{th}$ century (which factually weakened the VOC and made them an easy prey) was concealed.

Recording return cargoes at low prices seems to be prudent. In fact, it turned out to be imprudent because the VOC had to compensate its operations in the East Indies with a subsidy, which gradually and invisibly developed into the financing of continuous losses.

The presented development of economic value indicates that the decline of the VOC started around 1715. Although this insight is based on knowledge about the development of future cash flows, the facts indicate that this was about the time when stakeholders started “cash-cowing” the organisation and neglected the structure by failing to make the proper investments. With hindsight, it is easy to reconstruct this development. In reality, the VOC did not even record past financial events accurately. Adequate recording, analysis and explanation of past financial events do not guarantee accurate insight in future developments, but together they represent a step in the right direction.

## 2.5 A historical example of financial reporting and risk measurement: insurance

The initial reaction of companies to uncertainty in financial reporting was simply not to recognise the assets they were uncertain about. That this changed in the course of the 19th century for tangible fixed assets and during the early days of the New Economy for intangible assets must be attributed to the fact that business became more capital-intensive and it was unacceptable to investors to show newly raised capital invested in tangible or intangible assets as a loss. There is no evidence that this change was due to a change in the treatment, recording and measurement of uncertainty.

Insurance is an industry where the management and measurement of risk belongs to the core business. It is therefore worthwhile to investigate briefly how the very early insurance contracts were accounted for. L.J. Daston (1987, page 237) writes about this:

> Insurance and gambling are two institutionalised approaches to risk taking. We see them as diametrically opposed approaches: gamblers pay to take unnecessary risks: buyers of insurance pay to avoid the consequences of necessary risks.

In the development of insurance over time, the position of the Church is worth mentioning. In the 13th century, Pope Gregorius IX proscribed the most popular form of marine insurance because of alleged usury incorporated in these contracts. This forced medieval lawyers to think about acceptable forms of insurance and other aleatory contracts in order to prevent usurious elements in the transfer of risks. The standard was that “those who shared risks deserved a share in the profit as much as those who shared labour.” Life assurance was deemed a form of gambling and was prohibited (by the code of the Low Countries, 1570) in many continental European countries until the 19th century (Daston, 1987, page 239).

As remarked in section 2.2, the problem of life assurance and property and casualty insurance attracted the attention of many mathematicians. John Graunt was the first who constructed a mortality table from the “Bills of Mortality” collected by the city of London since 1603. Huygens and Johan de Witt (*De Waardye van Lyfrenten near Proportie van Losrenten*) used Graunt’s statistics for scientific analysis to predict future mortality given a certain age and to set premium rates. Johannes Hudde constructed the first mortality statistic based on a universe of annuity beneficiaries rather than a universe of the general population. Bernouilli used his Law of large numbers to justify the use of past observations to predict future patterns (on the assumption that past patterns are repeated in the future). De Moivre, who lived in exile in England, was a regular advisor of insurance brokers (and of gamblers).

Nevertheless, it is fair to say that, in general, premium rates (both life and non-life) were to a great extent based on experience and intuition rather than science. Understandable, as historical patterns did not repeat themselves very well, because of the improvement in people’s health and thus in mortality, replacement of timber houses by brick houses in the cities, etc. The actuary in the 18th century was more a clerical than a mathematical function.

Little is known about financial reporting policies of the old insurance companies. From the literature available, we can deduce following:

*Fire insurance*

Fire insurance protected the possessions of the insured against the consequence of fire, mostly by taking care of the reconstruction. In Continental Europe, fire insurance originated from "neighbour aid" which gradually evolved into mutual insurance.

In England, the first shareholder-owned fire insurance companies (such as the Sun Fire Office and the Royal Exchange) were founded in the early 18$^{th}$ century. Premiums and the capital supplied by the shareholders were put into a fund (in the early days of the Sun Fire Office, the cash was deposited in a strong box) which was used to pay the claims. The balance was available for the shareholders. Volatility in the annual claim volume was absorbed by the share capital, which was adjusted from time to time on a trial and error base. In fact, this was one of the first practical demonstrations that in order to deal with uncertainty about and volatility in future cash flows a sufficient base of (economic) capital is needed.

Profit or loss was to large extent measured by counting the cash left after the end of a certain underwriting year, or at later time after all claims had been settled. Today, we would call this the completed contract method for enterprises other than insurance undertakings. Since fire claims by their nature can normally be settled quite rapidly, the balance of premiums received and claims paid could be assessed within an acceptable time. Thus, initially no statistics in the financial reporting of fire insurance.

*Marine insurance*

For marine insurance, it was difficult to assess the profit as the difference between premium receipts and claims paid within a reasonable time. Sea voyages often lasted many years and only at the end of the voyage were all claims were known, so that the result could be assessed.

Accordingly, the results were not assessed annually. Instead, the premiums received for a certain voyage were kept in a fund and all claims were paid from that fund. At the end of the voyage, the balance of receipts and payments was the result of the voyage. Later, the fund was kept for a certain underwriting year rather than a voyage, but the principle of maintaining a fund until virtually all information became available was maintained and is even applied today for marine, transport and aviation insurance. In financial reporting, this method is commonly known as the "completed contract method".

Thus, no statistics in the financial reporting for marine insurance either. The system of recognising profit is quite similar to the accounting for lots of goods as described in section 2.1.

*Life assurance*

One of the first forms of life assurance consisted of annuities issued by (mostly municipal) governments. The form was simple. An amount of capital was supplied by the annuitant and the authorities paid an interest rate (which was higher than the interest rate on loans) until the person assigned to the contract had died. These contracts had a high selection element (the persons assigned to the contracts were mostly young and healthy people) triggered the need for appropriate tariffs by class or age, usually based on the investigations by Johan de Witt and Johannes Hudde described above.

The forerunners of life assurance in the Netherlands were pools called tontines (Wagenvoort, 1961). They became popular in the Republic during the second half of the 17th century. Two basic forms can be distinguished.

- Interest tontine: this is a contract where a number of participants jointly supply a sum of money. The debtor pays annual interest on the total sum, the interest being divided over the surviving participants. As the population of participants decreases over time, so does the interest per capita. After the last participant dies, the principal was for the benefit of the issuer. This form was usually chosen for tontines issued by (municipal) governments, such as the City of Kampen in 1670, and others.
- Capital tontine: as above, but the principal was for the benefit of the last survivor or a group of last survivors or to the survivors on a specific termination date.

For the tontine annuities issued by municipalities, the issuer normally provided collateral (e.g. a land lease).

The private contracts of survival had a fund that needed to be invested. Instruments were sometimes (government) bonds and (in the $17^{th}$ century, between 1671 and 1704) often shares in the VOC, discussed in section 2.4.

The shares in the VOC were quite actively traded. Wagenvoort mentions quotations for 1622 (300%), 1671 (600%), 1672 (250%) and 1720 (1260%). The quotations did not bear much relationship to the subjective values previously calculated. The rate mentioned for 1622 would give the investor a yield of 5.75%, for 1671 3.8% (which was below the bond interest), and for 1672 over 8% (remember that 1672 was the year of the war against France, Germany and England and of internal riots). The market value in 1720 was hardly a realistic price anymore. The market prices were originally derived from G.C. Klerk de Reus, *Geschichtliche Überblick der administrativen, rechtlichen und finanziellen Entwicklung der NOIC*.

Jacob van Dael, the broker involved in the issuance of the tontine of Kampen in 1671, had calculated an average long-term annual return of 3.5% on the VOC shares. It was the exceptionally high dividend in 1671 that gave the participants in the private tontines temporarily a higher return.

The bookkeeping and reporting of tontines was quite simple and practical, being based on receipts (capital payments and investment income) and disbursements (benefits and expenses paid) per tontine. This approach is also quite similar to the accounting for lots of goods described in section 2.1. Thus, even with the early forms of life assurance, for which the tariffs were based on statistical analysis, no statistics were applied in the accounting.

For the tontines described above, the recording of receipts and payments was adequate, because the participants were entitled to all benefits and bore all the risk. There was no need to determine period profit, because nobody was entitled to it. This became different for the shareholder-owned companies, of which the Equitable Society in England was one of the first. This company was founded in 1765 and sold insurance that granted reversionary payments to widows and orphans.

Their premium rates were calculated by Richard Price[10] and were based on his book *Observations on Reversionary Payments*, which was considered the standard work on this subject until the 19th century (Bernstein, 1996, p. 155). The premium rates and the acceptance policy were very conservative (interest 3%, only healthy lives insured, most prudent mortality table, and flat expense surcharge of 6%). Furthermore, the survival rates were substantially understated. The shareholders saw Equitable's funds grow very rapidly and liked to have insight into the free equity available to them. In 1775, Price's nephew William Morgan calculated the liabilities (based on estimated future cash flows) and found that the free surplus was 60% of total assets. From this point on, projections of future cash flows based on statistical assumptions of mortality gradually played a more and more important role in assessing profit and stakeholders' surplus of life assurance companies.

10 Richard Price was the member of the Royal Society of London who "inherited" the famous treatise on "solving a problem in the doctrine of chances" from Thomas Bayes and took care of its finalisation and publication. See section 2.2.2.

## 2.6 The agent and his principal

Traditionally, records are kept to comply with the law (e.g. as a basis for taxation), to keep track of available income or to render account to a principal. The latter follows from the "contract" between an agent and a principal. Often such a "contract" involves the management of an enterprise for which the principal supplied the funding. When such an enterprise is listed on a stock exchange, the principal may be an unknown party to the agent.

The most basic arrangement between an agent and a principal is where the agent acts as a custodian of values owned by the principal. Such a contract serves an unambiguous purpose, as does the information from the agent to the principal on the fulfilment of the contract.

Running the principal's enterprise by the agent is far more complex, especially when the principal is an anonymous party that communicates to the agent through the financial markets and when there are other stakeholders involved with potentially conflicting interests. This complex situation has influenced financial reporting over time, from which it can be observed that the historical development of financial reporting has been driven by incidents rather than concepts. This section briefly describes the main streams in thinking on financial reporting, the friction in the relationship between agent and principal, and the relevance or irrelevance of the funding of an enterprise. The result is a variant to Mattessich's (1995) Conditional-Normative Accounting Theory (CoNaT).

### *2.6.1 Developments in thinking on financial reporting*

Financial reporting is basically about the degree to which enterprises meet their financial targets. Mattessich (2002) distinguishes two main streams for researching enterprises' behaviour (including their financial reporting): normative theories and positivism.

A normative theory relates to logical consistency with underlying assumptions of how logically thinking people *should* behave and what entities *should* do. Examples of normative theories are the early German normative theories, which state for example that "the businessman ought to optimise efficiency and performance for the general benefit of society rather than for the primary benefit of individual firms or persons" (Mattessich, 1995, p. 174). Applying such a normative theory as a basis for, say, a reporting framework entails the risk that reality will go in another direction and the framework will become irrelevant.

Positivism excludes normative premises from theories. Unlike normative theories, it predicts what people and entities *will* do, rather than deduce what they *should* do. Positive Accounting Theory is identified with empirical research (Mattessich, 1995, p. 161). An important research topic is the information content of financial figures and the response of financial markets to these figures. Recent examples are an investigation into the effect of market risk disclosures that have been mandated by the US SEC on trading volumes (Linsmeier et al, 2002) and market responses to recognition and disclosure (Barth et al, 2003).
The empirical research until 1981 has been summarised by Dopuch (Mattessich, 1995, p. 151). Below, some major findings, together with the conclusions from later research, are summarised:

1 Annual and interim earnings announcements both have information value. The correlation between unexpected movements in stock prices and unexpected earnings increases with the

magnitude of the unexpected earnings. Penman (2003, p. 90) memorises that research by Ball and Watts and by Beaver in the early 1970s proved that current earnings are an indicator of future earnings[11]. Later research indicated that financial-statement analysis helps in forecasting. And it is undisputed that future earnings drive shareholder value (Penman, 2003, p. 80).

2 The market is willing to rely on management's forecasts.
3 Other financial data reported in annual reports are not as highly correlated with unexpected movements in stock prices.
4 The relationship between voluntary changes in accounting principles and unexpected movements in stock prices is only relevant when such changes relate to the enterprise's expected cash flows (a move from FIFO to LIFO, etc.).
5 FASB regulations do not affect shareholder value; The market is obviously able to see through any cosmetic changes in the presentation of financial statements.

Mattessich (1995, p. 151) calls the results of the phase of empirical research until 1981 modest in relation to the evidence and encounters many contradictions of evidence. Furthermore, some empirical observations have a normative consequence. For example, if the announcement of annual and quarterly earnings has a high price-information content, it follows that poor information on enterprises' profitability, or even a misunderstanding about the quality and sustainability of the reported earnings, leads to miss-pricing of shares.

### *2.6.2 A brief explanation of the agency theory*

Agency theory is described as the theory of the relationship between the principal (for example a shareholder in an enterprise) and an agent of the principal (company's managers). The theory holds that managers will not act to maximise shareholder value unless appropriate governance structures are implemented in the related enterprise to safeguard the interests of the shareholders (Jensen & Meckling, 1976).

Agency costs can be defined as the total costs and loss of opportunities because the agent does not act in the interest of the principal, as well as the costs of corporate governance and oversight procedures intended to minimise the former costs and losses.

The contract between the agent and the principal starts with the purpose of the contract, the alignment of this purpose between principal and agent, and the response by the agent in the form of a strategy. Indeed, one could set a purpose in accordance with the classical economic theory, i.e. profit maximisation, but this might easily lead to friction between agent and principal.

In this respect, I would like to recall Burgert's (1967, p. 154) observation that there are different concepts of profit for different purposes. Agency costs can result from the fact that the agent maximises another concept of profit than the principal expects him to do. Maximisation of profit with a short time horizon could be at the expense of sustainable profit and thus at the expense of shareholder value. One could solve this by deciding that the only qualifying profit concept to

11 Observe that in this time the deferral and matching principle for allocating income and expenses to periods was still predominant above the asset and liability concept.

maximise is the increase in shareholder value during the period under review. This economic concept of profit has been demonstrated by an example in section 2.3, but later chapters will demonstrate that it is only of practical use in a situation of perfect foresight, as assumed in the example mentioned.

An example of short-term profit taking precedence over growth in shareholder value relates to savings on research and development programmes, which improves bottom line results in the short run, but may decrease revenues or even jeopardise continuity in the future. Financial reporting may show the short-term success of improving profitability, while the negative effects of this “cash cowing strategy” remain concealed.

Kennedy (2000) mentions many examples where actions vis-à-vis stakeholders other than shareholders may affect shareholder value, whilst such actions may appear profitable in the short run. Aggressive laying-off programmes may be effective to increase returns on the short run, but in the long run they may decrease employee loyalty, which might cause talented people to leave. Closing branches may increase profitability, but could decrease accessibility by customers and thus decrease customer loyalty and incur expenses later in order to regain this loyalty.

Apart from divergence in purposes between the agent and the principal, the main causes of agency costs can be summarised as follows:

- Costs of monitoring and procedures to establish a contractual arrangement between agent and principal that motivates the agent to act in the interest of the principal.
- Extra consumption and additional expenses that the principal would not have spent.
- Inefficient use of assets.
- Asymmetry on risk information: the principal does not discount the price of risk (known by the agent) in the purchase of its stocks or bonds or in other kinds of contractual arrangement.
- Asymmetry of value information: the principal has a different expectation of future cash flows than the agent, based on what the latter knows about.
- There is also a reverse asymmetry: the principal may price risk and belief about future cash flows differently from the agent’s expectations. This may be due to imperfections in the communication between agent and principal. Here, financial reporting can help reduce agency costs.

In its governance rules, the OECD mentions the following basic purpose:

> The corporate governance framework should be developed with a view to its impact on overall economic performance, market integrity and the incentives it creates for market participants and the promotion of transparent and efficient markets.

At first sight, this is the starting point of a normative theory. It would be applicable in practice if one could demonstrate that this behaviour would maximise the fundamental value of an enterprise (i.e. the future profit stream) and resolve goal conflicts so that it:

- Maximises realisable values for stock for the short term.
- Optimises the security of creditors, lenders, policyholders, etc.
- Optimises employability and human capital readiness in the long run.

- Makes stakeholders benefit from economic growth on the long run, which is important for pension plans, for example, whose primary purpose is to provide a benefit in real terms.
- Accepts that product lifetimes are limited and that product and service development activities may add to long-term value at the expense of short-term profitability.

The extent to which the agent may consider his contract an arrangement by which he is awarded to the extent he creates fundamental value depends not only on the ability of a society to resolve conflicts between various classes of stakeholders, but also on the possibility to report on the agent's success in creating fundamental value, and increases therein, in a reliable way in the absence of perfect foresight.

Looking at corporate governance as it has emerged over the past decade, some interesting observations can be made. Deminor Rating assigns a corporate governance quality index to public companies, by evaluating the publicly available information on the rights and duties of shareholders, takeover defences, disclosure on corporate governance and the structure/functioning of the board. Blom et al. (2003) found that an increase in this index by one point saves nine basis points in the cost of issued debt.

Bauer et al. (2003) investigated the same Deminor Rating of about 85% of the FTSE Eurotop 300 enterprises for the period 1997 to 2002. They constructed a portfolio of well-governed enterprises and a portfolio of badly governed enterprises. They found that the first portfolio outperformed the latter by almost 3%. This result is similar to that of an earlier study into the California Public Employees Retirement System, a pension fund with a policy to be actively engaged in the governance of their investees (about 42 funds). These funds outperformed the S&P 500 index by 52%[12] over the period 1987 to 1992 (Blom et al., 2003). In the same empirical study, Bauer et al. found that the corporate governance quality index was negatively correlated with reported earnings and return on equity. Although they could not find an explanation for this phenomenon, their assumption is that well-governed enterprises have a more prudent approach towards profit recognition.

### *2.6.3 The relevance or irrelevance of funding*

In 1958, Modigliani and Miller introduced the so-called irrelevance rule (Jonkhart, 1980 p. 142). It states:

> In a perfect market no action that does not result in an alteration of the real income stream generated by physical (*or intangible*) assets of the entity can alter the entity's equilibrium value[13]. This is because equal access to the capital market means that the investor can replicate the leverage structure of the entity himself.

This rule is has to be modified for environments where, for tax purposes, equity financing is treated differently from debt financing.

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12 Which is also close to 3% (2.79% on a continuous compound basis).

13 A free interpretation of an equilibrium value is the value in a situation where demand and supply have forced the value of an enterprise towards its fundamental value, i.e. the present value of its future cash flows.

Jensen & Meckling (1976, p. 333) challenge the irrelevance rule. They observe that the value can be created for the shareholder by increasing the enterprise's investment risk after debt is in place.

It is now recognised that the existence of positive costs associated with bankruptcy and the presence of tax subsidies on corporate interest payments will invalidate this irrelevance theorem, precisely because the probability distribution of future cash flow changes as the probability of the incurrence of the bankruptcy costs changes, i.e. as the ratio of debt to equity rises.

In the example of section 2.3, a situation of perfect foresight was assumed. There, the situation described by Jensen & Meckling could not happen. Chapter 3 will elaborate on the consequences of abandoning the situation of perfect foresight and the required place of the factor of risk in financial reporting. In this section, I would like to restrict myself to two positive observations.

1. Examples are known of situations where an increase in the corporate leverage (e.g. by repayment of equity) led to an increase in the stock price of the related enterprise.
2. A sudden inability by an enterprise to meet its commitments and to perform on its debt is perceived to be one of the most shocking events in the financial world, leading to damaged investor confidence and endangering market liquidity.

In relation to these observations, one could conclude that financial markets under certain circumstances do, *but should not*, reward changes in the financing structure of an enterprise that affect the risk of not being able to meet its commitments. In this respect, the attitude of the agent, the information communicated by the agent to the principal, and the attitude of the principal as a result of this information are all relevant.

First, let us look at the behaviour of the agent. Boot (2005) observes that Limperg did not take risk into account in his theory. However, Limperg departs from an ethical-normative point of view that a debt arrangement should only be entered into if repayment is guaranteed (*with a high degree of certainty, given that absolute certainty does not exist:* Boot, 2005, p. 143). Of a later date are the principles on capital adequacy and solvency, issued by the International Association of Insurance Supervisors (2002). In addition to the perceived need for supervisory control of insurers' capital adequacy, these principles highlight the enterprise's own responsibility to understand and manage the risks they underwrite and to keep appropriate levels of economic capital related to those risks. In other words, don not enter into an insurance contract if you are not sure that you can perform. This principle was adopted by CEIOPS in their consultation on the Solvency II project by the European Union[14]. This can be explained not only by ethical-normative theory (you will not put policyholders unduly at risk), but also by positivism (the cost of shattered confidence is enormous).

Second, the information available to the agent is relevant. Information asymmetry may cause a wrong view by the agent, resulting in a wrong reaction from the financial markets. The markets may therefore erroneously award the principal for behaviour that does not add fundamental

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[14] CEIOPS stands for Committee of European Insurance and Occupational Pension Supervisors. Their recommendation to the Solvency II subcommittee of the European Union in relation to risk management is that insurance enterprises should have their own strategies for solvency capital in place as an integral part of the overall business strategy.

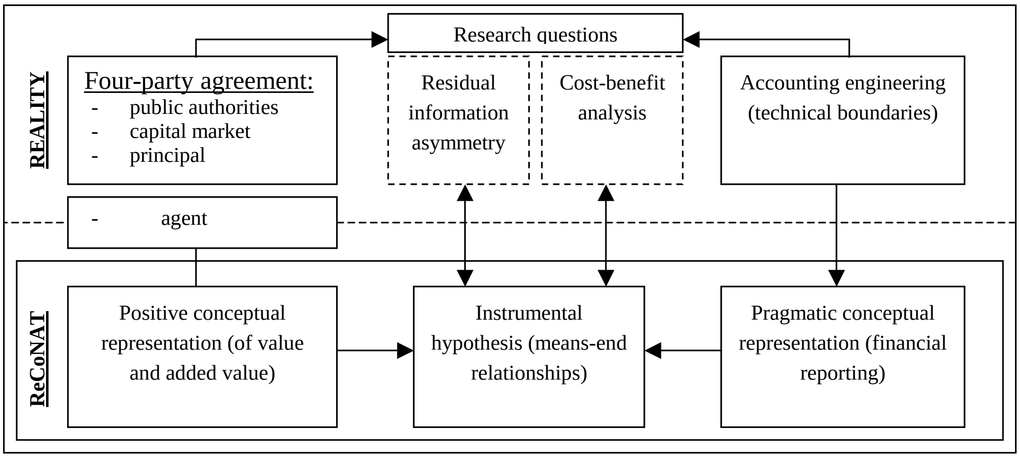
shareholder value or is even value destructive. This matter becomes really complicated if the choices that the agent makes do not only affect expected future cash flows, but also relate to the expected value of future cash flows in relation to the risks associated with them. Mitigating the information asymmetry between agent and principal may correct the signals to the financial markets that are the means of communication by the principal to the agent. The next chapters deal with this issue.

Lastly, the extent to which information is properly received and understood by the principal and the extent to which the principal really sends a signal to the capital market that stimulates the creation of fundamental shareholder value are significant. The importance of an active role by investors/principals in enterprises' corporate governance has been explained above.

### *2.6.4 Conditional Normative Accounting Theory*

Mattessich (1995) created a synthesis between the positive accounting theory (based on observations) and accounting theories that were based on normative premises. The result is a framework for financial reporting that has its roots in game theory[15], i.e. Conditional-Normative Accounting Theory (CoNAT). In other words, the normative behaviour of an agent is driven by the positive observations from the outside world.

**Figure 2-9: Revised Conditional Normative Accounting Theory (ReCoNAT)**




Such a positive observation might be that the principal wants the agent to optimise the overall economic performance (compare this with the basic purpose of corporate governance rules according to the OECD). However, the principal will only have such a purpose if it optimises the value (a function of the total future cash flows of an enterprise) and solves the goal conflict between profit maximising for the short-term or medium term and maximising shareholder value.

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15 According to the Stanford encyclopaedia of philosophy, game theory is the study of the ways in which strategic interactions among rational players produce outcomes with respect to the preferences (or utilities) of those players, none of which might have been intended by any of them.

Many examples can be thought of where maximising short-term wealth is to the detriment of the long term and therefore to the detriment of value.

- Insufficient research and development may lead to a situation where products cannot be replaced when they reach the end of their life cycle, possibly causing a decrease in future cash flows.
- Insufficient development of human capital may lead to insufficient availability of qualified staff, which may restrict an enterprise's ability to move forward or even maintain its present status.
- Insufficient care for sustainable customer satisfaction may lead to erosion of the customer base in the long run.
- Insufficient care for compliance with laws and regulations and for, integrity of communication may disturb confidence and hamper access to capital.

Not all conflicts between overall economic performance and enterprise value or profits can be resolved in a contract between agent and principal and the agent cannot deal with these conflicts in managing the enterprise or in the reporting thereon.

So let us take the vision of international organisations (such as OECD), stock exchange supervisors, financial industry regulators, etc. on corporate governance and construct a "four-party" agreement as the basic driver for agent's actions and behaviour. The four parties are government, capital market, principal and agent.

The responsibility of government is to enforce laws in order to prevent illegal or unethical behaviour from increasing shareholder value. For example, an enterprise that causes severe environmental damage should not be rewarded more than the enterprise that invests to prevent such damage.

The responsibility of the capital market is to create sufficient liquidity and transparency. If this task is properly fulfilled, stocks and other financial instruments can be traded without a liquidity penalty at their fundamental value and agents do not need to make a trade-off between short-term generation of cash flows and long-term generation of value.

The responsibility of the principal is to give the right impulses to the agent, either via the capital market or via active involvement in the corporate governance (compare Calpers; see section 2.6.2). This implies that the principal is obliged to understand financial reporting and to identify the key value and risk drivers.

*Then*, the responsibility of the agent is to define and execute a strategy that is, within the boundaries of the four-party agreement, focused on the sustainable creation of value and to report on the progress.

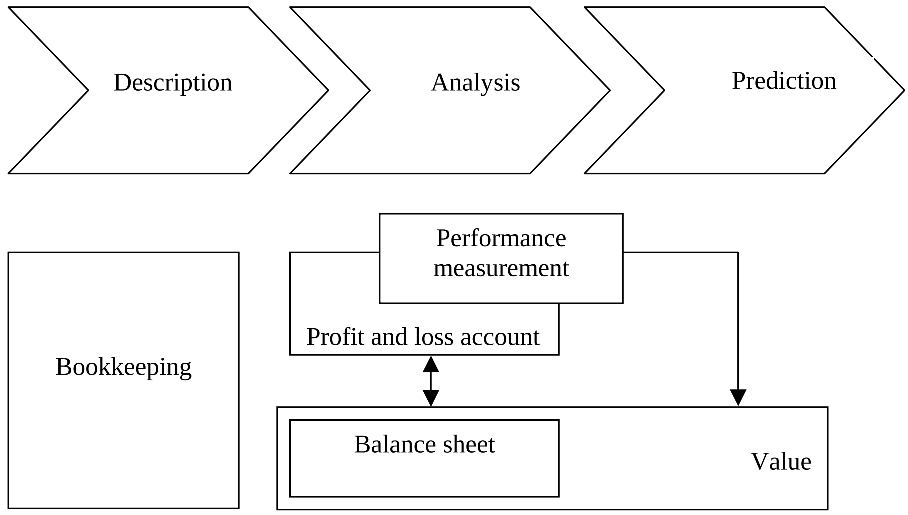
This leads to a revised conditional normative accounting theory as shown in Figure 2-9. This figure is simpler than the original presentation by Mattessich (1995), because it does not deal with potential conflicts between the agent and various groups of stakeholders. In ReCoNAT, these are solved within the four-party agreement.

The conceptual representation that accounting should produce is value. But value is driven by expected future cash flows, which are in turn driven by risky choices that the agent makes for the account and risk of the principal. Representation of this value has its limitations and this is the reason for the pragmatic conceptual representation (compare Schmalenbach's substitution theory; see section 2.3) that minimises information asymmetry between agent and principal, given the technical limitations of accounting engineering and cost-benefit analysis.

## 2.7 Summary and conclusions

Van Stridiron (1943) makes a general distinction between descriptive and scientific statistics, or (more detailed) between description, analysis and prediction. These concepts are shown as connected to bookkeeping, performance and value in Figure 2-10.

**Figure 2-10: Statistics and financial reporting**




In section 2.1, the development of bookkeeping from informal notes on financial historical events to a sophisticated, systematic and largely self-controlling system has been described. It had to be concluded there that bookkeeping itself is neither the condition for nor the instrument to measure value and income.

In his *Summa*, Pacioli included lots of practical tools for the merchant, including suggestions on how to divide the earnings from an enterprise between partners. These suggestions were to a great extent based on past events. When he applied these suggestions to a *game*, it became a subject of discussion between the gamblers. While merchants and bookkeepers went on to record historical financial events and measure income and capital retrospectively, the gamblers and the mathematicians developed techniques for valuing a bet. In section 2.2, the development of thinking about handling uncertainty with respect to future events has been described. It has been found that historical data play a role in evaluating possible future developments, because historical patterns tend to repeat themselves. However, this repetition is imperfect and the degree of imperfection is not always known. Thomas Bayes made a great contribution by not addressing predictions from a known set of probabilities, but by addressing the question of what the probability of a future event (or value) is, given the observations we have available. His theorem makes it possible to “account for” the risk implications of recorded events.
In the same section, it was stated that different people have different attitudes towards risk, that the same human being may have a different attitude towards risk at different times, under different circumstances and with respect to differently formulated proposals with equal effect.

In section 2.3, it has been shown that the value of an enterprise depends on the amount and timing of the *future* cash flows; in other words, it is not possible to derive value from past events; it is only possible to explain a balance sheet from past events. In the same section, the different concepts of profit have been discussed. One of the concepts, namely gathering information about the performance of the enterprise, may be the most relevant one with respect to value as described above. A performance statement reflects the enterprise's ability to create value from its core competence. The skills and aims of the enterprise make it probable that it will repeat its performance to a certain extent in the future. The probability of repetition will be higher for the performance measured than for windfall profits arising from speculative actions or otherwise taking positions. The baker will most probably bake his bread next year too; the winner of the lottery will probably not repeat his "deed of valour".

Sections 2.4 and 2.5 have shown that enterprises dealt with uncertain elements in financial reporting by simply attributing a zero value to them. It appeared to be a misunderstanding that this approach was prudent. Quite the contrary. If the VOC had been committed to recording the value of its ships and other (tangible) fixed assets, the adverse effects of neglecting maintenance and replacements would have been visible in the first half of the 18$^{th}$ century.

Even the insurance industry, where the transactions are largely based on a statistical approach, financial reporting was based on a retrospective approach, which only gradually changed over time.

So where was financial reporting formally invented? I am afraid, I have missed it! My investigation and observations give the impression that financial reporting rules developed when there was a certain need or incident, but never within a framework of measuring value and performance.

Grammateus invented a system for establishing the result on inventories from the need to close the books annually. His system is retrospectively oriented. In the 19$^{th}$ century, tangible fixed assets were recognised as an asset, probably because they became significant due to the industrial revolution and the building of the railways. In the 20$^{th}$ century, intangible assets became an issue, probably for much the same reason.

The invention of financial reporting requires the analysis of the relationship of the provider and the user of financial information regarding enterprises that are founded for an indefinite period and where management and ownership/funding are separated. Accordingly, the relationship between an agent and his principal has been analysed in relation to the Conditional-Normative Accounting Theory. Issues such as goal conflicts between agent and principal and between agent, principal and other stakeholders become relevant. Information asymmetry (the agent is better informed about the enterprise than the principal) also becomes a factor to deal with. I have simplified this theory by assuming a four-party contract between government, capital market, principal and agent. The working assumption in this book is that goal conflicts are resolved within this contract, so that the enterprise, or the agent who runs it, does not have to worry about them. Given a well-functioning four-party contract, this is true. Given an ill-functioning contract, I feel that the enterprise is not the place to solve goal conflicts or to align its financial reporting to them. The consequence of this working assumption is that the progress of the enterprise in creating long-term shareholder value and the risky choices that the agent makes for the account of the principal should be the key elements in financial reporting. So financial reporting focuses on the minimisation of information asymmetry. The Revised Conditional-Normative Accounting Theory starts with the assumption of a well-functioning four-party agreement. In fact, the assumption is no more or less than that the rules of the game according to which the enterprise plays and reports are well defined. Winning the game, while playing by the rules, maximises shareholder value (driven by the long-term aggregate of expected future cash flows) whilst creating a situation in which no other party is worse off. Hence, financial reporting focuses on the stage of realisation of the strategy to create shareholder value and on the risks/degree of uncertainty relating to future cash flows. The pragmatic conceptual representation is the "best fit" to this information need, given the accounting and risk measurement technology available.

In terms of a pragmatic conceptual representation, I sympathise with Schmalenbach's theory that primarily focuses on the profit and loss account. Figure 2-10 shows that measuring performance is a matter of bookkeeping (descriptive statistics) and analysis, which is a judgemental process. However, it is far less judgmental and subjective than measuring value, which is entirely dependent on estimated future cash flows. When value is to be measured, gauging performance is an important component.

Finally, I wish to comment briefly on Schmalenbach's principle of prudence, discussed in section 2.3.1. Consider the effect of this principle applied to a very simple example of an inventory with a balance of € 5,000,000. The valuation principle is cost or realisable value.

In the case of an expected realisable value that is normally distributed with a mean of € 7,500,000 and a standard deviation of € 1,000,000, the probability that the book value is correctly shown by the historical cost is more than 99%. With a mean of € 6,000,000, this probability is 84%, and with a mean of € 5,100,000, only 53%.

In all three cases, the carrying value of the inventory is € 5,000,000 and the financial statements reveal no differences, unless risk information is included in them.

This example demonstrates that even with Schmalenbach's focus on the profit and loss account, where the balance sheet is only the waiting room for future profits and losses, if correct but subjective principles are substituted by less correct but accurate principles, and if prudence is applied, there is no escape from dealing with predictions concerning future developments or from the need to manage and disclose them. Morgenstern (1963, p. 83) draws attention to this issue and advocates the reporting of variability indicators in addition to the book value of assets.

Basically, there are two approaches to risk in financial reporting.

1. Ignore it by setting uncertain values to zero (which was done by our ancestors and which in the end appeared to be imprudent).
2. Price it. In the next chapters, an attempt will be made to connect the price of uncertainty about future cash flows to the financial reporting as applied today.

**Appendix 2-I: Further explanation about the example in section 2.3.2**

*Formula to calculate the annuity with respect to tangible fixed assets per unit of product during the first 8 years:*

$$t = \frac{A + 2.50\sum_{n=9}^{10} \frac{p_n}{(1+i)^n}}{\sum_{n=3}^{10} \frac{p_n}{(1+i)^n}}$$

- t = annuity per unit of product for years 3 to 10.
- A = development costs including interest on the tangible fixed assets.
- $p_n$ = number of units produced and sold in year n.
- i = interest rate.

This leads to the following depreciation schedule:

| | Opening balance | Annuity | Interest | Depreciation | Closing balance |
|---|---|---|---|---|---|
| 3 | 706,000 | 77,990 | 28,240 | 49,750 | 656,250 |
| 4 | 656,250 | 133,768 | 26,250 | 107,518 | 548,732 |
| 5 | 548,732 | 133,768 | 21,949 | 111,819 | 436,912 |
| 6 | 436,912 | 133,768 | 17,476 | 116,292 | 320,620 |
| 7 | 320,620 | 133,768 | 12,825 | 120,944 | 199,677 |
| 8 | 199,677 | 133,768 | 7,987 | 125,781 | 73,895 |
| 9 | 73,895 | 39,179 | 2,956 | 36,223 | 37,672 |
| 10 | 37,672 | 39,179 | 1,507 | 37,672 | 0 |

The opening balance at year 3 includes the cost of development (€ 700,000) and interest during the development (€ 6,000). The revenue per product is € 20 during years 1 to 8 and € 17.50 in years 9 and 10. The difference should be attributed to the innovation in year 9; hence in years 9 and 10 the plant contributes the amount t as calculated above less € 2.50.

*Formula to calculate the annuity with respect to development costs:*

$$l = \frac{D}{\sum_{n=3}^{10} \frac{p_n}{(1+i)^n}}$$

- *l* = annuity per unit of product for equalisation of labour costs.
- *D* = Total labour costs during the development period.

This leads to the following equalisation schedule:

| | Opening balance | Annuity | Interest | Depreciation | Annual labour costs | Closing balance |
|---|---|---|---|---|---|---|
| 3 | 200,000 | 87,257 | 8,000 | 79,257 | 100,000 | 220,743 |
| 4 | 220,743 | 149,663 | 8,830 | 140,833 | 100,000 | 179,910 |
| 5 | 179,910 | 149,663 | 7,196 | 142,467 | 100,000 | 137,443 |
| 6 | 137,443 | 149,663 | 5,498 | 144,165 | 100,000 | 93,278 |
| 7 | 93,278 | 149,663 | 3,731 | 145,932 | 100,000 | 47,346 |
| 8 | 47,346 | 149,663 | 1,894 | 147,769 | 100,000 | ( 424 ) |
| 9 | ( 424) | 99,775 | ( 17 ) | 99,792 | 100,000 | ( 216 ) |
| 10 | ( 216) | 99,775 | ( 9 ) | 99,784 | 100,000 | - |

Applying the present reporting rules set by the International Accounting Standards Board, the intangible assets, i.e. development costs of the concept, could be recognised as an asset, provided that they can be identified separately.

The accrual in year 9 and 10 which is needed to ensure that the labour costs are a constant factor in relation to the goods produced, would not qualify as an asset. Unlike Schmalenbach, the IASB gives primary concern to the definitions of assets and liabilities.

The development in interest expenses can be further explained as follows:

| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|
| Interest expenses | 32,450 | 32,450 | 27,814 | 23,178 | 18,543 | 13,907 | 9,271 | 4,636 |
| Absorbed in tangible fixed assets | ( 28,240) | ( 26,250) | ( 21,949) | ( 17,476) | ( 12,825) | ( 7,987) | ( 2,956) | ( 1,507) |
| Absorbed in intangible fixed assets | ( 8,000) | ( 8,830) | ( 7,196) | ( 5,498) | ( 3,731) | ( 1,894) | 17 | 9 |
| | ( 3,790) | ( 2,630) | ( 1,331) | 204 | 1,987 | 4,026 | 6,333 | 3,137 |
| Notional interest on equity | ( 4,000) | ( 2,990) | ( 1,691) | ( 156) | 1,627 | 3,666 | 6,093 | 2,897 |
| Financing of inventory | 210 | 360 | 360 | 360 | 360 | 360 | 240 | 240 |

# 3 Uncertainty and current financial reporting

In the previous chapter, the historical development of bookkeeping, risk measurement and financial reporting has been discussed. As an analogy, I have used van Stridiron's (1943) troika that defines the processes of statistical science, i.e. systematic recording of historical events, analysis of the data sets and prediction.

Bookkeeping can be compared with the first step; financial reporting contains elements of the last step, due to the purposes that have been attributed to it[16]. Section 2.3 demonstrates that financial reporting on performance and value is perfect subject to the condition of perfect foresight and can be summarised by two simple formulas.

$$Value_t = \sum_{i=t+1}^{n} \frac{Cashflow_i}{(1+rate)^i} \text{ and}$$

$$\text{Performance} = \text{Value}_t - \text{Value}_{t-1}$$

Performance represents the value *created* during the period, i.e. the discounted increase in cash flows that will (under perfect foresight certainly) be *realised* in the future. Abandoning the assumption of perfect foresight reduces the second equation to a "concept for the mind" with no solution, because the left and the right part contain unknown parameters. Unless …………

*… past events can be analysed together with environmental factors and intentions, leading to an assessment of the degree to which historical events repeat in the future, which assessment can be used as input for value estimates that can, together with their measured quality (uncertainty and accuracy) be reported reliably.*

In chapter 2, I concluded that financial reporting was never formally invented. Initially, people reported documented historical events that were translated to a common value. Estimates (of uncollectible receivables, of the lifetime of tangible fixed assets and ultimately of fair value of assets and cash generating units) gradually took their place in financial reporting when the perceived need of the user arose, but with hardly any consideration for the disclosure of the degree of reliability of such information.

Diepenhorst (1951, page 2) concludes that uncertainty was one of the most neglected areas in business science. While major steps have been made since then in operations research, investments/finance and similar areas, I believe that this statement is still true for financial reporting, because although there is a solution for systematically valuing and recording historical events, there is no solution for systematically recording and evaluating the risk and the assessment of attributes of recorded events that will in some way affect future developments that are relevant to estimates in financial reporting.

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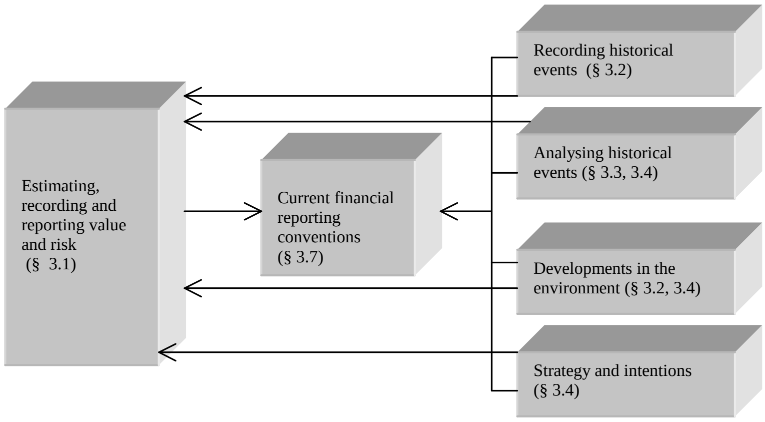
16 The IASB framework (§ 15) states: "The economic decisions that are taken by users of financial statements require an evaluation of the ability of an enterprise to generate cash and cash equivalents and of the timing and certainty of their generation".

This chapter focuses on the effects of uncertainty on financial reporting. The roadmap is as follows:




In section 3.1, the example that has been used in section 2.3 subject to the condition of perfect foresight is further discussed by including some simple conditions of uncertainty about the development of future cash flows. The influence of the volatility resulting from uncertainty on value is demonstrated. The relevance of value and volatility to lenders is also discussed.

In section 3.2, some conventions for recording the financial effects of historical events are discussed. The gap between subjective value and equity that is built from only historical events is shown.

In section 3.3, price fluctuation (an often-discussed change in the environment) is included in the model and the behaviour of equity in relation to value and that of profit in relation to performance is evaluated against the background of the available literature. The main purpose is to investigate to what extent price fluctuations are a topic to address separately in financial reporting (standards) from other changes in the environment of an enterprise.

In section 3.4, the differences between the recording of (comprehensive) income and analysing proven performance are discussed. The main purpose is to investigate what tools exist to objectively classify the various recorded elements according to the probability and extent that they will recur in the future.

In section 3.5, some conventions are discussed with respect to management's reporting about events during the reporting period, their views on developments in the environment, their intentions and strategy and their future estimates.

In section 3.6, the aspects of Recording, Explaining and Projecting are jointly discussed as a transparent approach to serve the need for deriving value-oriented (i.e. future-oriented) information from the recording and analysing of historical facts.

Finally, in section 3.7, the observations from the previous sections are held up against present (IASB) reporting standards. One of the topics discussed is the extent to which information involving estimates about future cash flows is unambiguously isolated from information resulting from documented historical events, because the degree of reliability is different between these two classes of information. Another topic relates to the question of where concepts that evolved in a natural way in the previous sections conflict with the current rules.

### 3.1 Subjective value and uncertainty

In section 3 of chapter 2, the value concept has been explained using the example of Sitting Duck Distillery plc. under the assumption of perfect foresight about future developments.

Both Schmalenbach (1923) and Edwards & Bell (1961) connect value to future profits/cash flows and not to what has been created in the history of the enterprise. In an environment of perfect foresight, no trade-off needs to be made between the relevance provided by documented historical events and the reliability of the measurement of created value. Historical events (such as in our example of designing a new product) can directly be translated into value, because the future cash flows are *known* and do not need to be *estimated*. In that case, value created in history consists by definition of the present value of incremental future cash flows and performance is synonymous with the value created during the period.

In this section, some uncertainty factors are introduced into the example and the effects are evaluated:

- The increased competitive force as a result of technological innovation does not happen for certain in year 8, but may happen in each year after year 3. The probability in each year is 12%.
- The abrupt change in consumer preference does not happen for certain after year 10, but may happen in each year after year 3. The probability in each year is 2.50%.

Furthermore, corporate income tax has been introduced in the example, primarily to demonstrate how deferred tax assets should be measured. In chapter 2, corporate income tax has been ignored, because it did not add any relevant aspects there. It is assumed that the cost of developing the company's concept are tax deductible in the year they are incurred, irrespective of whether they are capitalised in the statutory balance sheet. Tax losses are assumed to be carried forward indefinitely.

The enterprise has only two options for reacting to adverse events:

- In the case of technological innovation, it can reinvest in a cheaper plant in the years of planned reinvestment (i.e. in years 11, 18, 25, etc.).
- If consumer demand abruptly ceases, the enterprise can stop all operations with no layoff expenses. Inventory can be sold at historical cost and the scrap value of the plant equals removal costs.

For the example, use is made of an Excel model, which is explained in Appendix 3-I.

Uncertainty has a number of effects. In the first place, the business does not necessarily stop after 10 years; it may even still exist (although the probability is less than 2.5%) after 150 years. The present value of the *expected* cash flows amounts to € 1,336,000. However, this does not take into account that uncertainty has a price, which is often reflected as a surcharge to the risk-free discount rate. I use a surcharge of 4.5%, based on the explanation by Copeland et al. (2000, page 221), which is discussed in Appendix 3-I.
And there is more. In the adverse scenario (abrupt cessation of consumer demand), the loan cannot be fully repaid. The lender will limit the risk of a full or partial loss of the loan and will ask for collateral. In the example, only the inventories qualify as collateral since the other assets

have no direct net realisable value. Consequently, the lender will require a minimum amount of *economic capital*. This means that the initial shareholders' investments will be higher than in the situation of perfect foresight and that there is a restriction on distribution to the shareholders. In the example, the required economic capital is set at such a level that the default risk in each year is limited to 0.50%. Under normal circumstances, this is in line with an AA rating for debt with a term of 5 to 7 years. The calculation of this economic capital is explained in Appendix 3-I.

Finally, the loan will probably not be granted at the risk-free interest rate, but with a surcharge of 50 bp for default risk. The total effect of uncertainty to the value is summarised in Table 3-1. This table shows that uncertainty is not only translated into a surcharge to the risk-free yield but also into the demand for a capital buffer in order to deal with possible adverse deviations from plans and expectations. This concept has been formalised in most countries for the financial service industry (banks and insurance companies). Although it is only used intuitively for other industries (e.g. banks demand that equity is a minimum percentage of total assets when granting a loan), it exists and is a relevant factor when determining value.

**Table 3-1: Effect of uncertainty on value**

| | Value at inception | Value at beginning of year 4 |
|---|---|---|
| Discounted cash flow at risk-free rate | 1,336 | 1,450 |
| Price of uncertainty | ( 522) | ( 453) |
| Discounted cash flow at 8.5% (Copeland et al. page 221) | 814 | 997 |
| Extra economic capital to reduce default rate to 0.5% | | 640 |
| Cost of extra economic capital to reduce default risk to 0.5% | ( (220) | ( 244) |
| | 595 | 1,392 |
| Extra cost of debt (default surcharge on debt interest of 0.5% for approx. 5 to 7 years for AA rated debt; Copeland et al., page 212) | ( 11) | ( 9) |
| | 584 | 1,383 |

At the beginning of year 4, the "fundamental" value for the owner amounts to € 1,383,000. The standard deviation of all possible values resulting from all possible scenarios during years 4 to 10 is 582,000, resulting in a volatility of the equity value of 42%. Standard deviation is a common measure for risk.

Value (driven by expected future yield) and volatility[17] are relevant data for a purchase and sales transaction between knowledgeable, willing parties.

It is also worthwhile to look at the enterprise from the perspective of the lender. The enterprise has an irrevocable obligation to pay interest and redeem the loan, and the total assets may serve to fulfil this obligation. In certain circumstances, the value of the total assets is insufficient to service debt, in which case a condition of default exists. Some writers (a.o. Merton, 1974) have written on the relationship between lender and shareholder as follows:

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17 In practice, an investor would not only be concerned with the risk of a specific investment, but primarily with the risk that the specific investment adds to his total portfolio.

The lender has written a call option to the shareholder, which gives the latter the right at redemption date to the total assets of the enterprise at a price equal to the amount due to the lender. In my example, the debt is repaid in annual instalments. Each year, the shareholder has to make a decision whether he wants to exercise (part of) his option. The example has 28 conditions of default over the period of seven years during which the loan is repaid, with the option not being exercised in one of those years. The probability that one of these conditions arises is 16.24%.

**Figure 3-1: Frequency distribution of default losses**

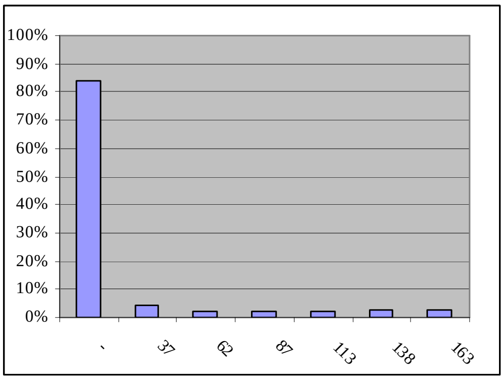
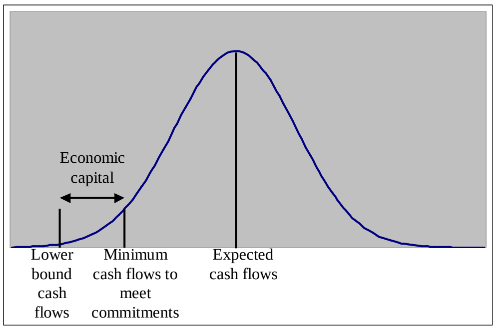



Figure 3-1 shows the amounts that the shareholder "saves" by not exercising his option in years that the value sinks below the strike price (condition of default). The weighted average of these amounts is € 12,000. Hence, the extra premium (the time value) the shareholder is willing to pay and the lender wants to receive for the option amounts to € 12,000. This is equal to the present value of the risk premium (50 bp) embedded in the debt interest rate.

In other words, the option as defined above can be translated into a required risk premium on the debt interest rate.

In Appendix 3-I a calculation has been made with the general Black and Scholes model for option pricing. This model results in a substantially lower premium, due to the assumptions about the future development of the asset value. An alternative calculation has been made using the CreditGrades™ model of Risk Metrics Group Inc., as described in their technical document of 2002. These calculations come very close to the enterprise-specific premium in the example.

**Figure 3-2: Economic capital**




Both models use the value and the volatility as major input variables. It is a key observation that for shareholders and creditors alike these two variables are obviously crucial, the first for evaluating the value of its property, the second to evaluate the solvency of their debtors. One might expect that external financial reporting would focus primarily on giving information about value and volatility, i.e., on expectations and uncertainty regarding future cash flows.

Lenders and management of an enterprise will focus on different questions. Lenders (when engaging in a loan or when trading debt paper) will ask themselves what the risk is that the loan will not be (entirely) redeemed and will want to be compensated for bearing this risk.

This compensation is basically what models such as CreditGrades™ estimate. Management will ask themselves what capital base they need (so what dividends can be paid or what capital has to be attracted). Figure 3-2 shows the relationship between the required economic capital and the expected cash flows and the volatility of those expected cash flows. While the example demonstrates that the enterprise on the one hand and the shareholders and creditors on the other use value (based on expected cash flows) and volatility around that value (i.e. a function of the volatility of uncertain future cash flows), it reveals a curiosity that is shown in Table 3-2.

**Table 3-2: Analysis of value total assets**

| | Equity | Debt | Total net assets |
|---|---|---|---|
| Expected value cash flows year 4 - 10 | 1,055 | 799 | 1,854 |
| Expected value credit spread | ( 8) | 12 | 4 [18] |
| Expected value cash flows after year 10 | 336 | | 336 |
| | 1,383 | 811 | 2,194 |

The enterprise is committed to redeeming the debt in years 4 to 10. The total present value of expected cash flows amounts to € 1,858,000. External credit rating models would consider the total value of € 2,194,000, which includes discounted cash flows for the period after redemption. Theoretically, this seems to be correct in a world where liquidity is always available (one of the assumptions of the capital market theory): as long as there is value, there is a rationale to finance it. For the enterprise, this means that it must be able to demonstrate its value in order to remain solvent. This would be another argument why external financial reporting should provide value relevant information.

In the balance sheet in Table 3-3, the subjective elements of future projections are concentrated in the subjective goodwill and in the estimate of the required economic capital, which eventually determines the cash available for the owner. Tangible fixed assets are still carried at historical cost less depreciation, although their value is solely connected to the value of the enterprise as a whole. In a situation such as this, Hoogendoorn (1999, page 203) would present the tangible fixed assets at their net realisable value (which is zero in our case and would thus mean higher subjective goodwill) in order to be sure that all subjective elements are concentrated in the line subjective goodwill.

A financial reporting model such as this would be attractive, because it represents the true value of an enterprise, protects against overstatement of distributable earnings by assessment of the required economic capital, and it is dualistic because it presents a net profit that reconciles with the movement in equity.

**Table 3-3: Balance sheet and profit and loss account based on subjective value and profit**

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| **Balance sheet** | | | | | | | |
| Subjective goodwill | 880 | 906 | 923 | 932 | 930 | 916 | 889 |
| Tangible fixed assets | 600 | 500 | 400 | 300 | 200 | 100 | - |
| Inventory | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Collateral assets | 647 | 561 | 469 | 377 | 285 | 193 | 631 |
| | 2,136 | 1,976 | 1,801 | 1,618 | 1,424 | 1,218 | 1,529 |
| | | | | | | | |
| Capital and legal reserves | 1,341 | 1,290 | 1,231 | 1,162 | 1,084 | 993 | 1,420 |
| Tax payable | 100 | 107 | 107 | 108 | 108 | 109 | 109 |
| Loan | 695 | 579 | 464 | 348 | 232 | 116 | - |
| | 2,136 | 1,976 | 1,801 | 1,618 | 1,424 | 1,218 | 1,529 |

18 The difference between the value of the credit spread in the debt and the effect on equity is caused by corporate income tax.

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| **Profit & Loss account** | | | | | | | |
| Yield on subjective value | 118 | 114 | 110 | 105 | 99 | 92 | 84 |
| Past - anticipated subjective profit | 112 | 110 | 107 | 104 | 100 | 96 | 91 |
| Subjective profit | 230 | 224 | 217 | 209 | 199 | 188 | 176 |
| Net change in required economic capital | ( 46) | ( 51) | ( 59) | ( 68) | ( 79) | ( 91) | 427 |
| Distributable earnings | 276 | 275 | 276 | 277 | 278 | 279 | ( 251) |

However, hardly any information is given on possible volatility of future cash flows. Past – anticipated subjective profits gives some indication about developments and changes in estimates, but would need a thorough analysis in order to be useful.

The profit reported above is nothing more than the difference between two consecutive subjective value estimates and gives no information in relation to the development of the drivers of the subjective value. The development of the subjective value depends on future cash flows, which are basically unknown and which can only be estimated from recording and analysing historical facts, together with developments in the environment and the strategy and intentions of the enterprise. Section 3.2 gives a brief description of how to summarise income and wealth from historical records. In sections 3.4 and 3.5, the analysis and reporting of developments and intentions are discussed.

Some of the concepts used in Table 3-3 have been defined by Edwards & Bell (1961, page 39). The meaning of these definitions is summarised below.

- Subjective value is the enterprise’s (present) value of a future dividend stream that results from a cash-generating unit (which can be a part of the enterprise or, as is the case in the example, the entire enterprise).
- Subjective goodwill is the excess of the subjective value over the market value of the individual assets less liabilities. In the example, the market value is equal to the book value of equity based on historical cost, since we did not (yet) model price fluctuations.
- Expected or anticipated subjective profit is the amount of profit calculated as the target discount rate used in the subjective value estimate times the subjective value, i.e. the target yield applied to the subjective value.
- Past subjective profit is the difference between two value estimates in two consecutive periods. This is the profit that could be distributed without impairing the subjective value of the enterprise.
- Past - anticipated subjective profit is the difference between the past subjective profit and the anticipated subjective profit. In our example, past - anticipated subjective profit originates from changes in the environment. The subjective value at the beginning of each period is based on expected cash flows representing a probability-weighted average of the scenarios H, L and N. The subjective value at the end of each period takes into account that during the period the scenario H has been realised. Under normal circumstances, the past anticipated subjective profit would include the value created during the accounting period. In the example, Sitting Duck does not create any value after the invention of the product concept, so the past anticipated subjective profit can only be due to changes (or lack of expected changes) in the environment.

## 3.2 Historical records of cash flow income and equity

Section 3.1 is mainly oriented to uncertain future cash flows and the related information about value and solvency. This section discusses relevant financial information about the past and the present. Table 3-4 shows, for the example used in the previous section, the cash flows of the enterprise for years 4 to 10 in the scenario H according to the direct method[19].

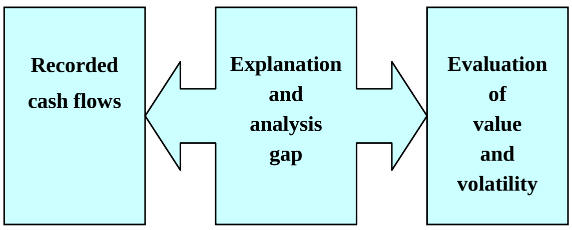
**Table 3-4: Cash flows of Sitting Duck Distillery Plc. Scenario H**

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| Receipts customers | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| Payments to suppliers and employees | (190) | (190) | (190) | (190) | (190) | (190) | (190) |
| Cash generated from operations | 410 | 410 | 410 | 410 | 410 | 410 | 410 |
| Interest paid less received | (11) | (5) | (4) | (2) | (1) | 1 | 2 |
| Tax paid | - | (100) | (107) | (107) | (108) | (108) | (109) |
| Net cash from operating activities | 399 | 305 | 300 | 301 | 302 | 303 | 304 |
| Loan redemptions | (116) | (116) | (116) | (116) | (116) | (116) | (116) |
| (Dividends) - Paid in capital | (276) | (275) | (276) | (277) | (278) | (279) | 251 |
| Net cash from financing activities | (392) | (391) | (392) | (393) | (394) | (395) | 135 |
| Cash flow enterprise | 7 | (86) | (92) | (92) | (92) | (92) | 439 |

Unlike the future-oriented information discussed in the previous section, the information presented above is based only on historical records and needs no judgment or estimate. In this respect, it can be regarded as the pillars that support financial reporting.

On the other hand, cash flow figures can be easily manipulated, e.g. by paying debts earlier or later. Furthermore, the cash flow to the shareholder and not the cash flow to the enterprise is relevant to the value. As discussed in section 3.1, cash flow available to the shareholder depends on the required economic capital that enables the enterprise to fulfil its commitments with a high probability. In other words, the dividends paid and the fresh capital attracted in year 10[20] are historical events, but they have been based on decisions that required an analysis of future developments.

**Figure 3-3: Information gap**




The left of Figure 3-3 refers to the historical records available and the right to the ultimate information needed by most if not all users of financial statements. The remainder of this chapter is mainly dedicated to the question of how the gap shown in the middle can be filled in order to get to the right side (estimates) from the left side (historical facts) in a transparent way.

To start, I would like to draw the reader's attention to Schmalenbach's opinion (see chapter 2) that in cases of uncertainty a conceptually correct estimate or accounting principle should be

19 According to IAS 7, the direct method is a method of reporting cash flows whereby major classes of gross cash receipts and gross cash payments are presented.

20 That is required to attract a loan in year 11 that enables the enterprise to replace the plant.

substituted by a less correct, but accurate estimate or principle. Let us define some financial reporting principles that are primarily based on recorded historical events.

- ❖ Sales and purchases are based on goods delivered and received respectively, rather than cash. This creates a balance sheet with accounts payable and receivable (for which actual receipt is not always certain) and neutralises the figures for payment behaviour.
- The wage expenses during the first two years are considered to be fully related to the development of the product concept. The cost of the product concept is recorded as an intangible asset.
- ❖ The investment cost of the plant is recorded as a tangible asset. Each period, the carrying value is decreased by the cost of the production units used during that period.
- ❖ Goods sold are recognised as revenue in the profit and loss account when delivered (in other words, when the enterprise has performed towards its customers). Cost of goods sold is recognised in the profit and loss account for the delivered quantities at their purchase price. This creates the item Inventories in the balance sheet.
- Expenses are recognised in the year of occurrence.
- Interest is recognised on a pro rata time basis.
- ❖ Taxes are calculated from the profit resulting from the above principles, at the effective rate.

Although these principles are based on events that actually took place, some elements of estimation are unavoidable. It was Pruijt's observation (1954, p. 21) that the determination of profit or surplus involves subjectivity in almost all instances. The subjective elements have been marked with ❖ and are explained below.

- Accounts receivable are expected to lead to cash but may to some extent (which has to be estimated) appear to be doubtful.
- The use of production units is a historical event, but the total production units that are embedded in the tangible fixed asset represent an estimate. This makes the cost allocated to the units used during the period an estimate (see Pruijt, 1954, p. 12). In practice, this problem is often evaded by adopting a linear depreciation pattern. I have used this approach in the example.
- Inventories are expected to be used in production and subsequent sales in an economic rational way. The extent to which this will not be the case (obsolescence, etc.) is an estimate.
- Tax results differ from statutory results. Consequently, the profit tax charged to the profit and loss account may differ from the tax assessment. The difference is either a deferred tax asset or a provision for deferred taxation, which is, dependent upon future results, expected to result in tax receivable or payable respectively. Without taking this expectation into consideration, profit tax would look unreasonable in relation to reported profits.

Lee (1984) advocates a system of cash flow reporting (CFR). In this system, the assets are classified by objectivity of measurement:
- realised assets (cash, bank, etc.)
- readily realisable assets (those having a market value).
- not readily realisable (market price, but due to the limited nature of the relating market not readily realisable)
- not realisable assets.

Lee's CFR consists of:

- statement of realised cash flows: gives a complete (gross) overview of the total cash flow transactions during the defined period. This statement follows the so-called direct method, i.e. the cash flows by capture (sales, purchases, disbursements, etc.) are presented.
- statement of (readily and not readily) realisable cash flows: this statement describes how better off the entity is in terms of accounting by the conventional indicator of economic performance, i.e. period profit[21].
- statement of financial position. The stepping-stone report between the cash flow statements.
- statement of changes in financial position.

**Table 3-5: Balance sheets and profit & loss accounts Sitting Duck Distillery plc.**

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| **Balance sheet** | | | | | | | |
| Intangible fixed assets | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| Tangible fixed assets | 600 | 500 | 400 | 300 | 200 | 100 | - |
| Inventory | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Collateral assets | 647 | 561 | 469 | 377 | 285 | 193 | 631 |
| | 1,456 | 1,270 | 1,078 | 886 | 694 | 502 | 840 |
| Equity | 591 | 514 | 437 | 360 | 284 | 207 | 661 |
| Provision for deferred taxation | 70 | 70 | 70 | 70 | 70 | 70 | 70 |
| Tax payable | 100 | 107 | 107 | 108 | 108 | 109 | 109 |
| Loan | 695 | 579 | 464 | 348 | 232 | 116 | - |
| | 1,456 | 1,270 | 1,078 | 886 | 694 | 502 | 840 |
| **Profit and loss account** | | | | | | | |
| Sales | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| Cost of sales | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| Salaries | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Depreciation | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Total expenses | 290 | 290 | 290 | 290 | 290 | 290 | 290 |
| Operational result | 310 | 310 | 310 | 310 | 310 | 310 | 310 |
| Interest | 11 | 5 | 4 | 2 | 1 | (1) | (2) |
| Profit (loss) | 299 | 305 | 306 | 308 | 309 | 311 | 312 |
| Profit tax | 105 | 107 | 107 | 108 | 108 | 109 | 109 |
| Profit after taxation | 194 | 198 | 199 | 200 | 201 | 202 | 203 |

Although this reporting method includes some strong elements concerning objective records of historical events without judgmental elements, it has a weakness: realisable cash flows are deemed directly realisable (as if the underlying assets were sold). In reality, they will not be sold but used in the business process. Consequently, no reconciliation is possible between realisable cash flow and realised cash flow in future periods. In other words, CFR records cash flows in an objective way, but does not support the explanation.

In Table 3-5, the balance sheet and profit and loss account for the years 4 to 10 are presented for a situation where revenues and margins remain at the same high level during those years (scenario H).

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21 Note that this includes all unrealised profit on direct and indirect realisable assets, including stocks, etc. that are not normally included in the profit figure. In addition, (e.g. with vehicles, etc.), it records profit on sales transactions that will never take place, because such assets will not be sold but used and "locked out" when the finished products are sold.

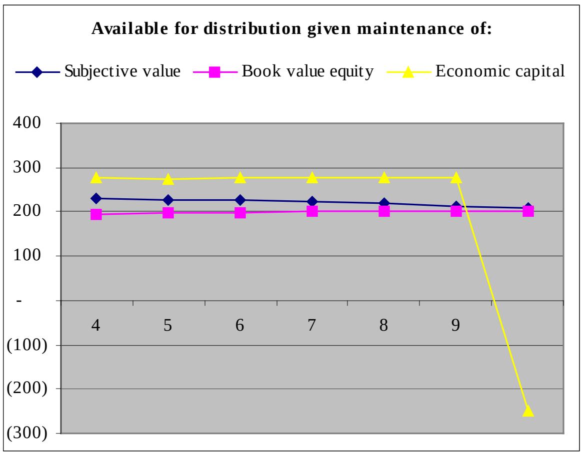
Table 3-6 presents a roll forward schedule for subjective value and subjective goodwill as described in section 3.1, and the book value of equity.

**Table 3-6: Roll forward schedules Sitting Duck Distillery plc.**

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| *Subjective value:* | | | | | | | |
| Opening value | 1,387 | 1,341 | 1,290 | 1,231 | 1,162 | 1,084 | 993 |
| Anticipated subjective profit | 118 | 114 | 110 | 105 | 99 | 92 | 84 |
| Past/anticipated subjective profit | 112 | 110 | 107 | 104 | 100 | 96 | 91 |
| Dividends/contribution | (276) | (275) | (276) | (277) | (278) | (279) | 251 |
| | 1,341 | 1,290 | 1,231 | 1,162 | 1,084 | 993 | 1,420 |
| *Book value equity:* | | | | | | | |
| Opening value | 672 | 591 | 514 | 437 | 360 | 284 | 207 |
| Profit after taxation | 194 | 198 | 199 | 200 | 201 | 202 | 203 |
| Dividend/contribution | (276) | (275) | (276) | (277) | (278) | (279) | 251 |
| | 591 | 514 | 437 | 360 | 284 | 207 | 661 |
| Subjective goodwill | 750 | 776 | 793 | 802 | 800 | 786 | 759 |
| | | | | | | | |
| *Subjective goodwill:* | | | | | | | |
| Opening value | 715 | 750 | 776 | 793 | 802 | 800 | 786 |
| Subjective profit | 230 | 224 | 217 | 209 | 199 | 188 | 176 |
| Profit after taxation | (194) | (198) | (199) | (200) | (201) | (202) | (203) |
| | 750 | 776 | 793 | 802 | 800 | 786 | 759 |

The schedule of the subjective goodwill shows that additional value is created by the subjective profit: the Profit after taxation (i.e. the profit after taxation based on historical events, using the principles described above) is "unlocked" to the book value of the equity. The dividends consist of these "unlocked" profits and the part of the economic capital that is not needed anymore, or less the additional economic capital, needed to support investment and financing transactions.

**Figure 3-4: Annual amounts available for distribution**




The increase in equity in year 10 needs further explanation. Each year, all cash flow that is not needed as economic capital to control the default risk for the lender is distributed to the shareholder. In other words, the enterprise distributes more cash than the amount that would maintain the subjective value and more than the amount that would maintain the book value of the equity. By doing this, new capital has to be attracted in year 10, in order to generate sufficient collateral assets to acquire a new loan. The new loan and the new capital will be used to finance the replacement of the plant in year 11. This is also the reason for fluctuations in the subjective goodwill, although in Table 3-6 the economic circumstances and the knowledge about the future are the same in each year. The need for economic capital is different from year to year. In Figure 3-4, the amounts are compared that would be available for distribution without impairing the subjective value, the book value of the equity, or the required economic capital.

As can be seen, the amount available for distribution in years 4 to 9 is the highest if the only requirement were maintenance of the required economic capital. However, in this case the capital base in year 9 will be insufficient to attract a new loan in order to replace the plant. In other words, the enterprise must attract new capital in order to survive from year 10 onwards. This triggers the problem of maintenance of capital in an enterprise, which is further discussed in section 3.3.

The balance sheet shown in Table 3-5 includes intangible fixed assets, i.e. the cost of developing the enterprise's concept, and tangible fixed assets, i.e. the plant. The example has been constructed so that neither type of asset has a directly realisable value. The value of both types of asset fully depends on future cash flows of the enterprise. Looking at common practice in financial reporting, nobody would hesitate to recognise the plant as an asset, but many would argue the recognition of the intangible asset under review.

**Table 3-7: Balance sheets and profit and loss accounts Sitting Duck Distillery PLC in scenario L**

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| **Balance sheet** | | | | | | | |
| Intangible fixed assets | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| Tangible fixed assets | 386 | 321 | 257 | 193 | 129 | 64 | - |
| Inventory | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Collateral assets | 556 | 468 | 376 | 284 | 192 | 100 | 359 |
| | 1,147 | 996 | 839 | 683 | 527 | 370 | 565 |
| Equity | 452 | 398 | 344 | 291 | 237 | 184 | 481 |
| Provision for deferred taxation | ( 5) | 8 | 20 | 33 | 45 | 58 | 70 |
| Tax payable | 5 | 11 | 11 | 12 | 13 | 13 | 14 |
| Loan | 695 | 579 | 464 | 348 | 232 | 116 | - |
| | 1,147 | 996 | 839 | 683 | 527 | 370 | 565 |
| **Profit and loss account** | | | | | | | |
| Sales | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| Cost of sales | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| Salaries | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Depreciation | 100 | 64 | 64 | 64 | 64 | 64 | 64 |
| Impairment | 214 | | | | | | |
| Total expenses | 474 | 224 | 224 | 224 | 224 | 224 | 224 |
| Operational result | ( 174) | 76 | 76 | 76 | 76 | 76 | 76 |
| Interest | 11 | 9 | 7 | 6 | 4 | 3 | 1 |
| Profit (loss) | ( 185) | 67 | 68 | 70 | 71 | 73 | 74 |
| Profit tax | ( 65) | 23 | 24 | 24 | 25 | 26 | 26 |
| Profit after taxation | ( 120) | 43 | 44 | 45 | 46 | 47 | 48 |

Yet the only difference is that the plant has a physical appearance. From an economic point of view, both assets are identical. It is useful to view this issue from the point of view of stewardship. Compare the message "we have spent € 200,000 to build the enterprise's structure" with "we have incurred initial losses of € 200,000". The second message is relevant neither as a value indicator, nor as a performance indicator. The message "the funds spent to build the enterprise's structure are still exceeded by the expected future benefits" or "an impairment loss of X had to be recognised" has a greater information value.

Remember the historical example of the VOC, which proves that there is nothing prudent about not recognising assets because of uncertainty; it could even lead to an unobserved negligence of the unrecorded asset. In order to illustrate this statement, another variant to the Sitting Duck example (owing to technological innovation, competition has entered the market and revenues and margins have decreased [scenario L] from year 4) is presented Table 3-7.

The profit and loss account includes an extra diminution in value of the tangible fixed asset to bring it down to its replacement value (adjusted for the remaining lifetime). Without this impairment (and the related decrease in the provision for deferred taxation), the subjective goodwill would be negative, which would mean that the book value of all assets less liabilities exceeded the realisable value of the enterprise as a cash generating unit. This is a typical situation where an impairment of assets is appropriate.

**Table 3-8: Changes in subjective goodwill in scenario L**

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| Opening value | 715 | 93 | 110 | 122 | 128 | 128 | 121 |
| Subjective profit | (742) | 60 | 56 | 52 | 46 | 41 | 34 |
| Accounting profit | 120 | (43) | (44) | (45) | (46) | (47) | (48) |
| | 93 | 110 | 122 | 128 | 128 | 121 | 107 |

However, if the development costs had not been recognised as an asset, subjective goodwill (subjective value minus the lower book value of equity) would remain positive and no impairment of assets would have been triggered, and the profit and loss account would not reveal the financial effects of the changes in the environment.

Furthermore, Table 3-8 shows that, after the impairment, the subjective goodwill in year 4 is positive rather than zero. In order to adjust for only the negative subjective goodwill, a (pre tax) impairment of € 71,000[22] would have been necessary. However, my approach leads to depreciation in future years that is based on replacement value, which records performance better than depreciation based on historical cost less the negative subjective goodwill.

Adjustment of the tangible fixed assets to replacement value makes the enterprise comparable to other enterprises, irrespective of the year of investment of their tangible fixed assets.

Table 3-9 shows how subjective goodwill would develop if the impairment reflected only the negative subjective goodwill.

**Table 3-9: Changes in subjective goodwill given impairment to recoverable value**

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|
| Opening value | 715 | - | 33 | 60 | 82 | 97 | 106 |
| Subjective profit | (742) | 60 | 56 | 52 | 46 | 41 | 34 |
| Accounting profit | 27 | (28) | (29) | (30) | (31) | (32) | (33) |
| Closing value | - | 33 | 60 | 82 | 97 | 106 | 107 |
| Value for impairment to replacement value | 93 | 110 | 122 | 128 | 128 | 121 | 107 |

If tangible fixed assets are impaired to the recoverable value, subjective goodwill will increase from year to year because the date of reinvestment for a lower value comes nearer (which translates into lower interest and redemption of loans and thus into higher future net cash flows). If tangible fixed assets are impaired to the replacement value, the pattern of accounting profits in

22 The impairment according to Table 3-7 of 214 less 71 makes a difference of 143, which is 93 after tax.

the next years is more in line with the development of the subjective profit and the development of the subjective goodwill is more “natural”. Our approach is supported by Limperg’s coordinated value concept (Limperg 1965, page 331). Limperg’s opinion is that a rational decision maker would consider the lowest of recoverable value and replacement value. Only if the replacement value is lower than the recoverable value is the decision to replace rational. Table 3-8 is consistent with Limperg’s view that the negative difference between historical cost and replacement value of an asset should be considered as a loss (Limperg 1965, page 341). If the recoverable value were lower than the replacement value, impairment to recoverable value would be necessary in order to fully eliminate the negative subjective goodwill. This is corroborated by Limperg’s opinion that in this situation the replacement value is no longer appropriate because a rational enterprise would not replace.

The example leads to the following generally applicable statements:

1 A balance sheet that has been based on historical events includes estimates that are unavoidable (useful production units of tangible fixed attest, recoverability of accounts receivable, etc). Furthermore, there is the impairment of an asset if its value (due to factual changes in the circumstances) is not supported anymore by *estimated* future cash flows. In the example, an objective criterion, i.e. an available quotation for a replacement value has been used, but this is not always available.

2 The balance sheet includes assets that have no direct realisable value. No specific cash flows can be allocated, as their value only exists by virtue of the expected future cash flows of the enterprise as a whole. Yet a general resistance exists against the recognition of the cost of development of the firm’s concept as an intangible asset in situations where such resistance against recognition of the plant as a tangible asset would not exist. The cost of the firm’s concept represents future benefits. Stewardship vis-à-vis the owners would require that these costs are recorded as “an item” that generates future benefits and that from time to time owners are informed what benefits have been realised and whether there has been a change in expectation of future benefits. Recognition as an asset is harmless, as long as its nature can be recognised and as long as profit distribution is neutral towards recognition and non-recognition.

3 As long as distributable profit is capped by the required economic capital, there is no risk that recognition of certain classes of assets and the relating increase in the book value of equity would erode the financial position because of increased profit distributions.

Finally, the question can be asked as to whether a balance sheet that is mainly built from historical events can measure an enterprise’s solvency. The book value of the equity is by definition lower than the subjective value of the enterprise: where realisable value (or in our example replacement value) is lower than historical cost, amortisation to that lower value takes place. In other words, the book value of the equity is prudent. However, the problem is that one never knows how prudent, as the book value of the equity is not an x% lower bound of the value. In section 2.7, I presented an example in relation to Schmalenbach’s prudence concept and concluded that this concept does not solve the need to find the lower bound of expected future cash flows in order to measure solvency. Morgenstern (1963) proposed reporting both the book value and the x% lower bound of cash realisation for each balance sheet item. However, this concept has never been made operational.

Anthony (2004, page 52) suggests replacing the balance sheet by a solvency statement that contains the fair value of assets for which such fair value can be measured reliably (so only qualifying assets) and liabilities. This statement has many similarities with Lee's Statement of Financial Position (see above). In our example, the intangible and tangible assets would thus be excluded. According to Anthony, an enterprise is solvent when the balance of the solvency statement defined above is positive. In my opinion, such a solvency statement suffers from the following omissions:

- Although the fair value of assets and liabilities can be measured reliably, such measurement never projects the resulting cash flows with complete accuracy. As far as uncertainty is reflected in the fair value, it does not result in an x% lower bound of future cash flows resulting from the recorded assets and liabilities.
- The solvency statement does not embed all future cash flows.
  - The cash inflows generated by tangible and intangible fixed assets do not play a role.
  - The cash flows of contingent assets and liabilities do not play a role.
  - Other commitments do not play a role. An example is employee costs. Under normal circumstances, future employee costs are neither a legal nor a constructive obligation, because the relating labour still has to be "delivered". However, in most countries, exercising a real put option to lay off personnel has a price (i.e. redundancy payments) that has to be taken into account when assessing the x% lower bound of the future cash flows. Similar examples relate to long-term (both capital and non-capital) leases.
  - Some assets such as raw materials are options to generate future cash flows. However, in order to exercise such options, additional expenditures (such as purchase of additives) often have to be made.

To summarise, Antony's proposal does not lead to a report that covers all elements of solvency.

In the past attempts were made to predict defaults (or survivorship) from balance sheet ratios such as working capital/total assets, retained earnings/total assets, etc. Examples are Altman (1968) and Koh (1992). These models, that are based on linear regression between selected balance sheet ratios and bankruptcy events, do not measure the expected costs of default and cannot measure the economic capital required to limit such costs.

## 3.3 Influence of price fluctuations on income and required capital

Price fluctuations can be specific to certain assets or general (inflation). In this section, the effects on equity and income/performance of an enterprise are discussed. In section 2.3.1 the various purposes of preserving value within the company, mentioned by Burgert (1967, page 88) have been discussed. For this section, the maintenance of the real value of assets and of the capital adjusted for (general) changes in purchasing power are relevant. Before discussing them, it is worthwhile to look at the maintenance of nominal capital and the definition of income.

In the previous section, I have used a variant to the nominal capital maintenance purpose: all equity that is not needed for the operations or to support the quality of the debt can be distributed to the owner. In each year in which part of the debts are repaid, the economic capital necessary to limit the future default risk becomes smaller and thus part of the capital is available for distribution. This can be extended to all equity that is not needed to support the fulfilment of existing commitments and liabilities and to support the enterprise's strategy to create value can be distributed.

In section 2.3.1, several definitions for income have been given. One of them (that of Hicks) relates to the amount that someone has available for consumption without seeing his wealth decrease. As a variant, J.L. Meij (1941, page 196) considers a surplus as income if, after distribution of this income, the enterprise can be continued at the same level. In other words, a surplus is income if the enterprise can generate the same level of income (in real terms) in the future. Hicks's definition is from the perspective of the receiver of the income (or the principal), while Meij's definition relates to the enterprise that generates the income (or the agent).

In the example used in the previous section, the shareholder receives a dividend of € 276,000 in year 4 if scenario H applies. An amount of € 82,000 relates to a repayment on the capital supplied by him, so at € 194,000 at most can be considered income (i.e. the result from the recorded historical events and some estimates as described in section 3.1).

What can be spent by the shareholder according to Meij's theory if we consider continuation of the enterprise at the same level for an indefinite period of time? In order to continue the enterprise after year 10, investment in a new plant must take place. Here, uncertainty comes in. The expected value of the reinvestment amounts to € 496,490, based on 48% probability of an investment of € 700,000, 36% probability of € 450,000, and 16% of no investment because the activities have terminated. What amount should the shareholder save? An amount assuming that the circumstances (scenario H) remain the same? This would mean that the income available for consumption would be equal to the book profit. Under the assumption of no price changes or other changes in the circumstances, this would apply to Meij's concept of maintaining the future income level. Who should save: the company in order to safeguard its continuity or the shareholder in order to keep its income at the same level for an indefinite period? In practice, enterprises mostly retain the funds needed for reinvestment; in principle, the reinvestment option is for the shareholder to exercise.

Apart from the amount to be reinvested, there is another uncertainty, i.e. the cash flows after year 5. The expected value of the cash flow available to the shareholder and of the book profit in year 5 amount to € 255,000 and € 178,000 respectively. These amounts, which relate to the expected value according to the various scenarios, are lower than the amounts actually realised in year 4. The cash flows available for the shareholder may remain at the same level as in year 4, may (irrevocably) continue at a lower level or may even cease without any chance to recover the investment. This makes consumption of any amount in year 4 a risky decision. The shareholder may decide to put an additional amount aside for a rainy day. Needless to say, this decision cannot have anything to do with the way the enterprise measures its annual profit.

In the following, another factor will be brought under review, i.e. price fluctuations. Before analysing the effect on our example, a brief description of the literature is given. Tweedie and Whittington (1984, page 4 et seq.) give a description of most of the available methods. The example used by them has been summarised in Table 3-10. The replacement value method of Limperg has been added to this table. The example assumes that at the beginning of the period an inventory of 20,000 is purchased. It is financed by 15,000 of capital and 5,000 of debt. No transactions take place during the period. Consequently, only the effects of price fluctuation are reflected in income and equity.

**Table 3-10: Methods of accounting for price fluctuations**

| | Historical cost | Replacement value | Constant purchasing power | Current cost accounting (CCA) | CCA with gearing adjustment | Real terms |
|---|---|---|---|---|---|---|
| Stock | 20,000 | 24,000 | 22,000 | 24,000 | 24,000 | 24,000 |
| Equity at beginning of period | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 |
| Revaluation reserve | | 4,000 | | | | |
| Adjustment for purchasing power | | | 1,500 | 4,000 | 3,000 | 1,500 |
| Result book year | | | 500 | | 1,000 | 2,500 |
| Equity | 15,000 | 19,000 | 17,000 | 19,000 | 19,000 | 19,000 |
| Loan | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 |
| | 20,000 | 24,000 | 22,000 | 24,000 | 24,000 | 24,000 |
| Operating profit | - | - | - | - | - | - |
| Gain on borrowing | | | 500 | | | 500 |
| Unrealised holding gain | | | | 4,000 | 1,000 | |
| Real holding gains on stock | | | | | | 2,000 |
| | - | - | 500 | 4,000 | 1,000 | 2,500 |

A brief description of the methods is as follows:
The *replacement value method* prescribes that the balance sheet is to show the non-monetary assets at replacement value (if applicable, the lower realisable value). The revaluation of the assets to their replacement value are directly transferred to a revaluation reserve in equity if positive and charged to the profit and loss account if negative in comparison with the historical cost (Tweedie et all., 1984 page 31).

Profit is the increase in equity that is available for consumption (Limperg 1965, page 269). The consequence of this approach is that sales transactions realised in a certain period are charged for at the current cost of the input related to those transactions (which gives an unbiased picture of the performance margin on the sales transactions). With respect to fixed assets, it has a special effect.

Suppose that an asset with a historical cost of 700 and a useful lifetime of 7 years has a replacement value of 840 and a book value of 400 when it is 3 years old. According to Limperg, the full difference of 140 should be carried to the revaluation account, because that is the amount that has to be maintained in order to have sufficient capital available to fund the reinvestment at replacement value. The depreciation in years 3 to 7 will be 120 per annum, which means an exact allocation of costs of production units used at replacement value. In year 3, an additional amount of 40 is charged to the profit and loss account as extra depreciation. This is to be considered as a kind of “back service” depreciation, because the years 1 and 2 have been charged too little.

The method of *Constant Purchasing Power* takes into account the development in the general price level, without regard to the movements in the prices of the individual assets (in the example, the stock). In the example, inflation is 10%. Non-monetary assets are revalued in line with the general index. The purchasing power of the equity is kept constant by increasing it directly by the index factor. The balance of the revaluation of non-monetary assets and the direct adjustment to equity is profit (if debts exceed monetary assets) or loss (if monetary assets exceed debts).

*Current Cost Accounting* (CCA) takes into account the movements in the asset’s specific prices. The revaluation is presented as an unrealised holding gain in the profit and loss account. However, an amount equal to the revaluation is charged to the net profit and included in a maintenance reserve within equity, which is not available for distribution. The method of CCA was proposed by the Sandilands Committee in the UK in 1975. As a basis for the current value of assets, the committee proposed the lower of replacement cost[23] and recoverable amount.

CCA with a gearing adjustment splits the revaluation of assets proportionally in a part to be allocated to equity and a part to be allocated to debt. Only the part to be allocated to equity is included in the part of the reserves that are not available for distribution. The part to be allocated to debt is profit and (even if not yet realised) is available for distribution.

Using *Real Terms Accounting*, the assets are revalued according to the movements of the specific prices and the part of equity to be maintained is calculated on the basis of the general price index. The balance of debts and monetary assets gives a profit or loss related to the movement in the general price index. The holding gains on the assets represent the movement of the specific asset prices above the general price index.

In order to see how the example used in the previous section reacts to price fluctuations, I have included annual inflation of 3%. I have also assumed that the specific price fluctuations of inventories and tangible fixed assets are equal to the general price index. For reasons of consistency, the interest on debt and the discount rate have been adjusted for this inflation rate.

Table 3-11 shows the profit and loss account for year 10 for a situation where condition H with respect to sales volumes and margins remains applicable for all years and a situation where the condition changes to L in year 10.

As in the CCA method, holding gains have been included in the profit and loss account instead of being directly carried to the revaluation reserve, as prescribed in the replacement value theory. In my opinion, they represent profit. An enterprise that has a plant with a remaining useful life of 5

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23 Replacement cost differs from replacement value. Replacement cost is the cost of replacing the factor that is actually used in the product or service. Replacement value as used by Limperg is the cost of replacing the factor economically in the most efficient way, i.e. the economic equivalent rather than the technical equivalent.

years and a historical cost of 700 is in a better position than an enterprise that has to make an instant reinvestment for an amount of 800. The first enterprise has the benefit of holding a “stock of production units” for the next 5 years. It is fair to *record* this profit when realised, but in the *analysis* of the profit, it needs, in my opinion, to be stated separately. One of the reasons for this can be found in the discussion between Bernoulli and Von Leibnitz considered in chapter 2. The holding results included in the profit and loss account definitely qualify as results, but are less likely to repeat in the future then the transaction results (which are a direct reflection of the enterprise’s core business). A user of the financial statements who is interested in the value of the enterprise is implicitly interested in the *projection* of future earnings. Hence, an analysis of earnings by indication of future repetition will be useful to him.

**Table 3-11: Comparison year profit an loss accounts year 10 considering inflation**

| | Scenario H in 1 -10 | | | | Scenario H in 1 - 9, L in 10 | | | |
|---|---|---|---|---|---|---|---|---|
| | Without inflation | With inflation | | | Without inflation | With inflation | | |
| | | Transaction | Holding | Total | | Transaction | Holding | Total |
| Sales | 600.0 | 737.9 | | 737.9 | 300.0 | 369.0 | | 369.0 |
| | | | | | - | | | - |
| Cost of sales | 90.0 | 110.7 | (0.3) | 110.4 | 60.0 | 73.8 | (0.3) | 73.5 |
| Salaries | 100.0 | 123.0 | | 123.0 | 100.0 | 123.0 | | 123.0 |
| Depreciation | 100.0 | 123.0 | (23.0) | 100.0 | 100.0 | 79.1 | 20.9 | 100.0 |
| Total expenses | 290.0 | 356.7 | (23.3) | 333.4 | 260.0 | 275.8 | 20.6 | 296.5 |
| Operational result | 310.0 | 381.3 | 23.3 | 404.6 | 40.0 | 93.1 | (20.6) | 72.5 |
| Interest | (2.5) | (6.8) | | (6.8) | (2.5) | (6.8) | | (6.8) |
| Profit (loss) | 312.5 | 388.1 | 23.3 | 411.4 | 42.5 | 99.9 | (20.6) | 79.3 |
| Profit tax | 109.4 | 135.8 | 8.2 | 144.0 | 14.9 | 35.0 | (7.2) | 27.8 |
| Profit after taxation | 203.1 | 252.2 | 15.2 | 267.4 | 27.6 | 65.0 | (13.4) | 51.6 |

The holding loss in the profit and loss account with conditions changing to those of L in year 10 needs further explanation. Although the price level has increased, the replacement of the plant can be made at a lower value. In fact, the enterprise incurs a holding loss on the “stock of production units” at the beginning of the year. The historical cost of this “stock” amounts to 100,000 and is included in the profit and loss account. However, the sales transactions for the year should be recognised at a lower price when considering the actual production costs. This is consistent with Limperg’s theory of considering the replacement *value* rather than the replacement *cost.* Limperg also prescribed the separation of holding results and transaction results (Limperg 1965, page 325), but only for holding losses, since holding surpluses were, according to his theory, transferred to the revaluation reserve.

Schmalenbach (1923, page 276 et seq.) is also in favour of separating operational result from results from external influences (such as price fluctuations, fluctuations in plant occupation rates, change in market conditions, etc), in order to obtain a clear picture of the enterprise’s performance.

Table 3-12 shows that the equity (which in the example is equal to the required economic capital) is higher in a situation with inflation. However, this has been reflected in the raising of additional capital and not in the measurement of the results. This is consistent with Van Muijswinkel’s opinion. Van Muijswinkel rejects Limperg’s equivalence of the profit of an enterprise and the amount available for consumption (Van Rossum, 1979, page 261). Van Muijswinkel’s opinion is that capital maintenance is a matter of profit distribution, which is subject to many considerations,

such as debt rating, financing of acquisitions and growth, which have nothing to do with profit measurement. Van Straaten (1957) takes the same position. I agree with this view.

**Table 3-12: Balance sheets in year 10 considering inflation**

| | Scenario H | | Condition L in year 10 | |
|---|---|---|---|---|
| | Without inflation | With inflation | Without inflation | With inflation |
| **Balance sheet** | | | | |
| Intangible fixed assets | 200.0 | 200.0 | 200.0 | 200.0 |
| Tangible fixed assets | - | - | - | - |
| Inventory | 9.0 | 11.1 | 6.0 | 7.4 |
| Collateral assets | 631.4 | 805.6 | 359.9 | 465.0 |
| | 840.4 | 1,016.6 | 565.9 | 672.4 |
| Equity | 661.0 | 802.7 | 481.0 | 574.6 |
| Provision for deferred taxation | 70.0 | 70.0 | 70.0 | 70.0 |
| Tax payable | 109.4 | 144.0 | 14.9 | 27.8 |
| Loan | - | - | - | - |
| | 840.4 | 1,016.6 | 565.9 | 672.4 |
| **Book value equity** | | | | |
| Opening value | 206.8 | 206.8 | 206.8 | 206.8 |
| Result | 203.1 | 267.4 | 27.6 | 51.6 |
| Capital contribution | 251.1 | 328.4 | 246.6 | 316.3 |
| | 661.0 | 802.7 | 481.0 | 574.6 |

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The amount of economic capital required in addition to the situation without price changes bears no relationship to the methods described above, because these methods are all applied retrospectively, while required economic capital is estimated prospectively. Furthermore, the table shows that required economic capital decreases when the enterprise becomes less capital intensive (such as in a situation where condition L becomes applicable).

It can be concluded that price fluctuations (both general and specific) do affect the profit and loss account as a performance indicator and the required amount of equity to continue the business (defined as required economic capital), but that they are just one of the factors to be taken into consideration. At the beginning of this section, I highlighted the opinion of J.L. Meij, who only recognised profit if the relating amount can be made available for consumption and at the same time leave the earning power of the enterprise in tact. Our example demonstrates that uncertainty (even formulated in the simplest form) makes the decision to distribute and consume a risky choice. Effects of price fluctuations are just one of such uncertainties and I see no reason to treat them differently from the others.

### 3.4 Results and performance

In the previous sections, we have seen that there is more than one concept of income. In section 3.3 we have discussed the amount that is most likely available for consumption; in this section, the reported income as yardstick for the enterprise's performance is discussed.

As already remarked, the ideal measurement of the enterprise's performance is the economic value created during the reporting period. However, such a yardstick would be the difference between two value measurements that depend upon uncertain future cash flows. The way to estimate such future cash flows is to evaluate the enterprise's ability to generate cash flows in the past (its proven performance) and the likelihood that that it will repeat or improve this performance[24] in the future. The created economic value does not give information about this because it is directly derived from future estimates. So let us try to obtain an impression of the enterprise's performance by analysing the historical records as described in section 3.2.

At the start, there is the historical development of the cash flow. Since value relates to future cash flows, past recorded cash flows seem to be a logical starting point. Realised cash flows, especially when they are analysed against previous forecasts, present rich material for analysis. However, cash flows can be distorted by incidental patterns; they can even easily be manipulated by accelerating or holding back payments.

A profit and loss account prepared on an accrual base is not sensitive to the pattern of receiving and paying cash, but, as discussed in previous sections, unavoidably includes some estimates (for the lifetime of fixed assets, for obsolescence of inventories, for the degree receivables can be collected, etc.). Accrual accounting involves some speculation, because some expenses – such as depreciation and amortisation – are hard to check (see Penman, 2003, page 89). In order to analyse performance from reported results and cash flows, it is necessary to understand the core competence of an enterprise. J.L. Meij (1941, page 24) states in this respect:

Income originates from trading of goods or rendering of services, the enterprise has committed itself to.

This pronouncement is one at the extreme. In my opinion, the income from speculation is also income and can be spent. However, if one is interested in finding a pattern of results and cash flows that will probably repeat in the future, the cash flow generated by the core competence of the enterprise is the best bet. In other words, value is most likely created by repeating the production, trading and services the enterprise is committed to, rather than it repeatedly being lucky.

Kamp (2002, page 329) discusses the relationship between accounting quality and earnings quality of results. The accounting quality is related to the correct application of accounting principles in formal and material respects and the absence of creative accounting. Earnings quality is in Kamp's view related to:

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24 The word "performance" is often used for the so-called "clean surplus", i.e. all the developments from opening equity to closing equity, other than direct transactions with the shareholders (capital increases and decreases, dividends, etc.). I use the word "performance" for what the enterprise has created in relation to its strategy and intentions.

- the extent to which profit originates from the core business;
- the degree to which profit (*or elements within the profit*) is predictable because revenues and expenses show a stable pattern (*in other words, the degree to which a historical pattern is repeated in the future);*
- the extent to which the development of profit relates to the development of cash. The more the transactions realised are converted into cash, the less judgemental or estimation issues (such as estimating a provision for doubtful debtors) remain.

Looking at the profit and loss account, it is worthwhile to give some thought to the realisation principle. If the economic concept of profit is applied, value is recognised when it is created by developing a concept, acquiring a customer, etc. We saw before that this value could only be measured by comparing consecutive future projections. Schmalenbach (1923, page 109) substitutes the true but unreliable performance indicator that created value by a less true but more reliable indicator, which is based on documented historical events, i.e. the trading or swapping of goods or services that actually took place.

While for Schmalenbach the adoption of the realisation principle is a practical measure, Limperg (1979, page 87) took the principle view "without exchange no profit". Limperg clearly distinguishes the situation where an enterprise constantly operates in the same market, one time as a buyer, the other time as a seller, from the situation where the enterprise forms a bridge between two markets, the one in which it buys the inputs and the other in which it sells the outputs. His standpoint on the realisation principle clearly relates to the latter. The interesting point is that he relates performance measurement not only to a documented event (i.e. a transaction that actually took place), but also to the core business of the enterprise (i.e. the bridging of two markets by purchasing inputs and manufacturing and selling outputs). By directly reporting about its core competence, the enterprise gives information on the main value drivers, possibly with the highest potential of repetition in the future (because it is what the enterprise is committed to). Hence, the realisation principle is more than just a practical substitution in an uncertain environment. If applied to the proper situation, it gives information about the enterprise's performance.

In order to isolate the results from the core business, they should be separated from other activities (e.g. a production company that invests its surplus cash in securities). Results that are commonly separated are holding gains and losses. For all companies that do not make their money by taking positions in commodities, etc., holding gains and losses do not belong to the core business, are not likely to repeat in the future according to a predictable pattern and are thus less relevant in projecting value. In this respect, reference is made to the example in Table 3-11, where the gains and losses due to price fluctuations on holding positions (in inventory and in production capacity) have been separated from the transaction income. In this table, the transaction income has been based on the replacement value of the materials and production units used. My reason for this is not a capital maintenance concept or similar (such as in Burgert, 1967, page 191), but simply the fact that this pattern has the highest probability of repeating in the future, because of the enterprise's intention and commitment to this repetition. The holding gains and losses (i.e. the difference between the historical cost and the replacement value of the goods and production units used) will repeat too, but only until the moment of replacement.

Richard Barker (2003) discusses the separation of (core) earnings from results. As far as this kind of information is made available in financial statements, empirical evidence indicates that the investor appreciates different components of results in a different way (different valuation multiples). The most important findings that Barker refers to are:

- Movements in reported recurring profit have a stronger price-profit relationship than transitory components;
- Different valuation multiples are applicable to different components of profit. The more often the component recurs, the higher the observed multiple.

The shadow side of these findings can be defined directly: misclassifications between different (recurring and less recurring) components of results may lead to mis-pricing of the market value of an enterprise.

Barker (2004) discusses three concepts of earnings (operating earnings, recurring earnings and earnings controlled by management) that all have the purpose of isolating the part with the highest probability of future repetition and the income components to be excluded from these earnings concepts. He then mentions many problems in adapting these concepts to all types of enterprises in all situations.

The distinction between operating and non-operating earnings depends on the (core) activities of the enterprise. Consequently, reporting on operating income may be different for different types of business.

The distinction between recurring and non-recurring earnings is not black and white and involves a substantial element of judgement. E.g., supplying electricity to a fixed customer base is highly recurring and a unique one-off delivery contract by a utility plant might be considered non-recurring. However, the contracts of a building contractor, who always deals with one-time contracts with one-time customers, would most probably count towards his recurring income, but with a higher volatility than the recurring income of an enterprise with a fixed customer base. How to incorporate the inherent degree of volatility of recurring income into financial reporting would be a challenge.

**Table 3-13: Model proposed in the IASB project document of 18 December 2002**

| | Total | Income before remeasurement | Remeasurement |
|---|---|---|---|
| Business<br>Financing<br>Tax<br>Discontinuing operations<br>Cash flow hedges | | | |
| Total recognised gains and losses | | | |

Management control is closely related to the time horizon. Plant capacity is beyond management's control in the short term, but is at their choosing at some stage in time. Natural disasters cannot be avoided by management, but at some moment, management chooses a place of settlement. In other words, the distinction between profits and losses that are within management's control and those that are not is often arbitrary.

Barker then proposes to make another distinction, i.e. that of profit before remeasurement of assets and liabilities, the remeasurements and the total profit. He proposes to present such a profit and loss account in a matrix format in order to keep track of the profits on a line-by-line basis. Table 3-13 summarises a proposal for such a format in the IASB project document regarding comprehensive income (see: Barker, 2003, p. 21).

In my opinion, the model has some attractive features:

- Remeasurement of assets and liabilities often involves the more subjective elements in the financial statements, since assets and liabilities are often “marked to model”, which makes valuation and thus results (as the difference between two consecutive valuations) dependent upon management’s choices of parameters. The model thus makes a distinction between the “hard” and the “soft” elements in the financial reporting.
- In some cases, operating results and remeasurements are interrelated. E.g., the choice of the estimated useful lifetime for a tangible fixed asset may affect the impairment that is necessary at a certain stage. By presenting the income and expenses before remeasurement, the remeasurement and the total income and expenses line by line, the total amount affecting tangible fixed assets remains visible.
- Income and expense elements before remeasurement often show a trend. Remeasurements are often a consequence of a discontinuance of this trend. Suppose an asset has a value of 150 and produced an annual income of 20. This year, the annual income is 10 and it can be expected that this remains the case in the future. Using a discount rate of 10%, the realisable value of the asset is 100. The result for the year is -40. 10 represents the income before remeasurement, is the performance for the year and is the basis for assessing the current element in the result. -50 is a remeasurement; it is essentially one-off and has nothing to do with performance.

As indicated, the amounts in the remeasurement column are often supposed to move in a random walk over time[25]. A trend in remeasurement may indicate a systematic overstatement or understatement of assets and liabilities, and is as such an indicator of the credibility of measurement in past financial statements.

Although the results before remeasurement should provide the basis for assessing the trend in revenues and expenses, they may still contain incidental movements that are not likely to repeat in the future. In this respect, it is worthwhile to have a brief look at the process of normalising earnings that takes place in connection with the valuation of an enterprise. The information needed in such an analysis will be relevant for assessing value drivers, thus also for estimating future performance, and hence value. Copeland et al. (2000, page 157 et seq.) describe a procedure to refine financial statement information in order to isolate value drivers. To begin, amortisations and impairments are eliminated from the profit and loss account. These amounts result from an analysis showing that the recoverable amounts are less than the book values and consequently should not be part of the source data used for valuation purposes. In order to give the investor sufficient information, these should be separately visible, either on the face of the profit and loss account or in the footnotes, or eliminated from a separate performance statement.

Furthermore, it should be understood that many valuation models regard the total invested capital (i.e. net operating working capital, net property, plant and equipment an other assets) and not just the shareholders’ equity[26]. As a result, the interest on debts is eliminated (and should be shown separately).

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25 Except for systematic changes in the environment, such as inflation.

26 In connection with the invested capital, the weighted average cost of capital (WACC) is relevant. Based on the conclusions from the previous sections, it is fair to say that this WACC should be based on the relationship

As a basis for valuation, therefore, taxes, interest expenses and amortisations/impairments are added back to net results, giving an amount called EBITA (earnings before interest, tax and amortisation). Next, a notional tax amount is calculated on this EBITA, as if there were no amortisations and interest expenses. This tax amount is deducted from the EBITA, giving NOPLAT (net operating profit less adjusted taxes).

In order to isolate the "recurring" net operating profit (the net operating profit that has a potential for repeating in the future), the following information is needed:

- Results on discontinued operations.
- Results relating to previous years and other special items (which are less likely to repeat in the future), should be made separately visible, so that evaluation of possible distortion of the historical development should be possible.

Finally, results should be evaluated for their operational quality. For example, a company that invests in quality control systems may have a higher expense level than a peer that does not, but may be more successful in the future in maintaining its level of turnover and margin. The same may be the case for an enterprise that invests in research and development in order to increase the probability of continuance in products that meet customers' preferences.

Analysing results and performance in this respect, requires a fundamental analysis, which I would like to explain using the example of Sitting Duck Distillery plc. An attempt is made to compare the performance with another company, i.e. Exploring Eagle Liquor Manufacturing plc.

Looking at the profit and loss account presented in Table 3-14, Sitting Duck performs better than Exploring Eagle, because it has (given exactly the same circumstances) a better cost structure. Yet the value of Exploring Eagle in addition to the book value of the equity (the subjective goodwill) is higher.

**Table 3-14: Comparison of two companies**

| | Sitting Duck | Exploring Eagle |
|---|---|---|
| **Profit and loss account** | | |
| Sales | 600 | 600 |
| Cost of sales | 90 | 90 |
| Salaries | 100 | 130 |
| Depreciation | 100 | 100 |
| Total expenses | 290 | 320 |
| Operational result | 310 | 280 |
| Interest | 8 | 19 |
| Profit (loss) | 302 | 261 |
| Profit tax | 106 | 91 |
| Profit after taxation | 196 | 170 |
| **Subjective goodwill** | | |
| Opening value | 714 | 829 |
| Subjective profit | 230 | 193 |
| Profit after taxation | (196) | (170) |
| | 747 | 851 |

between the *target* economic capital and the total invested capital, which is not necessarily equal to the actual funding of an enterprise.

The solution to this puzzle is that Sitting Duck limits its activities to "cash cowing" the original product and company concept. Exploring Eagle spends an amount on research and development every year. This expenditure increases the potential to stay ahead of competitors and maintain high margins and sales volumes. Furthermore, it increases the probability of having alternative products available in case the customers' demand for the existing product suddenly collapses. This expenditure does not lead to higher profits when scenario H remains applicable, but reduces the adverse effects of scenario L and N and thus increases the probability of survival of the company.

This example shows that information about research and development costs is useful when analysing an enterprise's performance. This information can be a separate disclosure (as is done in the management disclosures and analysis (MD&A) required or recommended under most reporting regimes), in the form of one or more separate line items in the performance statement. Ultimately, the expenditure could be recognised as an intangible asset (a future business concept). The rules and limitations applying to the latter approach are discussed in section 3.7.

The conclusion of this section is that a (comprehensive) income statement gives only limited information about an enterprise's performance. Present financial reporting as a whole (including management disclosures and analysis) may give information on recurring performance and may be helpful in analysing the probability of repeating or improving this performance in accordance with the enterprise's intentions. However, even if this information is complete and unambiguous, it is only understandable to a very skilled user.

Financial reporting would be improved if, in addition to the traditional (comprehensive) income statement that *records* the developments, a performance statement that *analyses* the developments were presented. Needless to say, the information in such a performance statement is more subjective than a fixed formatted income statement, but it should be possible to define such internal controls over financial reporting that this kind of information is of sufficient quality. Finally, performance reporting can be further enhanced if it can be compared with an expectation for the same period presented earlier and with an expectation for the next period. Such a comparison demonstrates the degree to which performance is predictable and the potential of the enterprise to live up to its promises.

## 3.5 Management disclosures and analysis

The previous section discusses the relationship between profits that result from the process of recording historical events (see sections 3.2 and 3.3) and performance, for the purpose of obtaining an impression of the extent to which the past will repeat in the future. It is a commonly held opinion that for creditors and equity investors alike the primarily future cash flows are relevant. Future interest and redemption payments will come from *future* cash flows. Equity investors buy future earnings (Penman 2003, page 81). Barker (2003, page 11) takes the same position.

Corporate value is estimated by the projection of future profits; and the basis for making these projections is the income statement of the current year (e.g. Beaver, 1998; Penman, 2001). If certain components of the current year do not provide useful information in projecting future corporate performance, then these should be excluded from earnings.

The three earnings concepts distinguished by Barker have been discussed in the previous section. Barker concluded that until now there has been no "one size fits all" model that standard setters can prescribe. It is therefore useful to look at a "looser" format to discuss performance in relation to recorded profits, i.e. MD&A. The filing regulations of the US Securities and Exchange Commission (Regulation S-K) include detailed guidance for various financial and non-financial disclosures. I would like to focus primarily on:

- Item 229:303 from this regulation. This covers the management's discussion and analysis and requires disclosures on liquidity, capital resources and results of operations. I will specifically discuss the latter.
- Item 229:305 from this regulation. This covers disclosures on market risks.

The required disclosures focus tightly on trends and should thus enable readers to make their own assessments of future developments. In item 301 of the regulation, key financial information for the past five years is required (or additional years in order to keep the information from being misleading). According to item 303, the MD&A should cover a three-year period (or five years if trend information is relevant). The purpose is to provide readers with information that is relevant to an assessment of the financial condition and the results of operations by evaluating the amounts and uncertainty of cash flows from operations. According to section 3 of the instructions for item 303, the MD&A shall focus specifically on material events and uncertainties known to management that would cause reported financial information to be not necessarily indicative for future operating results and future operating conditions. This would include descriptions and amounts relating to:

- matters that would have an impact on future operations and have not had an impact in the past; and:
- matters that have had an impact on reported information, but are not expected to have an impact upon future operations.

The consequence is that unusual or infrequent transactions and changes that materially affect the amount of reported income must be explained. Significant components of revenue and expense must be described in order to give the reader an understanding of the enterprise's results from operations.

If there are material deltas in, for example, revenue (in other words, if it does not develop according to a trend), both the quantity and the price element must be discussed. In our example of section 3.2, in a year that scenario H changes to scenario L, the reason for the lower revenue should be explained by the fact that the enterprise lost market share and the fact that sales prices decreased due to the competitive pressure of market entrants. This would give a reader an important message that the financial statements basically do not give, i.e.: “Revenue and gross margin have decreased and this decrease is permanent, so the value of my equity investment has decreased”.

Enterprises are encouraged to give projections of revenue, results and results per share or other indicators as far as they are appropriate and not misleading. If an enterprise chooses to do so, it is its good-faith assessment of future performance, but there should be a reasonable basis for such an assessment. History of operations or experience may be a factor, but is not always necessary in preparing a reasonable estimate. Attention must be paid to enhancing investors’ understanding of the limitations that are inherent to forward-looking information. Basically, such projections or other forward-looking disclosures are not mandatory and especially in years of economic turbulence, management of most enterprises choose not to make them. A typical disclosure is:

Weak and volatile financial markets and geo-political uncertainty continue to create a difficult operating environment for our business. ……… has not provided an earnings forecast for 2XXX.

Basically, the rules regarding MD&A are designed in a way that, unless otherwise indicated, the reasons for past operating results are expected to continue to happen in the future. If management *knows* that this will not be the case (the revenues of an acquired company have only been included for a part of this year and will be fully included next year, a large customer has been lost, an incidental gain has been realised this year), this must be disclosed in order to direct the reader’s attention to the fact that the recorded events will not recur in the future.

However, as already indicated, extrapolation to a future trend is encouraged, but not mandatory. In other words, management may give their vision on the extent to which the past will repeat in the future or supply enough data to enable the reader to form his own.

The required disclosure on risk relates to existing markets where the movements in prices and rates are beyond the control of the enterprise. The disclosure relates to movements in interest rates, foreign currency exchange rates, commodity prices, stock prices and movements in other relevant markets. Recall the previous section, where the matrix model for the income statement was discussed, separating the results before remeasurement and the remeasurements. The remeasurements are expected to move in a random walk over time, especially if they include annual restatements to fair value of certain assets. The degree of volatility in the results from remeasurement is often associated with the degree of risk that the enterprise runs owing to its asset and liability positions[27]. However, they show the movement that has happened; from a risk point of view, it is more relevant to know the movements that may happen in the future. This is what item 305 attempts to accomplish.

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27 For pension plans this may not always be true, because these involve long-term commitments. Short-term volatility in the fair value of plan assets is often smoothed in the long run, which makes the annual movements less relevant.

Information about market risk can be given in three ways.

1 In a tabular format, where the various instruments (on-balance-sheet and off–balance-sheet) are grouped by common market risk characteristics (positions in commodities should be categorised by type of commodity, etc.). The table should include the fair value of the positions and information about the (expected) contractual cash flows for each of the next five years and the total for the period thereafter.
2 As a sensitivity analysis. Such an analysis gives insight into the change in future earnings, future cash flows or fair values if interest rates decrease from 4% to 3%, if oil prices increase from US$ 25 to US$ 30 a barrel, if the stock market index decreases from 9,000 to 8,000, etc., within the near term (up to one year from the date of the financial statements). Sensitivity to foreign currency risk should take into account the impact on transactions in foreign currencies as well as the potential remeasurement of the assets and liabilities in foreign currencies.
3 As a value at risk presentation, i.e. the risk that future earnings, book value of the equity, fair values or future cash flows are negatively affected by an amount X. The said risk should be set to 5% or less, in other words, there should be at least 95% confidence that the adverse effect will not exceed X.

The relevance of this information has been discussed by Linsmeier et al. (2003). They state that prior to the implementation of the required disclosures on market risk, there was uncertainty and diversity of opinion among investors about the effects on an enterprise's value as a result of changes in market rates and prices. In their opinion, this uncertainty and diversity stimulated trading in the enterprise's stock when such changes took place, in other words, caused the trading volume to increase. They found that after the implementation of the disclosure rules, the sensitivity of trading volumes to changes in interest rates, foreign currency rates and commodity prices has decreased in comparison with the period before implementation. Their conclusion is that disclosures on market risk are obviously relevant to investors.

### 3.6 Recording, explaining and projecting

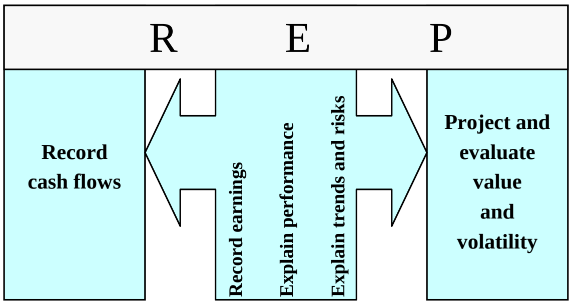
Section 3.1 concludes that value and volatility are of the utmost importance for most users of financial reports, irrespective of whether these users are owners or creditors. One would expect that everything in financial reporting would focus on explaining and quantifying value and volatility.

Sections 3.2 and 3.3 focus on recording historical events as strictly and objectively as possible, with estimates only allowed where they are necessary to value realised transactions or other historical events. Recording realised transactions (in the sense of the core competence of the enterprise) are key to performance.

What has been obtained from sections 3.4 and 3.5 can be summarised as follows:
- I have attempted to isolate an enterprise's performance from reported income in order to gain insight into the degree to which observed patterns repeat in the future with the intention of estimating future profits that are the basis for the enterprise's value.
- We have discussed the process of "normalising" income that commonly takes place when preparing enterprise valuations.
- I have separated results from remeasurement of assets and liabilities from the other results, because the latter includes more elements of performance and the former more elements of "winning the lottery".
- We have discussed MD&A as an instrument for presenting trends and incidents in a free format.
- We have discussed the sensitivity of future income (and value) to movements in market rates and prices that the enterprise cannot influence.

The natural conclusion to this would be a projection of recurring future income or cash flow. Despite the "safe harbour rule"[28], there is great reluctance to the issuing of such statements. This can be understood from a legal liability point of view, but is controversial when looking at the increased use of fair value in financial statements.

**Figure 3-5: Bridging the information gap**




A common definition of fair value is (IAS 32):

Fair value is the amount for which an asset **could be** exchanged, or a liability settled, between knowledgeable, willing parties in an arm's length transaction.

Fair value is often determined by market value (the amount for which an asset **has been** exchanged). Other than that, fair value has a forward-looking character. Fair value is often approximated to by quotations in an active market; in other

[28] A forward-looking statement that can be identified as such shall be deemed not to be a fraudulent statement unless it is shown that such statement was made or reaffirmed without a reasonable basis or was disclosed other than in good faith.

cases assets and liabilities are "marked to model", i.e. future cash flows are estimated and discounted using an appropriate rate. This sometimes makes the balance sheet the mother of all forward-looking disclosures.

Figure 3-5 shows how the explanation and analysis gap encountered in Figure 3-3 has been filled. The natural path of a description of historical events and its analysis, followed by projection and valuation, has been followed. We call this financial REPorting, where the capitals mean:

- Record, according to strict unambiguous rules.
- Explain, with more room for the entity's specifics and own judgment.
- Project, with a transparent reference to the first two steps and a gauge for uncertainty and imprecision.

The present path of describing historical events and remeasurement to fair value, followed by elimination of the effects of remeasurement in order to make the results ready for analysis is less obvious. Such *financial rpeorting* contains a methodological "typo".

The foregoing brings us back to Schmalenbach's opinion that it is impossible to present results and value on the face of one balance sheet and one profit and loss account. The same view is taken by Bindenga (1975, page 225). His view is that the profit and loss account should give information about the extent to which the primary goals of the enterprise have been met (performance) and should give sufficient information to support decisions by users of financial reports. In his opinion, this cannot be accomplished by a "balance-sheet-approach" for measuring results. Bindenga introduced the two-sided monism in which he accepts that it is impossible to present a balance sheet and a profit and loss account that show a direct relationship with each other and give a true and fair view of both value and performance. He abandons the "iron relationship" between valuation of assets and liabilities in the balance sheet and recognition of income, expenses, gains and losses in the profit and loss account.

According to Bindenga (1991, page 38), financial statements should consist of:

- a profit and loss account (in the deferral and matching tradition of Schmalenbach);
- a (dynamic) balance sheet;
- an asset-liability-based balance sheet, summarising the assets and liabilities;
- a reconciliation between the two balance sheets;
- a cash flow statement;
- a statement of projected normalised future cash flows;
- explanatory notes.

Bindenga does not include subjective (or any other presentation of self-generated) goodwill in the equity balance sheet. In his opinion, the projected normalised future cash flows provide relevant information about the true value of the enterprise.

## 3.7 Financial reporting conventions: the concepts and the rules

One of my conclusions from the historical analysis in chapter 2 was that financial reporting has never been formally invented, but rather developed from incidents and needs over time. In the previous sections of this chapter, an attempt has been made to develop concepts that are useful for measuring earnings and value (as a function of future earnings) when the factor uncertainty about future developments plays a role, as is the case in real life. The motto throughout these sections has been the classical discussion between Bernoulli and Von Leibnitz: historical patterns repeat in the future, but the degree of repetition is imperfect.

The idea that historical financial patterns repeat in the future is corroborated by empirical studies. An example is Penman (2003, page 91), who investigated the degree to which earnings (adjusted for extraordinary items and other one-off elements) are predictive of future earnings. His conclusion: "accounting earnings are forward looking".

In this section, the concepts developed in the previous sections are tested against existing regulation (mainly focusing on current IFRS). I specifically pay attention to:

- Recognition of intangible and tangible assets as defined in the example of section 3.1;
- Impairments of assets;
- Use of fair value and performance measurements;
- Present value in future cash flows in financial reporting.

### *3.7.1 Recognition of tangible and intangible assets*

In section 3.1, an example has been constructed where the tangible and intangible assets have the same nature: neither has a direct realisable value; the only future economic benefits consist of the cash flows that the enterprise as a whole generates.

It is relevant to look first at the nature of the intangible asset. The IASB defines an intangible asset as follows (IAS 38, amended 2004):

An intangible asset is an identifiable non-monetary asset without physical substance. An asset is a resource controlled by an enterprise as a result of past events and from which future economic benefits are expected to flow to the entity.

IAS 38 clearly states that not all expenditure incurred to generate future economic benefits results in the creation of a qualifying intangible asset. The IASB proscribes the recognition of internally generated goodwill as an asset.

The cost of the intangible asset should be measurable in a reliable way. If the asset is separately acquired, this is usually the case. In our example, the intangible asset has been internally generated. In such a case, the challenge is to objectively separate the cost of generating the asset from the recurring operational costs. An adequate cost allocation system and proper internal controls are necessary for reliably measuring the cost of the intangible assets. However, IAS 38 (§ 64) takes the view that for certain internally generated intangible assets, such as internally generated brands, mastheads, publishing titles, customer lists, etc., the expenditure cannot be distinguished from the cost of developing the business as a whole and does not qualify as an intangible asset.

In the example of section 3.1, the expenditure recognised as an intangible asset was clearly incurred during the development phase of the company. The company started at the moment the product was invented, the technical feasibility had been demonstrated, there was the intention to create the company structure and the technical, financial and other resources were available. The competitive advantage makes the future cash flows plausible. Hence, taking into account that sufficient future economic benefits are expected against the expenditure, all the criteria for recognising an intangible asset from development are met except two:

- The enterprise is not in control over the asset, because the future benefits relate to competitive advantage, which can disappear owing to events outside the control of the enterprise.
- The expenditure relates to the development of the business as a whole and contributes in a non-separable way to the expected future benefits as a whole. Therefore, the intangible asset in the example will not qualify as such within the scope of IAS 38: only the part of the expenditure that can be separately identified shall be regarded as an asset, a patent for example.

Tangible fixed assets (i.e. property, plant and equipment) are subject to the same definition of an asset as intangible assets (origination from a past event, cost should be reliably measurable and future economic benefits should be probable). IAS 16 gives specific and clear guidelines for establishing the cost of a self-constructed asset.

If an enterprise makes similar assets for sale, the cost of each of these self-constructed assets is equal to the standard cost of producing it, excluding the profit margin. Whether or not the enterprise makes similar assets for sale, wasted material, labour and other resources are eliminated from the cost of the self-created assets. An adequate system of internal control is necessary to measure such waste reliably. Such systems of internal control would include a budget for the cost of the assets to be created, a system for accurate, complete and timely recording of the expenditures, an analysis of the differences between budget and realisation (especially important is the question of whether these differences relate to waste or to mis-estimates) and sufficient segregation of functions (budgeting, recording, analysis and authorisation).

IAS 16 does not impose specific restrictions with respect to the extent to which tangible fixed assets, and their future cash flows, should be separately identifiable. Even property, plant and equipment that do not generate cash flows at all (such as assets purchased for safety or environmental reasons) can be recognised.

In the example of section 3.1, the cost of the plant can be reliably estimated, because a third party has developed it. Moreover, if it had been self-created, it could have been recognised as an asset within the limits mentioned above. As remarked before, the plant has no alternative use and has a net realisable value of zero. Nevertheless, there would be no hesitation about recognising a plant such as this as a tangible asset. As a result, the example includes two assets with great similarities and a different treatment if the IASB standards are applied.

Both the development of the company’s concept and the building of the plant are unprecedented, so there is no experience with respect to determining a reasonable value. For both assets, the only option is to use them in the enterprise. Future economic benefits can be specifically attributed to neither asset.

Hence, there is only one real key characteristic of the intangible asset under review: it is *intangible*. Reading IAS 38 gives the impression that the IASB only allows and prescribes the recognition of quasi-tangible assets (assets without physical form that are given a form by means of a licence, patent, concession or another document or visible entry in an official register) and proscribes the recognition of the real intangible assets, other than goodwill originating from the purchase of a business. In other words, only assets are allowed to be recognised whose physical reality can be established separately from their valuation. For the plant, this is clearly the case, as it could be shown, even if its value were zero. By contrast, the intangible asset receives its substance only from future cash flows at least equal to the disbursements embedded in the asset; i.e. only its value represents its existence.

Before commenting on this further, it is worthwhile to look at the consequences of not capitalising the development cost of the company's concept. Table 3-15 shows the balance sheets for the first 3 years with and without recognition of the intangible asset.

**Table 3-15: effect of recognition of intangible assets on Sitting Duck Distillery plc.**

| | With recognition | | | Without recognition | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 |
| Intangible fixed assets | 100 | 200 | 200 | - | - | - |
| Tangible fixed assets | 150 | 700 | 700 | 150 | 700 | 700 |
| Deferred tax asset | | | | 35 | 70 | 4 |
| Inventory | | 5 | 9 | | 5 | 9 |
| Collateral assets | 150 | 640 | 640 | 150 | 640 | 640 |
| | 400 | 1,545 | 1,549 | 335 | 1,415 | 1,353 |
| Equity | 250 | 734 | 671 | 185 | 604 | 541 |
| Provision for deferred taxation | | | 66 | - | - | - |
| Loan | 150 | 811 | 811 | 150 | 811 | 811 |
| | 400 | 1,545 | 1,549 | 335 | 1,415 | 1,353 |

If the development costs are not recognised as an intangible asset, another asset appears in the balance sheet, i.e. a deferred tax asset as a result of losses to be carried forward. According to the IASB, such an asset must be recognised, because in the circumstances it is probable that taxable profit will be available against which the deductible temporary difference can be set off.

In other words, when recognising the development costs as an intangible asset, it is necessary that the asset will generate at least the same amount of economic benefits in the future; when recognising the deferred tax asset (which does not represent any receivable, but is the tax relief on incurred costs under the assumption that sufficient future taxable profits will be generated), the proposition is the same. In the first case, the IASB proscribes recognition; in the second case, it prescribes recognition. The only difference is that a deferred tax asset is measured in relation to the taxable losses irrespective of the source of such losses and that the intangible asset should be assessed by measuring the development costs without too much subjectivity. I fail to understand why this would be a greater problem (given a decent internal control system) than with deferred tax assets or a unique self-developed tangible asset such as the plant in the example.

In section 3.2, the recognition of the intangible asset has been discussed from the point of view of stewardship. Self-created intangible assets have resulted in expenditure of shareholders' money and have (hopefully) created shareholder value. If this expenditure is carried to the profit and loss account, it becomes invisible. If the cost of self-created intangible assets is recognised in the balance sheet, it leads to a review from time to time, demonstrating which benefits have been realised and to what extent future economic benefits can still be expected. If the value gets lost, management has to explain why and this enhances reporting transparency.

Standard setters are often concerned that recognising intangible assets as described above overstates equity, which might trigger distributions to the shareholders or the borrowing of money, thereby weakening the financial position of the enterprise. In my opinion, this is the least of all worries. The user of the financial statements can easily see the nature of the intangible asset, especially when it is reported separately from the quasi-tangible assets. A larger problem is that the tangible asset has the same nature as the intangible asset (no separate realisable value, no alternative use, future economic benefits to be viewed for the enterprise as a whole). The user of the financial statement cannot see this unless it is specifically disclosed and thus cannot properly judge whether there is sufficient economic capital to enter into a transaction (e.g. granting supplier credit) with the enterprise.

The conclusion is that it is not the restrictions on the recognition of certain classes of assets that is of primary interest, but the restrictions on profit distribution from setting rules for minimum levels of economic capital. Van der Tas (2003, page 83) states that using separate principles for financial statements and for capital protection increases the information value of the financial statements, but still imposes restrictions to the distribution of the reported profit and thus protects creditors and other stakeholders. He mentions two methods for maintaining the required level of capital within an enterprise. The first is the traditional method, where only realised profits qualify for distribution. The second is to apply the prudential rules (such as Basle 2) under development by bank and insurance supervisors, where a capital requirement is responsive to risk. I am more in favour of the latter, because it is more in line with the observations in this chapter.

There are no IFRS that define the minimum capital required. The EU directives prescribe generic minimum capital amounts and define certain legal reserves (such as legal reserves relating to the recognition of certain classes of intangible assets). Supervisory agents of the banking and insurance industries are the only institutions that are in the process of developing minimum capital requirements that will control the probability of the enterprise being able to meet its obligations.

If a generic model for minimum economic capital (such as used in the example in section 3.1, based on the relationship between cash outflows from commitments and the lower bound of uncertain net cash inflows) could be developed, nobody would have to worry about recognising certain classes of assets. This is because it would not make any difference for the enterprise’s borrowing base or its potential to make distributions to shareholders, with the recognised asset remaining under review by users of the financial statements as long as it is expected to have value.

### *3.7.2 Impairment of assets*

In 2004, the IASB issued a revised IAS 36 that discusses impairment of assets. According to this exposure draft, impairment to an asset or a cash-generating unit should be recognised whenever the book value of the asset or the cash-generating unit exceeds the recoverable amount.

The standard defines:

- The recoverable amount as the higher of the net selling price (zero in the example) and the value in use.
- The value in use as the present value of the future cash flows expected to be derived from an asset or cash-generating unit.

According to the standard, the carrying value of an asset should be reduced to its recoverable value if the latter is lower. In the case of the recoverable value of a cash-generating unit being lower than its carrying value (including the goodwill allocated to the unit), the standard prescribes the following procedure:

- If the recoverable amount exceeds the carrying value of the net assets excluding goodwill, the goodwill is reassessed as the difference between the recoverable amount and the *fair value* of the net assets. The difference between the reassessed goodwill and the carrying value of the goodwill is charged to the profit and loss account.
- If the carrying value of the net assets excluding goodwill exceeds the recoverable amount, this difference is charged to the profit and loss account and adjusted to the assets of the unit on a pro rata basis, whilst the carrying value of the goodwill is fully charged to the profit and loss account.

There are two important differences between this standard and the approach that I applied in section 3.1. In the first place, the intangible asset as constructed in the example would not qualify for recognition under IFRS. Consequently, in accordance with IFRS, a loss of value would not be recorded, because the value as such would not have been recognised in the first place.

Furthermore, in accordance with IFRS, assets would have been impaired to the recoverable value instead of to the lower of recoverable value and replacement value. As can be seen from the example, an impairment to replacement value (if this is lower than the recoverable value) leads to future depreciation costs that are comparable with those of competitors that have more recently purchased their capital goods and is therefore more indicative for measuring performance. Such an impairment also provides more insight into the recurring cost of the use of capital goods in the future. Recurring cost and performance are of primary interest when a user of financial reports is interested in value.

### *3.7.3 Fair value accounting*

In the previous section, fair value has been briefly discussed as the end of the process of recording, analysing, projecting and measuring. It was found that the definition of fair value is future oriented. Fair value is often assessed as a documented historical event, i.e. a real transaction at a certain date in a comparable instrument in an active market (mark-to-market). By the time the financial statements are issued, this is a historical value, only slightly less historical than historical cost. In other cases, fair value must be estimated by using an option-pricing model or a discounted cash flow model (mark-to-model). In all cases, uncertain future cash flows are involved.

The reason for recognising such fair values on the face of the balance sheet is obscure. Originally, fair value accounting was primarily introduced for derivatives. At the inception of a derivative contract, often no or negligible cash flows are involved, whilst the cost of settlement (and thus the risk exposure) may be huge. Carrying derivatives at fair value gives them a place in the balance sheet (Krens 2003, page 371). In my opinion, this approach only shows a movement after it has occurred; more interesting is the disclosure of outstanding positions and the sensitivity of these positions to changes in market conditions. Consequently, carrying derivatives at fair value on its own does not take away the concern of standard setters.

Including fair values as described above in the balance sheet crosses the line of a balance sheet that is mainly the aggregate of documented historical events. If one wants to cross that line, one should do so in a way that avoids false volatility in equity and earnings and eventually consider focusing on the total enterprise's value. A value at an undefined point between the book value based on documented historical events and the "true value" has no meaning for any user of financial statements.

It has been extensively discussed that the driver of value is the repetitive element in earnings. I therefore feel that financial reporting should primarily be concerned with the driver and only in the second place with the value. Schmalenbach's opinion is that financial statements can only serve one purpose (monism) and he opts for (in my opinion justifiably) the measurement of earnings.

### *3.7.4 Present value of future cash flows*

IFRS addresses the use of the present value of expected future cash flows at two points.
The first relates to the test for impairment of goodwill and fixed assets and the second to the use of fair value, where (see IAS 40 and 41):

- there is no active market for the related asset or liability that provides fair value evidence;
- there is no active market for comparable assets and liabilities, and:
- no relevant recent prices on a less active market are available.

The standards that mention present value of expected future cash flows as a means to estimating present value, do not give much guidance on the estimation of the cash flows or the discounting. IAS 36 gives more extensive guidance for estimating the future cash inflows and cash outflows and applying the discount rate when assessing value in use.

The standard gives a reference to reasonable and supportable assumptions that represent management's best estimate. In a reference to the planning and control cycle, it states that projections should be based on the most recently approved budgets or forecasts. External evidence relating to future developments should receive greater weight than internally generated scenarios and estimates. The cash flow projections should include all expenditures that will be necessary to ensure the projected cash inflows (e.g. maintenance expenses). Net benefits that arise from future restructuring that has not been committed to or from future investments should not be taken into account. Finance costs are not included in the cash flows.

The discount rate should reflect the time value of money and the risk that is specific to the asset.

Effectively, this would mean that the discount rate reflects the weighted average cost of capital, being a mix of the interest cost attached to the debt that is used to acquire the asset and the cost of the equity involved in the acquisition. The proportion of equity should represent the economic capital that is required to provide a high degree of certainty that the enterprise can meet its commitments (towards creditors and other stakeholders). Ideally, this economic capital is related to the x% lower bound of the projected cash flows.

**Figure 3-6: Relationship of volatility to cost of capital**

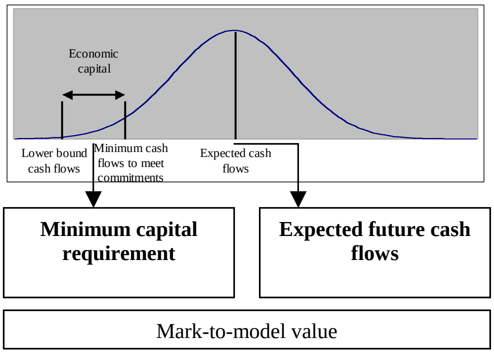



Figure 3-6 shows the relationship between expected value and volatility of future cash flows (which determines required economic capital, see Figure 3-2) and fair value on a mark-to-model basis.

The higher the volatility of the future cash flows, the more economic capital is required and the higher the WACC is. Consequently, it is necessary to involve not only the expected value of cash flows, but also the volatility of future cash flows when performing impairment tests or when estimating fair values that are based on discounted cash flows. Present financial reporting standards do not provide any guidance on this, primarily because standard setters did not integrate capital protection and capital maintenance rules in their standards.

A value estimate that is based on the present value of expected future cash flows (for the value of shares, expected future dividends) is often called the fundamental value. Conceptually, there is no difference from a fair value according to a deep market quotation at a certain moment. Willing and knowledgeable sellers and buyers of an asset or liability (or a complex of assets and liabilities) have current and expected future cash flows in mind when they enter into purchase and sales transactions. When the preparer of a fundamental value uses the exact belief about future cash flows and the attitude to risk and volatility of the market parties, fundamental value equals the market price. Market quotations tell you the size of the fair value, while a fundamental value analysis also explain why. Consequently, the drivers behind fundamental value are relevant to financial reporting.

### 3.8 Summary and conclusions

In this chapter, the effect of uncertainty on financial reporting has been evaluated. Uncertainty can primarily be translated into the risk that cash flows will develop differently than expected. Value and volatility appear to be key information for shareholders and lenders as users of financial statements alike, as well as to enterprises for assessing the required level of economic capital to ensure a high probability of meeting their commitments.

**Figure 3-7: Relevance of value and volatility**

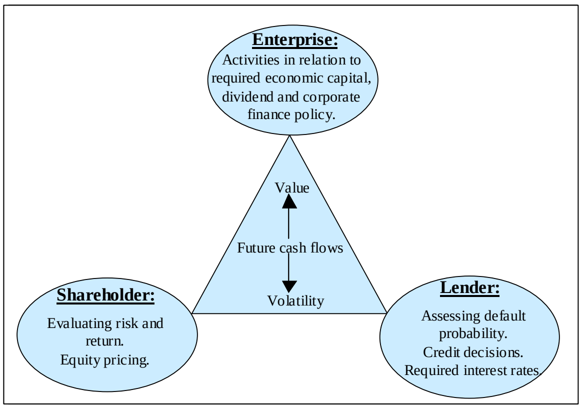
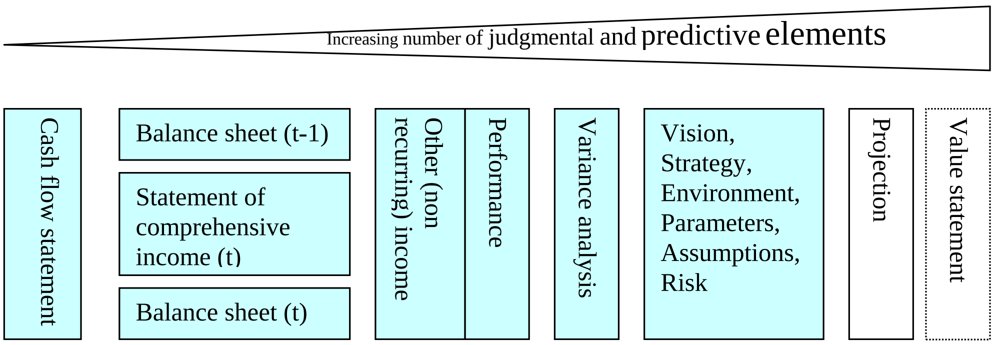



Figure 3-7 summarises the relevance of value and volatility to major categories of users of financial reports and to the enterprise itself. The common factor throughout is future cash flows and the degree of uncertainty.

I have attempted to show how to deal with uncertainty by first describing documented historical financial events, then analysing them and finally making future estimates. In such an approach, earnings that have the potential to show recurrence in the future, rather than their value (which is no more than the consequence of those future earnings), have a central place in financial reporting. The paradox revealed by this chapter is that someone interested in value should primarily focus on cash flows, income and expenses, and performance, and only secondarily on assets and liabilities.

In summary, I use the REPorting model shown in Figure 3-8.

**Figure 3-8: Transparent comprehensive reporting model**




This model presents a further development of the two-sided monism introduced by Bindenga (1991). Such a reporting model would include:

1 A cash flow statement. This is the only statement that includes exclusively historically documented events and therefore has the highest reliability. In my opinion, information about movements in cash flows should be as informative as possible. This can be accomplished by using the direct method for most industries.
2 A balance sheet, that is primarily based on historical events (including observed changes in prices on active markets), but unavoidably includes estimates for impairments and provisions ("discretionary accruals", which can be identified separately).
3 A statement of comprehensive income that explains all movements in equity except direct transactions with the owners/stakeholders.
4 A performance statement that primarily demonstrates the quality and the potential recurrence of the earnings.
5 An analysis of the performance statement, including a variance analysis in relation to previous periods and past projections in order to isolate the recurring trend.
6 A description of strategy, intentions and environmental factors that are relevant to expected future trends.
7 A qualitative and quantitative description of:
   – The risk of cash flows developing differently than expected.
   – The risk of cash flows falling below the level required to meet all existing legal and constructive obligations.

Finally, a projection and a value statement is definitely useful information, because it reflects management's expectations and intentions. Although this is highly subjective information, the reporting model described above is sufficiently transparent to enable readers to adjust projections and value estimates to their own beliefs and attitudes to uncertainty. If fair value in its prospective definition is to be applied, it is in the value statement and nowhere else in the financial statements, because it would otherwise lead to a book value of equity that represents neither historical events nor the value of the enterprise.

To avoid any misunderstanding: The avoidance of the use of fair value and changes therein in the "traditional" balance sheet and income statement relates to fair value in its predictive sense, i.e. the amount for which an asset or liability **could be** exchanged. Market values for which similar assets or liabilities **have been exchanged** are based on documented historical events.

In this respect, recognition of the cost of self-created goodwill in the balance sheet is as useful and as harmless as the recognition of other classes of assets without directly realisable values or options for alternative use. One restriction on this assertion, given the inherent limits to internal control procedures over financial reporting, is that the cost of self-created goodwill can be objectively separated from normal operational costs (which is usually the case for greenfield operations and certain research and development projects). Applying a healthy approach to minimum required economic capital ensures that recognition does not lead to an increase in the distributable part of equity. In other words, recognition should be connected to rules on economic capital requirements that restrict distribution of profit and repayment of capital.

In analysing performance, it can be concluded that it is always useful to separate transaction results related to the core competence of the enterprise from holding gains and losses, because the former category has a higher repetition factor than the latter. The example in this chapter demonstrated that, in situations of impairment or price fluctuations, performance measurement is better served by using replacement value rather than realisable value (unless replacement would be economically irrational).

Finally, let us look at the income for the owner. We have seen that the annual **cash flow** available to the owner can be defined as:

Reported net profit - change in required economic capital

which is also the basis of the value of the enterprise to the owner. In section 3.3, we have seen that price fluctuations influence the required economic capital and thus the cash flow to the owner. However, price fluctuations are just one of the influencing factors, so they do not require separate treatment.

Now we know the cash flow available to the owner, what is the income for the owner? Let us review two scenarios:

1 An individual has to obtain his income for 10 years from a debt instrument with a face value of 100,000 that is repaid to him by means of 10 annuity instalments of 16,275 (based on 10% annual interest). He knows that inflation is 5%. Using the Hicksian definition of income (at the end of the period the individual has to be as well off as at the beginning), the income available for consumption in year 1 will be only 12,950. The remainder will be reinvested in order to be able to index the amount available for consumption in the future. After spending 12,950, the individual is still as well off in real terms as at the beginning of the period.

2 An individual has to generate his income from equity investments that on average give cash income of 15,000. The lowest income observed in the past 10 years was 5,000 and the highest 25,000. This makes the choice between consumption and saving a risky one. Suppose in a certain year the individual receives 21,000. What should he do, spend it all or save part for a rainy day? Applying the Hicksian definition of income here would require an analysis of the individual's belief in future developments and his appetite for or aversion to risk.

These two examples demonstrate that the ultimate receiver of income has his own considerations for assessing the amount that can be spent. His natural behaviour is to smooth the amount available for consumption. It is a widespread misunderstanding that the enterprise that generates the income has to do the smoothing for him. It is justified that such smoothing is considered a reporting perversity nowadays, because it conceals the real trends that are relevant to understanding the enterprise, its performance, the volatility that is inherent to its choices and activities, and its financial position.

## Appendix 3-I: Model used in example

Basically, there are 3 possible scenarios in the example, viz.:

- H: Turnover and margin remains at the initial high level.
- L: Turnover and margin decrease due to increased competitive pressure as a consequence of technological innovation.
- N: Cash flows decrease to zero and remain there permanently as a consequence of an abrupt cessation of customers' demand.

There are also the following intermediate scenarios:

- H-L: The first year that the status changes from H to L. In this year, inventories can be decreased, which results in one-off additional cash flow.
- H-N: The first year that the status changes from H to N. An additional cash flow is generated from the liquidation of inventories.
- L-N: The first year that the status changes from L to N. An additional (though lower) cash flow is generated from the liquidation of inventories.

The change in status is irrevocable, i.e. H cannot be reached if the status is L or N and L cannot be reached from status N.
The operational cash flow for the different scenarios can be summarised as follows:

| | H | L | H-L | L-N | H-N | N |
|---|---|---|---|---|---|---|
| Sales | 600,000 | 300,000 | 300,000 | - | - | - |
| Cost of sales | 90,000 | 60,000 | 60,000 | - | - | - |
| Salaries | 100,000 | 100,000 | 100,000 | - | - | - |
| | 410,000 | 140,000 | 140,000 | - | - | - |
| First year of change in cash flows: | | | | | | |
| Inventory | | | 3,000 | 6,000 | 9,000 | |
| | 410,000 | 140,000 | 143,000 | 6,000 | 9,000 | - |

The operational cash flows are increased by annual inflation.
The probability distribution of the possible operational cash flows for the years 4 and 5 can be summarised as follows:

| **Operational cash flow** | **4**[29] | **5** |
|---|---|---|
| 410,000 | 90.00% | 81.00% |
| 140,000 | 0.00% | 7.31% |
| 143,000 | 7.50% | 6.75% |
| - | 0.00% | 2.50% |
| 6,000 | | 0.19% |
| 9,000 | 2.50% | 2.25% |
| | 100.00% | 100.00% |
| Expected value | 379,950 | 352,204 |

In each subsequent year i, the probability of a certain operational cash flow scenario is given by the following formulas:

---

29 For the Exploring Eagle case in section 3.4, the probabilities have been set to 93% for H, 6% for L and 1% for N, because of the effect of the R & D costs on the potential continuity of the enterprise.

$$P(H)_i = P(H)_{i-1} \times 0.90$$

$$P(L\_H)_i = P(H)_{i-1} \times 0.075$$

$$P(L)_i = \{P(L)_{i-1} + P(L\_H)_{i-1}\} \times \{1 - 0.025\}$$

$$P(N\_H)_i = P(H)_{i-1} \times 0.025$$

$$P(N\_L)_i = \{P(L)_{i-1} + P(L\_H)_{i-1}\} \times 0.025$$

Reinvestments take place in year 11 and each seventh year thereafter. If the scenario is H, the reinvestment will be 700,000 increased by compound annual inflation. If the scenario is L or L_H, the reinvestment will be 450,000 increased by compound annual inflation. In all other cases, the reinvestment will be zero.

The supplier of the long-term loan runs a risk of default on interest and redemption payments that is related to the abrupt cessation in customer's demand. In order to limit this default risk, the enterprise is required to keep a minimum level of assets that serve as a collateral for the lender. It is assumed that a default event always occurs at the beginning of a year, just after payment of the interest for the previous period. The expected value of a default for each year is then given by the formula:

$$E(D)_i = \{L - C - S_h\} \times \frac{P(N\_H)_i}{1 - P(N)_i} + \{L - C - S_l\} \times \frac{P(N\_L)_i}{1 - P(N)_i} \text{, where:}$$

$E(D)_i$ = expected value of the amount in default
$L$ = loan balance
$C$ = assets that can serve as a collateral in case of default
$S_h$ = liquidation value of inventories in scenario N_H
$S_l$ = liquidation value of inventories in scenario N_L

The default quota is given by $Q = \frac{E(D)_i}{L}$.

The minimum amount of collateral assets can then be calculated for the end of each year using the following formula:

$$C = \frac{(L + T - S_h).k_h + (L + T - S_l).k_l - L.Q}{L} \text{, where}$$

$T$ = preferred (tax) debt
$k_h$ = probability of discontinuation from a High scenario
$k_l$ = probability of discontinuation from a Low scenario

Economic capital is the balance of all assets (including collateral assets) less liabilities.

Cash flow available to the shareholder is the cash flow generated by the enterprise plus or minus the net change in economic capital. The minimum amount of collateral assets/economic capital limits the default risk of the lender.

In real life, collateral assets consist of inventories, debtors, etc. The example has been set up in a way that cash is the only collateral to be given. Such cash could also be used for borrowing less or earlier redemption. In order to keep the proposition for the enterprise rational, the interest rate on the cash has been set equal to the interest rate on the loan.

As indicated in section 3.1, the development costs are recognised for tax purposes when incurred. This leads to the following pattern of tax equity in relation to statutory equity in the initial periods.

| | 1 | 2 | 3 |
|---|---|---|---|
| **Equity for tax purposes** | | | |
| Opening | | 150,000 | 533,998 |
| Tax result (after tax) | - 100,000 | - 100,000 | 189,635 |
| Profit distribution | 250,000 | 483,998 | - 185,882 |
| Closing | 150,000 | 533,998 | 537,751 |
| | | | |
| **Statutory equity** | | | |
| Opening | | 250,000 | 733,998 |
| Profit (after tax) | | | 123,263 |
| Profit distribution | 250,000 | 483,998 | - 185,882 |
| Closing | 250,000 | 733,998 | 671,378 |
| | | | |
| Difference | 100,000 | 200,000 | 200,000 |
| Deferred tax | 35,000 | 70,000 | 70,000 |
| Carry forward losses | - 35,000 | - 70,000 | - 3,628 |
| Net deferred tax | - | - | 66,372 |

The carry forward losses are used for setoff in period 4. Consequently (see Table 3-5), the profit tax charged in scenario H to the profit and loss account amounts to € 105,803, which leads to tax payable of this amount less the balance of losses carried forward (€ 3,628), i.e. € 102,175.

The selection of the discount rate is a subject that has been extensively studied by various researchers. As it is beyond the scope of this study to describe all the aspects, only a limited description of the relevant factors is given.

Cost of equity is defined as the return on risk-free securities plus the enterprise's systematic risk, multiplied by the market price of risk (Copeland et al., 2000, page 214). The most common approach for estimating the return on risk-free securities is the return on a long-term government bond (Copeland et al., 2000, page 16). I opted for 4%, being the yield of 10-year euro-government bonds at the time of developing this example.

The rationale behind looking primarily at the market price of risk is that the investor does not look at the risk profile of an individual enterprise, but at the risk related to his total (diversified) investment portfolio and the extent to which an investment in such an enterprise changes this portfolio risk. One way to measure market risk premiums is to look at historically observed returns on equity investments in relation to observed returns on long-term government bonds. Looking at the observed averages in the US stock market for the period 1926 to 1998 and evaluating the various possible methods of calculation, a market risk premium of between 6% and 6.5% seems to be a fair choice. However, unlike most other stock exchanges in the world, the US market operated without any interruption during the 20th century. This had a positive effect on observed equity returns in comparison with other countries. Jorion and Goetzmann estimate this effect at between 1.5% and 2% (Copeland et al., 2000, page 221). Adjustment for this "survivorship premium" leads to a market risk premium of between 4.5% and 5%. For the example, I have selected 4.5%.

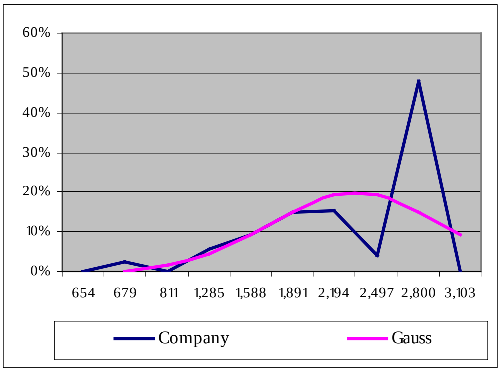
The enterprise's systematic risk, or the β, is usually measured by the covariance between the returns of the market (portfolio) and those of the enterprise. In the last decade of the 20th century, considerable doubt was expressed relating to the relevance of the β in explaining equity returns. Fama & French concluded that it has hardly any relevance, whilst Kothari, Shanken and Sloan found a "significant linear relationship between β and returns". Copeland et al. comment on this (2000, page 225):

It takes a better theory to kill an existing theory, and we have not seen the better theory yet.

In the example, I used a β of 1, which effectively means that the risk premium for the enterprise is perfectly correlated to the risk premium of the market.

The model described in this appendix has been customised for the illustrations given in chapter 3. In order to compare it with more generally applicable models for valuation and credit rating, it is useful to look at the volatility of the total value of the net assets (i.e. the value for the shareholder increased by the interest-bearing debt).

**Figure 3-9: Distribution total asset values**




For years 4 to 10, the equity and asset values for all possible combinations of the scenarios H, H_L, H_N, L, L_N and N have been calculated. The frequencies of the values have been plotted in Figure 3-9 and compared with part of the Normal distribution that is often used in generalised models for equity valuation and credit pricing. When the value of the total assets is below € 811, the enterprise is in default. It can be seen that the company-specific distribution has a "fat tail" as compared with the corresponding part of the Gauss curve. The volatility of the asset values (i.e. the relative standard deviation) is 0.28.

In section 3.1, I have constructed an option granted by the lender to the shareholder to acquire (or not to acquire) the enterprise's assets at a strike price equal to the remaining outstanding debt. Because this option enables the shareholder only to buy at favourable conditions (no default), it increases the value for the shareholder to an amount equal to the present value of the risk premium in the debt interest rate. The table below summarises the total value of the option.

| | |
|---|---|
| Asset value | 2,194 |
| Strike price | 811 |
| Intrinsic value option | 1,382 |
| Time value option | 12 |
| Total option value | 1,395 |

A general model for valuing the option described is the Black & Scholes option-pricing model. The formula to calculate an option price according to this model is shown below (Howell et al., 2001, page 132).

$$c = V.N(d_1) - e^{-r(T-t)}E.N(d_2)$$

where:

$$d_1 = \frac{\ln\left(\frac{V}{E}\right) + \left(r + \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}$$

$$d_2 = d_1 - \sqrt{T-t}$$

| | |
|---|---|
| V= | Current value of the assets. In our example, the value of the assets amounts to 2,194,000 at the beginning of year 4. However, the loan is repaid in 7 equal annual instalments. Consequently, there are 7 options. For each of them, the rounded value amounts to € 313,000. |
| E= | Strike price of the option or the outstanding debt. There are 7 options, each having a rounded strike price € 116,000. |
| r= | Real risk-free interest rate; 4% in the example. |
| σ= | Volatility of the value of the assets, i.e. the standard deviation relative to the value; 0.28 in the example. |
| t = | Time of valuation of the options (beginning of year 4 in the example). |
| T= | Time of exercising a particular option, i.e. at the end of years 4, 5, 6, 7, 8, 9 and 10. |
| N(..) | Cumulative probability according to a normal distribution. |

The values of the 7 options under review are detailed in the table below.

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|
| Value assets | 313.43 | 313.43 | 313.43 | 313.43 | 313.43 | 313.43 | 313.43 | 2,194.03 |
| Redemption due | 115.89 | 115.89 | 115.89 | 115.89 | 115.89 | 115.89 | 115.89 | 811.25 |
| Intrinsic value | 197.54 | 197.54 | 197.54 | 197.54 | 197.54 | 197.54 | 197.54 | 1,382.78 |
| Time value | 0.00 | 0.08 | 0.36 | 0.81 | 1.36 | 1.95 | 2.54 | 7.11 |
| | 197.54 | 197.62 | 197.90 | 198.35 | 198.90 | 199.49 | 200.08 | 1,389.89 |

The sum of the time values of the Black & Scholes options (€ 7,110) is lower than the entity-specific premium of € 12,000, which exactly provides a 50 bp risk surcharge over the period in which the loan performs. The main source of the difference is the fact that the Black & Scholes model assumes that the possible development of the asset around the risk-free interest is normally distributed. The enterprise-specific model takes into account the specific "jump-like" pattern according to which defaults take place.

The Risk Metrics Group has developed a model that partly takes into account the jump-like occurrence of a default, i.e. the CreditGrades™ model (Finkelstein et al., 2002). Unlike the Black & Scholes model, the development in the value of the asset is not compared with the value of the outstanding debt, but with a default barrier, which is not a fixed amount, but has its own drift and its own volatility. The model records a default if and when the developed value of the assets "hits" the developed value of the default barrier at any time before maturity. The model first calculates a continuously compounded risk spread that is sufficient to cover the expected value of the default losses (the par spread $c^*$).

The model needs following input variables:

- Market value of the asset at inception. Similar to the Black & Scholes example, a calculation is made for each loan instalment with a specific maturity.
- Debt. Each instalment is treated as a separate debt.
- Risk-free rate; 4% in the example.
- Volatility of the asset value; 28% in the example.
- Present date. Beginning of year 4.
- Expiration date. An instalment at the end of years 4 to 10.
- Expected value of the default barrier. Empirical research (Finkelstein et al., 2002, page 13) indicates a value of 50%. I used 100% in my calculations, however. The reasons are that, in the specific example, value jumps are irrevocable and collateral assets are easy to realise at their face value. Consequently, there is no incentive to creditors to "muddle on" when value hits a default barrier based on 100% of the outstanding debt.
- Volatility of the default barrier. The empirical research mentioned above indicates a value of 0.30. I used this in my example.
- Entity-specific recovery rate given default. This can be directly calculated from the example and amounts to 88%.

The model has been described in chapter 2 of the CreditGrades™ technical document (Finkelstein et al, 2002); the formulas are summarised in Appendix 3-II. The results based on the values described above are summarised in the table below.

| | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|
| Assets | 313.43 | 313.43 | 313.43 | 313.43 | 313.43 | 313.43 | 313.43 | 2,194.03 |
| Debt | 115.89 | 115.89 | 115.89 | 115.89 | 115.89 | 115.89 | 115.89 | 811.25 |
| Par spread | 0.15% | 0.27% | 0.36% | 0.43% | 0.47% | 0.50% | 0.52% | |
| CDS price if par spread =0 | 0.15% | 0.52% | 0.99% | 1.49% | 1.97% | 2.40% | 2.79% | |
| Amount CDS | 0.17 | 0.60 | 1.15 | 1.73 | 2.28 | 2.78 | 3.23 | 11.95 |

The sum of the values of the credit default swaps (CDS) is similar to the premium that should be paid in order to cover the expected default losses. Given the choice of the parameters (especially the expected default barrier and its volatility), the sum of the prices of the credit default swaps approximates the premium included in the enterprise-specific model.

**Appendix 3-II : Formulas for the calculation of the par spread and the price of a CDS, according to the CreditGrades™ model**

| Formula | Input variables | Remarks |
|---|---|---|
| $d = \frac{V_0 e^{\lambda^2}}{LD}$ | $V_0$ = Initial asset value per share<br>L = Expected value default barrier<br>D = Debt per share<br>$\lambda$ = Volatility of default barrier | |
| $A_t = \sqrt{\sigma^2 t + \lambda^2}$ | $\sigma$ = Volatility of asset value<br>t = Moment in time | |
| $P(t) = \phi\left\{-\frac{A_t}{2} + \frac{\ln(d)}{A_t}\right\} - d.\phi\left\{-\frac{A_t}{2} - \frac{\ln(d)}{A_t}\right\}$ | | Survival probability up to moment t. |
| $\xi = \frac{\lambda^2}{\sigma^2}$ | | |
| $z = \sqrt{\frac{1}{4} + \frac{2r}{\sigma^2}}$ | r = Risk-free interest rate | |
| $G(u) = d^{z+0.5}\phi\left\{-\frac{\ln(d)}{\sigma\sqrt{u}} - z\sigma\sqrt{u}\right\} + d^{-z+0.5}\phi\left\{-\frac{\ln(d)}{\sigma\sqrt{u}} + z\sigma\sqrt{u}\right\}$ | | u= $\xi$ or t+$\xi$ in next formula |
| $c^* = r(1-R)\frac{1-P(0)+e^{r\xi}\{G(t+\xi)-G(\xi)\}}{P(0)-P(t)e^{-rt}-e^{r\xi}\{G(t+\xi)-G(t)\}}$ | R = Asset-specific recovery rate | Required par spread (surcharge on risk-free rate). |
| $CDS = (1-R)\{1-P(0)\} - \frac{c}{r}\{P(0)-P(t)e^{-rt})\} + \left(1-R+\frac{c}{r}\right)e^{r\xi}\{G(t+\xi)-G(\xi)\}$ | | Price for a CDS given a spread of c over r. |

# 4 Life insurance: an illustration of the mechanics

This chapter and the next are closely related. I want to investigate whether the Financial REPorting concept as explained in chapter 3 can be applied to the insurance industry and the degree to which it is already implicitly applied.

I focus on life insurance as this industry has much similarity with the example used in the previous chapter. There is a closed set of events (life or death at a certain moment) and the status (growing older or death) is irreversible, similar to moving to a "lower revenue – lower margin" scenario or to a "stop" scenario in the example of chapter 3.

This chapter addresses some of the mechanics of life insurance. As in chapter 3, a very simplified example is used. Although it does not nearly describe the complexities that life insurance enterprises face, it illustrates many of the important issues this industry has to confront, such as the impact of demographic developments, investment performance, asymmetric risks (from embedded options), and the volatility of future cash flows in relation to economic capital requirements.

The road map of this chapter is as follows:

| Mechanics | Implications | |
|---|---|---|
| 4.1 The mechanism of life insurance | 4.2 Total results and required economic capital | Conclusions |
| | 4.3 Real world scenarios | |
| | 4.4 Volatility and time | |
| | 4.5 Dilemmas in allocating results to periods | |
| | 4.6 Bridging two markets | |

In section 4.1, the main drivers behind life insurance will be explained. I use a simple example and apply the same "look what happens" approach used for the Sitting Duck example of section 3.1, in order to identify the drivers behind value and volatility. Such an example leads easily into the field of financial mathematics. Instead of going deeply into the analytics, I wish to restrict myself to the example in order to demonstrate what mainly drives value and volatility in life insurance. Consequently, no generalised models are given. Instead, the central theme in this study is served by the example, i.e. how can the drivers behind value and volatility be recorded, analysed and reported in an unambiguous way.

In section 4.2, the value and volatility of the section 4.1 are translated into a "pure economic capital", which is compared with the current views of insurance supervisors. The relationship between the amount of economic capital and the risk exposure in the insurer's own books is demonstrated.

Section 4.3 describes very briefly how the assessments from “real world cash flow projections” can be equated to “risk-free world” cash flows. This issue is important because the pricing of options (many features of insurance products, such as interest floors, are options) is risk-free and arbitrage-free, so the related cash flows are risk-adjusted cash flows. However, realised cash flows are obtained in the real world. Comparisons of experience to assumptions are only meaningful if real-world experience is compared to real-world assumptions. This section demonstrates that real-world stochastic models and risk-free/arbitrage-free models produce the same answers, provided that discounting is done properly.

In section 4.4, the relationship between volatility and the lifetime of an insurance contract is described. The indication is that the volatility for an insurance enterprise (and so its exposure to adverse cash flow developments) depends to a large extent on the discretion the enterprise has to smooth investment returns over a certain number of periods.

In section 4.5, the same example is used to highlight the dilemmas for life insurance companies when allocating results to different financial reporting periods. These dilemmas result from the fact that, for a contract with a very long lifetime, the progress has to be measured over a small part of this lifetime. Kaplan et al (1991, page 17) describe this dilemma in another context:

It is meaningless to allocate profitability to short periods within a project. But it is relevant to look for indicators of short-term progress in relation to the plans.

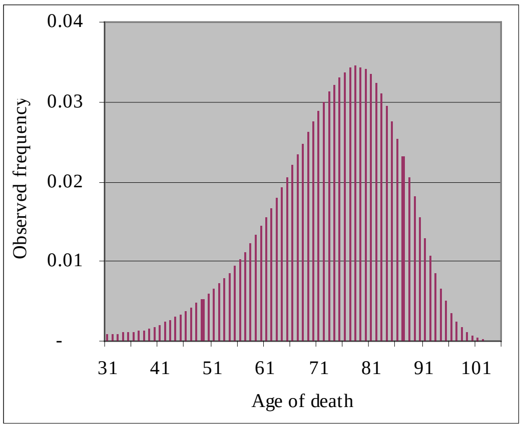
In this section, an answer is sought to the question of what the most natural way is to gauge progress (and consequently to realise result) in the services relating to an existing book of life insurance contracts.

Section 4.6 explains why the pricing of insurance products is likely to include more margins than the cost of solvency discussed in section 4.5 and why it is less appropriate to treat insurance products in a similar way to financial instruments.

## 4.1 The mechanism of life insurance

Christiaan Huygens wrote his *Calculating in Games of Chances* in 1660 when he was 31 years old (see section 2.2). In this treatise, he predicted that he would reach the age of 55. For this prediction, he used the mortality tables that were initially constructed by John Graunt and further improved by Hudde and De Witt. If he had used the 1976/1980 Dutch mortality table for males, his prediction would have been 73, being the frequency-weighted average age according to the mortality table mentioned for a male aged 31.

**Figure 4-1: Death frequencies males 31 years and older**




Huygens died at age 66, so he was "dead wrong" with his projection. In Figure 4-1, the distribution of death rates of 31-year-old males is presented (1976/1980 mortality table).

This distribution has a mean of 73.4 and a standard deviation of 12.2. If one wanted to predict the age of death with 95% confidence, one would arrive at an estimate of between 50 and 90, which is typical non-information.

However, for a large group of persons, the mortality pattern can be predicted with reasonable accuracy. For a group of 5,000 persons, the average age at death can be predicted with an accuracy of less than 6 months. This is the basis for the "manufacturing process" of a life insurance company. An individual cannot do his financial planning (or assess the amount he can spend without jeopardising his future spending power) if he does not know whether he still has 20 years or 60 years to live. With a margin of 6 months, such planning is possible.

The example used is based on an endowment, where all future investment income is for the benefit of the policyholder. The insurance company guarantees an investment yield of 2/3 of the risk-free interest rate. Furthermore, the company deducts 2% from the premium to cover acquisition costs, and each subsequent year 50 basis points from the funds invested to cover its operational expenses. If the funds invested grow by the risk-free rate, the expenses can be exactly recovered from operations.

The proceeds of this type of insurance are often used to redeem mortgage loans. A "term rider" (that pays a sum insured at death of the policyholder during the lifetime of the policy) is nearly always attached. For reasons of simplicity, no term rider has been included in the example. Moreover, for reasons of simplicity, payment of a single premium at inception of the policy is assumed. In the example, 10,000 males each buy such a policy when they are 40 years old. The policy pays out at age 60, if the insured is alive then. The benefit is the value of the funds invested with a minimum of € 100,000[30]. The real risk-free interest rate has been set to 3%, so the guaranteed interest is 2%.

30 In the remainder of this section, all amounts have been rounded to thousands of euros.

The principles used in calculating the single premium are largely based on two ancient concepts discussed in chapter 2, i.e.:

- The principle of a fair bet (Christiaan Huygens), which implies that the value of a bet (in this case the insurance premium) is equal to the expected value of the outcome (in this case on survival or on death).
- The law of large numbers (Bernoulli), which implies that for sufficiently large numbers of observations, the observed frequencies converge to the probabilities of the related events. In the example, this means that for sufficiently large numbers of people, the observed mortality frequencies can be regarded as the true mortality probabilities.

These rules make it relatively simple to calculate a single premium rate. We start with 10,000 policyholders aged 40. According to the mortality table, 8,734 are expected to be alive at age 60, when the policies mature. They are each entitled to a benefit of 100 units. The value of a unit depends on the development of the invested funds, but the minimum guaranteed benefit is € 100. Hence, the sum of the amounts to be paid on maturity is € 873,400. Since the minimum guarantee is based on an interest rate of 2%, the company levies a total amount from the policyholders of roughly € 587,800. Divided by 10,000 policyholders, this gives a premium rate of € 58.78. An actuarial textbook will show this in a much more generalised and sophisticated way, but this is the general idea. The remainder of this section is devoted to:

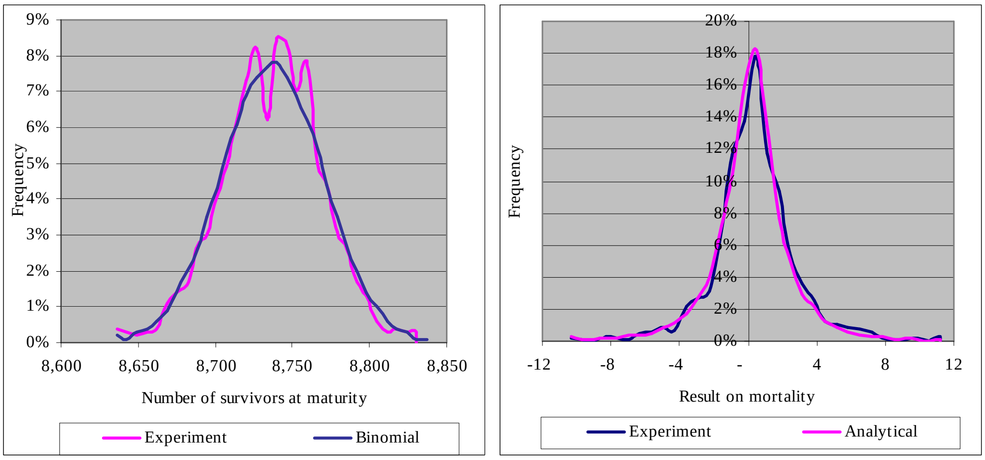
- Mortality results
- Expense results
- Impact of the guarantee
- Volatility and the relationship to the economic capital required.

I developed the example described above using a simulation program that is described in Appendix 4-I. As far as possible without going too deep into financial mathematics, the simulation results have been validated by analytical methods that are explained in the same appendix. The graphs shown in the remainder of this section represent continuous distributions in some cases and discrete distributions or the frequency distribution of the simulation results in others. For presentation reasons, they are shown as continuous lines. The numbers on an x-axis represent the lower bound of the class for which the frequency or probability is presented. Amounts are shown in thousands of monetary units.

### *4.1.1 Mortality results*

If we simulate 1,000 "realities" (the experiment), the average number of people alive at maturity is 8,734. Figure 4-2 shows the distribution of the survivors at maturity and the mortality results realised over the total period. "Experiment" outcome is the frequency of results from the simulation. In the left-hand graph, the frequency distribution from the simulation is compared with a binomial distribution for a cohort of 10,000 policyholders and a survival rate of 0.8734. If we consider the 95% interval (around the mean), the lower bound is 8,672 survivors and the upper bound 8,787, with a range of 1.3%. Although this is a small range, it shows that there is a non-zero probability that the company will make a loss.

**Figure 4-2: Distribution of survivors at maturity and mortality results**




The present value of this loss is shown at the x-axis of the right-hand graph in Figure 4-2. The "Analytical" line has been derived from a mixed distribution of the number of survivors and the benefit per survivor. This is explained further in Appendix 4-I. The variance is relatively low, because all policies in the example have the same value. Should there be a high variability in the sums insured, the variance would be substantially greater. The 99% lower bound is about € -8,000. This means that the company needs a surplus of € 8,000 to be 99% certain that it can meet its commitments, not taking into account the other risks. This is also addressed in section 4.2.

**Figure 4-3: Developments in observed mortality**

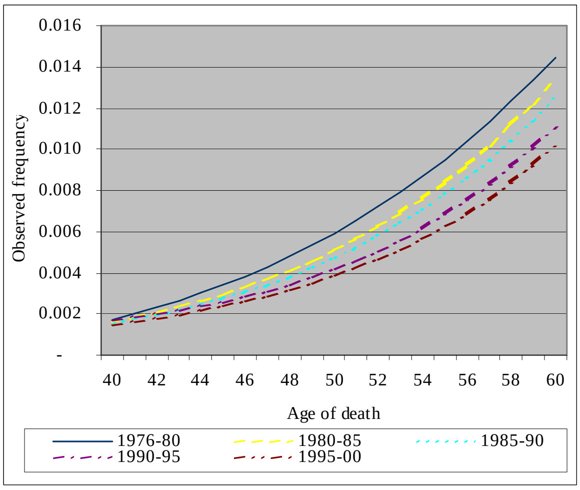



Figure 4-3 reveals a complication. For the calculation of the premium rate, we used the 1976/1980 mortality table. The deaths recorded according to this table have already taken place. Remember that historical patterns repeat in the future, but with a certain (often unknown) degree of imperfection. Survival probabilities have improved over time. For example, according to the 1976/1980 table, the frequency of people dying during their 42nd year of age is 0.0023. The 1980/1985 table shows a frequency of 0.0021, 1985/1990 0.0020, 1990/1995 0.0020 and 1995/2000 0.0018. Table 4-1 shows the number of survivors on maturity based on the various mortality tables. The last column, "Adjusted", gives the expected number if the deaths in the first five years occur according to the 1980/1985 table, in the second five years according to the 1995/1990 table, etc. In other words, it is the realistic mortality experience for policies that were taken out in 1980 and matured in 1999.

**Table 4-1: Expected survivors according to various tables**

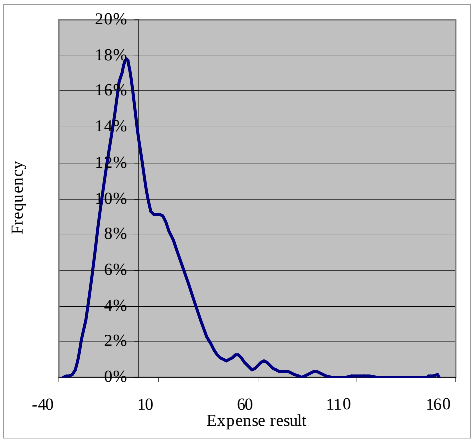
| 1976/1980 | 1980/1985 | 1985/1990 | 1990/1995 | 1995/2000 | Adjusted |
|---|---|---|---|---|---|
| 8,734 | 8,877 | 8,956 | 9,067 | 9,147 | 9,085 |

The difference between the adjusted survival rate and the survival rate based on the 1976/1980 table (used for the premium rate) is 4%. With hindsight, over the total lifetime of the policy, this effect is easily seen. From year to year, it is a challenge to distinguish structural changes from incidental ones. For example, in year 3 there are 21 deaths (frequency 0.0021). Using a binomial distribution, we can calculate a 95% confidence level for the "real" death fractions. The confidence bounds are 0.00141 and 0.00302. The death fractions according to the tables under consideration vary from 0.0018 to 0.0023. In other words, the mortality experience does not give significant information at this time that mortality is improving. Now suppose that in year 16 there are 63 deaths. The corresponding 95% confidence bounds are 0.00506 and 0.00776. This would provide significant evidence that the original table, which indicates a death fraction of 0.00951, is no longer applicable and that the estimated future benefits are understated. In order to both discover trends in mortality and revise estimates in good time, a combination of qualitative and quantitative information is used in practice.

### *4.1.2 Expense results*

Figure 4-4 shows the distribution of the expense results (withdrawal of the loading from the fund less the real expenses) of the 1,000 rounds in the experiment.

**Figure 4-4: Distribution results on expenses**




As can be expected, the average is close to zero. Each year, the expense loading is a percentage of the value of the investment fund and the expenses represent a fixed amount. If the fund developed according to the risk-free interest rate, the loadings would be just enough to cover the expenses. Consequently, the expected value of the margin is zero.

The 1% minimum bound of the distribution shown is about € -30,000 (only 10 rounds in the experiment showed a lower margin).

In the real world, not only are expense loadings uncertain, but expenses themselves do not exactly obey the assumptions used when calculating the premium rate. Efficiency results, inflation, occupational results (less policies are sold, so less coverage for fixed expenses), developments in information technology, changes in the structure of a company, etc. may influence expenses actually incurred and the effect may be severe over the total lifetime of a life insurance policy. This is discussed further in section 4.5.2.

### 4.1.3 *Impact of the guarantee*

The company has guaranteed that the policyholder, if alive on maturity, receives a minimum benefit, irrespective of the value of the investments at that time.

**Table 4-2: Investment of premiums received**

| | |
|---|---|
| Total premiums received. | 587,751 |
| Deducted for acquisition costs (2%) | 11,755 |
| Amount invested | 575,996 |
| Present value of the expected annual deduction for maintenance costs | 54,944 |
| Net initial value for policyholders | 521,052 |

Table 4-2 shows the allocation of total premiums received. 2% is deducted up front to cover acquisition costs (agent commissions, cost of preparing the policy, etc.). This leaves an amount of € 575,996 to be invested. Investment takes place (according to the policy conditions) in an instrument with volatility (i.e. standard deviation of the annual return as a percentage of the annual return) of 15%[31]. A fee of 0.5% is withdrawn annually from the fund in order to cover the enterprise's expenses. The present value of all annual fees using the risk-free rate amounts to € 54,944, so the net initial value for the policyholders is € 521,052.

We assume that the value of the investments develops in according with Brownian motion. This is further explained in Appendix 4-I, but in layman's language, the idea is that the net period change of the investment fund equals the real risk-free interest rate plus or minus a combination of a random factor and the volatility. In other words, the expected value of the return is always the real risk-free interest, but the range of probable changes depends on the volatility. Note that the expected return is the risk-free return and not the "real world" expected return, which would most probably include a risk premium to reflect the risk aversion of most investors. The approach is appropriate, because the purchase price of the instrument to be invested in already reflects the associated risk. The yield guaranteed to the policyholder has been expressed as a fraction of the risk-free interest rate. Consequently, the calculated premium and thus the funds initially invested have a risk-free dimension.

**Figure 4-5: Cost of guarantee**

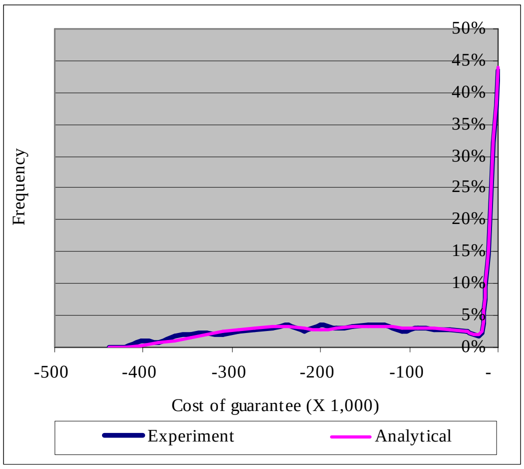



Figure 4-5 shows the frequency distribution of the cost of the guarantee for the company, i.e. the difference between the value of the investment fund on maturity and the guaranteed amount for those cases where the investment value is

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31 This is close to the average volatility of the investment funds monitored by Morning Star, which vary from cash funds to emerging market, technology and other funds with a high risk profile. At 9 July 2004, the 4,501 funds monitored by them showed an average three-year standard deviation of 16.67%.

lower. The distribution is one-sided: the losses are for the insurance company; the surpluses over the guaranteed value are for the policyholder. Hence, we have about 550 cases with a loss for the company and 450 cases with a value of zero for the company, which is the mass shown on the right-hand side of the graph. The average discounted value of all those cases is € -111,000, so the transactions under review are potentially unfavourable to the company. In order to make it a "fair bet", the total premium should be increased by € 111,000 or 19%.

Given the choice of the model, there is an easier way to calculate this amount. Consider the minimum guarantee as a put option given to the policyholder. The policyholder, assuming that he is alive on the maturity date, can be regarded as the owner of a number of investment units. On the maturity date, he has the option to sell these units at a certain strike price (the guaranteed value). The premium for such a European put option can easily be calculated using the Black & Scholes model for option pricing (Hull, 2003, p. 246; see also Appendix 3-I).

$$p = Ee^{-rT} N(-d_2) - SN(-d_1)$$

Where:

$$d_1 = \frac{\ln\left(\frac{S}{E}\right) + \left(\frac{r + \sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

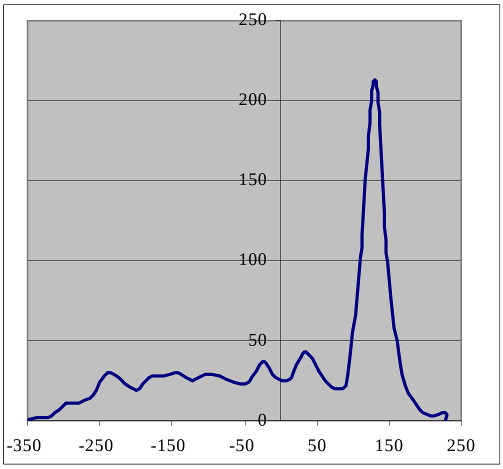
- E = Strike price, the guaranteed value of 100 per policyholder in the example.
- S = Spot price of the investment. Refer to Table 4-2. Taking into account the expected discounted value of the annual deductions for maintenance costs, the spot value of the investment on behalf of the policyholders is € 52 per policyholder.
- σ = Volatility of the annual yield.
- T = Lifetime of the option
- N(x) is the cumulative probability distribution function for a standardised normal distribution.

This formula gives a rounded premium of € 111,000, which is equal to the expected loss according to the simulation model. This is not surprising, as the model uses the same approach that underpins the Black & Scholes model.

## 4.2 Total results and required economic capital

In chapter 2 we saw that uncertainty relating to future cash flows implies uncertainty that an enterprise can meet its commitments to creditors (in this case policyholders). By holding an amount of economic capital, the enterprise controls the risk of not meeting its commitments. This holds for all types of enterprises, but is specifically regulated for the financial industry. Insurance supervisors, such as in Europe, often still have standardised formulas to calculate the required solvency (percentage of technical provisions, percentage of assets by class, etc.), but many of them are in the process of developing methods and models where the required solvency is more explicitly responsive to risks and related to value and volatility[32]. This section seeks the pure economic capital as the amount needed to provide x% (in the example 99%) certainty that all commitments can be met. In the example, I measure the probability of meeting all future commitments until complete run off of the business. The present solvency requirements that are responsive to risks ad related to value and volatility (such as the Integrated Prudential Source Book in the UK) often stipulate a one year's Surplus at Risk. The philosophy behind this is that there should be enough funds to meet all commitments during the next year and to transfer all liabilities or hedge all risks at the end of that year. This is a practical solution to setting economic capital requirements and meets a specific requirement of the regulators, i.e. that they can enforce the move to a matched situation and hence protect policyholders' interests, if developments are detrimental. Hare et al. (2005, p. 257) state in this respect:

**Figure 4-6: Total results from experiments**




To continue trading, … a company might need to raise capital, but, if it chose not to do, the regulator could act to protect policyholders. This implies that the definition of basic solvency, the calculation of capital requirements and whatever regulatory actions are available, all need to be internally consistent.

A run-off approach may not have this quality automatically, as a funding valuation does not give the regulator enough assets to do anything useful. A company which was solvent on a funding basis, but failed a capital test based on a full run off, might not have enough assets to implement a hedge without further capital injections, nor, by definition would it be considered strong enough to continue operating un-hedged.

Figure 4-6 shows the distribution of the total results of the simulation rounds, assuming that the cost of the guarantee at inception is charged to the policyholder. These results are the total of results on mortality, expenses, cost of the guarantee and the additional put-option premium income related to the guarantee.

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32 Examples are the Integrated Prudential Source Book in the UK (already implemented), the Solvency II initiative by the European Union and the *Financieel Toetsingskader* in the Netherlands (both scheduled for implementation).

The weighted-average result is close to zero, which can be expected because the experiment has been designed as a "fair bet". The different sources of profit and loss are mutually interrelated. The development of the funds invested influence the results on expenses. The mortality experience leads to changes in the expected number of investment units to be paid on maturity. Consequently, it influences the amount of funds invested and thus the results on expenses.

The frequency of negative results reflects the probability that the company will not be able to fully meet its commitments. Insurance supervisors try to reduce this risk to a theoretical level by demanding minimum levels for solvency. Suppose that the risk that the company cannot fully meet its commitments was to be reduced to 1% (10 out of 1,000 simulation rounds), the company would need a buffer of € 310,000 (i.e. the 1% lower bound of the distribution in Figure 4-6, or the best of the 10 worst scenarios from the simulation). The lower bounds from the separate sources of profit are € -8,000 for mortality, € -315,000 for the guarantee and € -30,000 for expenses. Given the interaction between those sources, the combined lower bound is € -310,000. Mortality results and expense results in particular are negatively correlated. If, in the extreme case, all policyholders die, there will be a large mortality profit, but no funds left to withdraw fees; if, in the other extreme case, all policyholders survive, there will be a loss on mortality, but more funds left to withdraw management fees, resulting in a profit on expenses.

The required buffer in the example can be created in two ways:

- By increasing the premium by € 310,000. This would create a situation in which the company could meet its contractual commitments in virtually all cases. For the surplus that is still available after meeting the contractual commitment, the policyholder receives a "discretionary participation right". This is the approach that descends from the ancient tontines described in section 2.5. It is used by mutual insurance companies and for with profit funds.
- By attracting share capital of € 310,000. In this case, the shareholder receives on maturity the value of all assets after extinction of all liabilities.

The second approach introduces a complication. Paying in capital of € 310,000 gives the new shareholder a future benefit between zero and a large amount. The expected (weighted average) discounted value, however, is € 310,000. In other words, the shareholder is asked to exchange a risk-free investment for a non-risk-free one with the same expected return, which may be a fair bet, but is not perceived as a fair deal. A risk-averse investor will give a higher weight to the loss chances and will probably value a non-risk-free investment of € 310,000 at a lower amount, say € 132,000. In other words, an additional amount of € 178,000 has to be made available in order to "bridge" the difference between a risk-free investment and a non-risk-free one. This additional amount is known as the "cost of solvency" and has to be included as an additional margin in the premium rate. The total premium to be charged to the 10,000 policyholders is summarised in Table 4-3.

**Table 4-3: Total premium to be charged**

| | |
|---|---|
| Deterministic single premium | 587,751 |
| Put option premium | 111,574 |
| Cost of solvency | 178,000 |
| Total premium | 877,261 |

The total premium shown in this table correctly reflects the price for being at risk. For the shareholder, this price means that the expected return on his investment is not 3% (the risk-free rate) but 7.5%. In this example, this has been derived by assigning an investor's utility weight to the probability of each outcome, thereby giving unfavourable outcomes a heavier weight than favourable ones. This leads to a risk premium of 4.5%. In practice, it is more common to derive such risk premiums from observed market yields. Reference is made in this context to appendix 3-I.

The cost of solvency as calculated above amounts to 20% of the total premium. The reason for this high proportion is that the enterprise gave a guarantee to the policyholder for which it stands outright at risk. The experiment described in section 4.1 has been repeated for a situation where the guarantee has been hedged. The hedge consists of taking a short position in the unit-linked fund for a factor Δ. This factor eliminates the risk of the guarantee, given the fair value of the fund at that time (see to Hull, 3003, p. 210). A change in the fair value of the underlying assets and the elapse of time result in a different Δ. In the example, the hedge position is realigned monthly[33].

**Figure 4-7: Distribution total results**

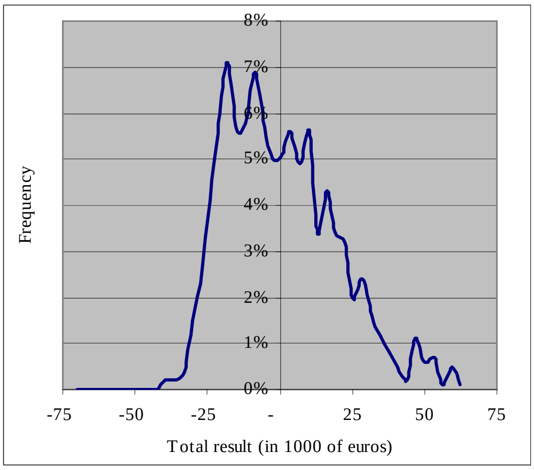



Figure 4-7 shows the distribution of the total results from the simulation model, given the hedging strategy described above. In this situation, capital of € 34,000 would be required to meet all commitments at a 99% confidence level (this is the best of the 10 worst scenarios from the simulation). This would considerably reduce the required premium as compared with Table 4-3.

**Table 4-4: Required premium for a given delta hedge**

| | |
|---|---|
| Premium per unit | 587,751 |
| Option value per unit | 111,510 |
| Cost of solvency | 20,000 |
| Total premium | 719,261 |

33 In the relatively simple example under discussion, it would be possible to eliminate virtually all risk by including the expense loadings in the delta hedge and by assuming a continuous realignment of the portfolio to the changed delta factor, or by purchasing a derivative. This reflects one of the principles behind market-consistent valuation: look for the price of the instrument that converts uncertain future cash flows into risk-free cash flows. In real life, however, insurance contracts contain elements (maintenance expenses, policyholders' lapses and surrenders, longevity) for which no deep markets are available for hedging or transfer risk. Hence, an example that leaves a net volatility for which a certain solvency level has to be maintained is realistic.

Note, however, that the cost of the guarantee itself remains the same irrespective of whether it is hedged or not. This is explained by the option theory where the cost of an option is determined by the cost of a delta hedge (Hull, 2003, p. 302).

Furthermore, the synthetic hedge strategy as described above works in normal market conditions. However, in rare situations (such as October 1987) it does not, because market movements are then so extreme that the realignment of the $\Delta$ factor cannot be effected in time.

## 4.3 Real world scenarios

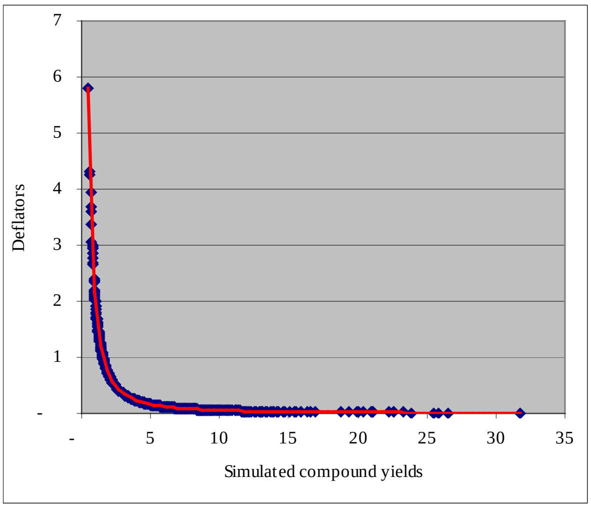
The simulation experiment described in the previous sections takes place in a world that does not exist, i.e. the risk-free world. There is a good reason for using this when estimating the value of derivatives on assets that have a quotation on an efficient market. Consider an investment in equities of € 1,000 and an investment in bonds of € 1,000. The first has an expected yield of 8% and the second of 4%. Yet they have the same market price, because the market aligned these prices to the risk/return preference of investors. The cash flow that is involved in exercising an option at a future time will also be realigned to investors' risk/return preferences. Consequently, as long as one stays within the world of market-quoted assets and their derivatives, one can easily perform cash flow projections using a risk-free and arbitrage-free interest rate and use the same rate for discounting. This makes calculations a lot easier.

However, in the real world, real cash flows are realised. These cash flows cannot be compared with projections from a risk-free world. Comparison of experience with assumption is often an important instrument for controlling the business, validating earlier projections and calibrating future projections. What is worse, not all cash flows originate from sources (assets or liabilities) that have a quotation on an efficient market. So somewhere in the planning and control cycle of an (insurance) enterprise, the real world clashes with the risk-free world when the cost of embedded options and guarantees are estimated.

In the real world, expected future cash flows are the starting point. The value of an asset is estimated by discounting these cash flows, using a discount rate that includes a risk surcharge (see chapter 3).

In the risk-free world, cash flows are remeasured to their risk-free equivalent and subsequently discounted at the risk-free rate. Both methods give the same answer for the value of the underlying asset, provided that the market price of risk (see Appendix 4-I) is treated in a proper way. Where the valuation of guarantees and options (embedded in insurance or other products) is involved, this is considerably more complicated than just applying a surcharge to the discount rate. Appendix 4-I gives a very high-level description of the gate between the risk-free world and our daily life of real cash flows, as well as the keys that fit the lock. In the language of an accountant, the following process is going on. Based on the model and the parameters chosen, a large number (in our example 1,000) of possible future cash flows are simulated.

**Figure 4-8: Fixed relation between deflator and simulated drift**



Each simulated cash flow is discounted by the deflator that is consistent with the specific outcome of the underlying random process. The weighted average of these discounted cash flows is equal to the weighted average from an equivalent simulation in the risk-free environment. Figure 4-8 shows the relationship between the drift resulting from each simulation round (in the example based on a real expected return of 8% in relation to a risk-free rate of 3%) and the related deflator. The higher the simulated drift, the lower the deflator that "compensates" the simulated drift. (The background to the relationship between drift and deflator is explained in Appendix 4-I.)

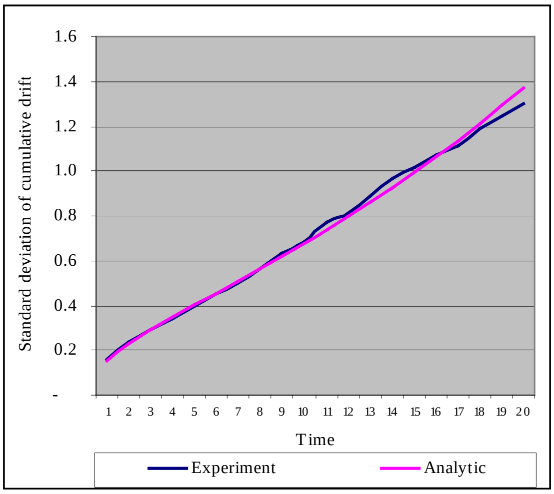
As explained further in Appendix 4-I, I used the Black-Scholes deflator, which is about the simplest deflator. This deflator can be used in a situation where uncertainty is modelled around future values of equity assets. When interest rate risk, or risk relating to other economic parameters, is modelled, the mathematics soon become agonising for the layman and are way beyond the scope of this study. It is important to know that technical solutions exist to seamlessly join the real world, where cash flows are experienced, to the risk-neutral world, where guarantees and options are valued. Hare et al. (2005, p. 247) state in this respect:

> For the deflator approach, any stochastic model can be used, although usually, a real world model is used, and a set of discount factors, the deflators, is produced to calibrate the model to the market. If a realistic model is used, then the mean returns will reflect the different risk premiums for different asset classes, with the spread of projected returns for each asset class reflecting their volatility (the risk neutral model is a special example of the deflator approach, with the risk-free rates as the deflators).

## 4.4 Volatility of the investment return and time

It is a common feeling that volatility decreases over time because time smoothes incidental peaks and surges in market prices. The findings from the experiment described in the previous sections of this chapter show the contrary to this feeling. Figure 4-9 shows the standard deviation of all simulated developments in the asset value (drift) per year. It compares the simulated numbers to the analytical development as explained in Appendix 4-I. This suggests that the volatility (and thus the economic capital requirement) of outright guarantees embedded in insurance products increases over time and may be severe for the typical lifetimes of policies (often 20 years or longer).

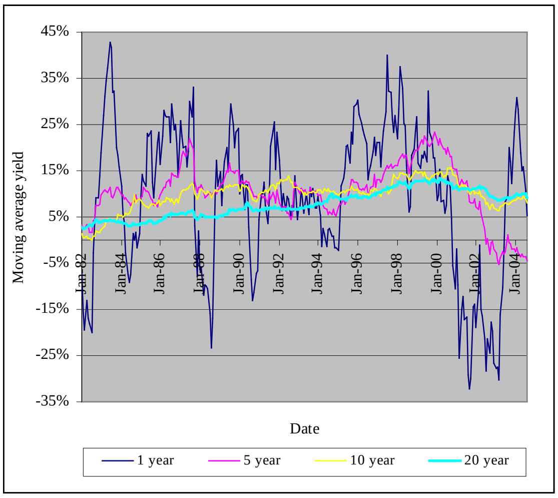
**Figure 4-9: Standard deviation of the drift**




The figure "contradicts" Figure 4-10, which shows the annual average yield and the five-year and ten-year moving average yields for the period January 1982 to August 2004.

The yield pattern from year to year is erratic, whilst the five-year moving average shows a more smooth line. The 10-year and 20-year moving averages are even smoother and show a return that is, in most periods, superior to the yield on long-term government bonds. In other words, if for policies maturing in the period 1982 to 2003 policyholders had been promised the highest of the risk-free return and the 20-year moving average of the S&P index and their premiums had been invested in S&P 500 stocks, this guarantee would only have come into the money in a limited number of cases (less than 0.5%). At first sight, one might conclude that there is a mean reverting power behind the development of share prices.

**Figure 4-10: Development annual yields S&P 500 index**




The commonly held opinion is that stock returns move independently from the historical development of stock prices. If history were to play a role in establishing future returns, technical analysts could make above-average returns by interpreting historical charts. There is little evidence that they are in fact able to do this consistently (Hull, 2003, p. 217). On the other hand, Siegel (1998, p. 32) makes two observations:

- The volatility, i.e. the standard deviation of the average returns is expected to decrease for longer holding periods according to the square root of the length of the holding period.
- Historical evidence (stock returns for the period 1802 to 1996) shows that the standard deviation falls faster than the rule described in the first bullet, which Siegel sees as a manifestation of the mean reverting power of equity returns.

So what is the secret behind the paradox of the increasing volatility and the smoothing patterns as time elapses? In my opinion, it is in the proposition to the policyholder. In the example used in the previous sections, investment funds are allocated to a certain policyholder. He is entitled to the value of these funds and has the option to put them if the value on maturity falls below a certain strike price. Hence, the investment units are isolated for the benefit of the policyholder. Even if there is initially the benefit of holding shares for the long-term, volatility will increase as the policy approaches maturity and the underlying assets have to be divested. In order to give a policyholder a moving average rate, it is necessary to share returns between generations of policyholders. If in year 1 the fund's return exceeds the moving average of that year and the (nine) preceding years, the excess is shared with policyholders of previous generations. If on the other hand the fund's return is less than the moving average, the policyholder is "subsidised" by policyholders of earlier generations. To do this, the enterprise must have the discretion to withhold some of the investment returns in order to provide such a "subsidy". This is in essence how the traditional with-profit funds in the UK work: the greater part of the surpluses generated is for policyholders, but the time of vesting and the allocation to policyholders (subject to specific rules laid down in the Principles and Practices of Financial Management) is at the discretion of the enterprise.

The discretion of the enterprise to smooth returns over generations of policyholders reduces the cost of guarantees (because the guarantees may be set off against surpluses that are realised but not yet vested) and the cost of shareholders' solvency (because the unallocated surpluses, or the Fund for Future Appropriation, serves as solvency capital until policyholders' rights are vested). It is a type of a joint venture model in which shareholders and various generations of policyholders share risks and returns during a certain period.

## 4.5 Dilemmas in allocating results to financial reporting periods

The previous section addressed the calculation of a premium rate under the circumstances and assumptions described. On maturity, all policyholders who are still alive receive a benefit that depends on the development of the funds invested, but with a guaranteed minimum. Shareholders pay in a minimum economic capital that ensures that the policy conditions can be fully met with 99% confidence. The shareholder receives an amount in return that varies from zero to a high amount, but the expected value of his yield is 7.5%, which is, in this case, the risk-free interest increased by a risk margin of 4.5%.

Hence, the beginning (the inception of the policy) and the end (settlement of the policy and payment to the shareholder) are clear. On maturity of the policies, the company knows exactly what the shareholder has earned (the results according to lifetime profit).

This section addresses the problem of allocating results to financial reporting periods. First, an analysis is presented based on an example that is "frozen" to a deterministic situation. Next, the influence of volatility is discussed. Finally, the core competence of a life insurance company is dealt with in relation to the question of allocating results to accounting periods.

### *4.5.1 Profit recognition in deterministic models*

For the purposes of this section, the example used in section 4.1 has been "frozen", i.e. the mortality pattern and the future yield develop exactly according to the assumptions, with no volatility. Since there is no volatility, the put option of the policyholder has no value and is not taken into consideration. However, the required economic capital and the additional risk margin on it as modelled in section 4.1 have been taken into consideration.

**Table 4-5: Development balance sheets and profit and loss accounts for deterministic model**[34]

| | Opening | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Investments | 881 | 905 | 929 | 954 | 979 | 1,005 | 1,032 | 1,060 | …….. | 1,456 | |
| Equity | 130 | 139 | 150 | 161 | 173 | 186 | 200 | 215 | ……. | 512 | |
| Technical provision | 751 | 765 | 779 | 792 | 806 | 819 | 832 | 845 | ……. | 943 | |
| | 881 | 905 | 929 | 954 | 979 | 1,005 | 1,032 | 1,060 | ……. | 1,456 | |
| Release margin | | 6 | 6 | 7 | 7 | 8 | 8 | 9 | ……. | 21 | 23 |
| Interest Equity | | 4 | 4 | 4 | 5 | 5 | 6 | 6 | ……. | 14 | 15 |
| Net profit | | 10 | 10 | 11 | 12 | 13 | 14 | 15 | ……. | 36 | 38 |
| Opening equity | | 130 | 139 | 150 | 161 | 173 | 186 | 200 | ……. | 477 | 512 |
| Closing equity | | (139) | (150) | (161) | (173) | (186) | (200) | (215) | ……. | (512) | |
| Shareholder cash flow | | - | - | - | - | - | - | - | ……. | - | 551 |

The opening value of the technical provision represents the premium received, including a margin that is sufficient to make the shareholders' equity increase by the required 7.5%.

The market value of the shareholders' equity can be calculated as the discounted value of the discounted distributable earnings (DDE). The distributable earnings include the risk-free rate on the required solvency (note that the required solvency was based on the lower bound of

34 Due to rounding, the figures shown might not add up correctly.

discounted cash flows; see section 4.2). This can be generalised using the analysis of L. Girard (2000, page 6). For reference, I use the same symbols as Girard. Although they are mathematically not fully sound, they are easier to understand for most readers. I have simplified the formulas somewhat by ignoring corporate income tax. Hence:

$$DDE = \sum_{t=0}^{T} \frac{I_t - \Delta RS_t}{(1+k)^t}$$

| | |
|---|---|
| DDE | = Discounted Distributable Earnings |
| t | = year |
| $I_t$ | = Result in year t |
| RS | = Required solvency |
| $DRS_t$ | =Change in required surplus during year t |
| k | = Required yield by the shareholder |
| T | = Total term of the projection |
| MVA | = Market Value Assets |
| MVL | = Market Value Liabilities |
| $MVL_t$ | = MVL at the end of year t |
| $L_t$ | = Benefit less premium cash flows |
| $E_t$ | = Expense cash flows |
| r | = Risk free rate |
| s | = Risk spread attached to the liability |
| $s_t$ | = s applicable in year t |
| $RP_t$ | = Required profit in year t |

In the example, this market value equals the book value in each year, which is not surprising because the margins in the premium are set exactly to an amount that gives the shareholder the required return. In a situation where all markets (for equity investments, insurance, etc.) were transparent, this equality would be true. Girard (2000, page 4) calls the estimation of the discounted distributable earnings the Actuarial Appraisal Method. He describes how in a transparent market this method gives the same result as the option-pricing method, where the market value of assets and insurance liabilities are calculated directly. To make this true, the following equality needs to be true:

$$DDE = RS + MVA - MVL$$ [35]

According to the option-pricing model, the market value of the liabilities can be calculated as follows (Girard, 2000, page 5).

$$MVL = \sum_{t=0}^{T} \frac{L_t + E_t}{(1+r+s)^t}$$

The market value of the liabilities at time t-1 can be derived from those at time t:

$$MVL_{t-1} = \frac{MVL_t + L_t + E_t}{(1+r+s_t)}$$

If we were to use the risk-free rate as discount rate, we would need an additional required profit in order to get the same value. In this case:

$$MVL_{t-1} = \frac{MVL_t + L_t + E_t + RP_t}{(1+r)}$$

35 Girard includes the element of corporate income tax in his formulas. I take a short cut on this point, because it simplifies the formulas and tax does not add too much information to this section. Other simplifications are that the yield on assets has been "frozen" to the risk-free rate and that the yield on assets against the required surplus is assumed to be the risk-free rate.

| | |
|---|---|
| DDE | = Discounted Distributable Earnings |
| t | = year |
| $I_t$ | = Result in year t |
| RS | = Required solvency |
| $DRS_t$ | =Change in required surplus during year t |
| k | = Required yield by the shareholder |
| T | = Total term of the projection |
| MVA | = Market Value Assets |
| MVL | = Market Value Liabilities |
| $MVL_t$ | = MVL at the end of year t |
| $L_t$ | = Benefit less premium cash flows |
| $E_t$ | = Expense cash flows |
| r | = Risk free rate |
| s | = Risk spread attached to the liability |
| $s_t$ | = s applicable in year t |
| $RP_t$ | = Required profit in year t |

The required profit in our simplified model can be expressed as:

$$RP_t = (k - r)RS_{t-1}$$

From this, we can derive the value of the risk spread attached to the liability in any year ($s_t$) as follows:

$$s_t = \frac{(1+r)(r-k)RS_{t-1}}{MVL_t + L_t + E_t + (k-r)RS_{t-1}}$$

This equation can also be derived for situations where corporate income tax is payable and where the yield on assets is not equal to the risk-free yield. In this simplified example where the return on assets is equal to the risk-free return[36] and no taxation is assumed, the formula for $s_t$ gives a constant return on total assets for all years:

$$\frac{Equity_t}{Total\_assets_t}.k + \frac{Technical\_provisions_t}{Total\_assets_t}.(r + s_t) = r$$

The following important conclusions can be made:

- Actuarial appraisal and valuation of liabilities according to option pricing (or market-consistent valuation) lead to the same value of insurance contracts, provided that the parameters are selected consistently.
- If all markets are transparent (in other words, prices for capital given a certain risk level are the same as prices for insurance given a certain risk level) and other circumstances remain equal:
  - the recognition of a part of the margin embedded in premiums received, and:
  - the valuation of insurance liabilities including the margins relating to the remaining period;

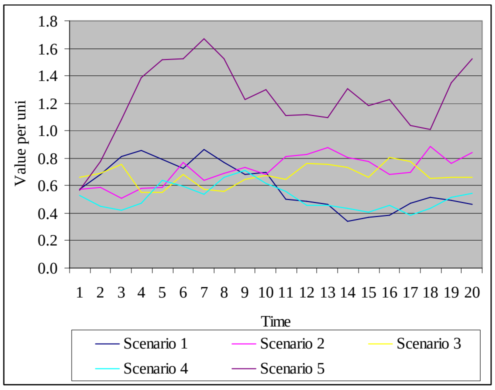
  result each year in a book value of the equity that equals the discounted value of distributable earnings. In other words, recognising margins in insurance contracts over time is consistent with the development of their value over time.

36 See section 4.3 for an explanation of how the risk-free world interrelates with the “real” world.

### *4.5.2 Profit patterns under uncertainty*

In the previous section, the situation was been "frozen" to the expected developments. The development in profits and values is attractive: the annual unlocking of margins results in a book value of equity that is always equal to the discounted value of future cash flows. With a large number of simulation rounds, the law of large numbers applies and the simulation averages will be close to the deterministic scenario. However, a company lives only in one scenario and deals with the lawlessness of one number. Figure 4-11 shows the development in the value of the investment fund according to five random scenarios. Although the average of a 1,000 random scenarios will converge to the model average, the individual scenarios can be erratic.

**Figure 4-11: Simulated values investment fund**




The foregoing gives rise to the following two questions with respect to the development in results and equity:

- How does the observed result develop in relation to the expected result?
- How do the observed developments affect the assumptions regarding the expected value of future cash flows and the volatility of this expected value?

Table 4-6 and Table 4-7 show a balance sheet and a profit and loss account for the first two years according to one simulated scenario that could have occurred.

**Table 4-6: Balance sheets according to one scenario**

| | Opening | 1 | 2 |
|---|---|---|---|
| Investments, risk-free instruments | 416,893 | 402,205 | 400,174 |
| Investment, fund | 575,996 | 623,340 | 634,679 |
| | 992,889 | 1,025,546 | 1,034,853 |
| Equity | 130,000 | 120,000 | 123,000 |
| *Technical provisions*: | | | |
| Policyholders' benefits | 751,315 | 798,084 | 808,391 |
| Guarantee | 111,574 | 107,462 | 103,462 |
| | 862,889 | 905,546 | 911,853 |
| | 992,889 | 1,025,546 | 1,034,853 |

**Table 4-7: Profit and loss accounts according to one scenario**

| | 1 | 2 |
|---|---|---|
| Expected profit margin | 5,836 | 6,273 |
| Mortality result | ( 312) | ( 128) |
| Expense result | - | 165 |
| Interest income on risk-free instruments | 12,507 | 12,066 |
| Change in fair-value guarantee | 4,112 | 4,000 |
| | 22,142 | 22,377 |
| Opening equity | 130,000 | 120,000 |
| Closing equity | ( 120,000) | ( 123,000) |
| Shareholder cash flow | 32,142 | 19,377 |

As in the previous section, it has been assumed that the premium received for the guaranteed benefit and the paid-in capital have been invested in risk-free financial instruments. The various sources of profit can be further explained as follows.

*Expected profit margin*
This is the profit that would arise if all assumptions were true. In fact, it is the difference between the premium and the "standard cost price" of the products sold. As explained above, this margin gives the shareholder the prospect of receiving the required yield of 7.5%.

*Mortality result*
This result arises because the actual number of survivors at the end of each year differs from the assumed number.

**Table 4-8: Mortality result**

| | 1 | 2 |
|---|---|---|
| Expected survivors | 9,983 | 9,968 |
| Actual survivors | 9,988 | 9,970 |
| | ( 5 ) | ( 2) |
| Impact on technical reserves | ( 312 ) | ( 128) |

Each year, the survivors are closer to receiving the benefit on maturity. This increases the expected value of the benefit. On the other hand, the rights of the deceased are forfeit. When the first effect exceeds the second (as is the case in Table 4-8), the mortality result is a loss.

The mortality result as presented above is based on factual observations (the deaths recorded in the life book under review). However, the impact of the observations on the future assumptions (Is it reasonable to assume that the future years will still develop according to the original assumptions?) has not been evaluated. In year 1, 12 men died in contrast to the assumption of 17.
A sample of 10,000 units with 12 deaths would (using a binomial distribution) have an upper bound of 19 and a lower bound of 7. In other words, the "sample result" (12) does not significantly "reject" the assumption (17). In the second year, 18 men died in contrast to an assumption of 20. A sample of 9,988 units with 18 deaths would (using a binomial distribution) result in an upper bound of 27 and a lower bound of 12. In this year, too, there is no "significant" difference from the assumed pattern. However, negative mortality results were observed for two consecutive years and this could weigh as evidence that mortality assumptions for the remaining lifetime of the contract should be adjusted.

*Expense result*
Table 4-9 shows the expense result from the example.

**Table 4-9: Expense result**

| | 2 |
|---|---|
| Higher investment fund value than assumed | 163 |
| More policies than assumed | 2 |
| | 165 |

This observation, together with demographic information and other qualitative information, might reveal a long-term trend in mortality caused by medical advances, changes in lifestyle, etc., or simply indicate that the mortality table used for the premium calculation does not apply to the group of policyholders. Section 4.1.1 demonstrates the importance of timely adjustment to the correct mortality assumptions.

The first profit driver relates to the value of the investment fund. In fact, the company put itself partly at risk regarding the investment yield. If the investment fund performs badly, the expenses are not fully recovered. This has little to do with the expense performance itself (efficiency and expense coverage).

The second profit driver relates to the number of policies in force. The higher the number of policies, the better the expense coverage is.

Table 4-9 shows numbers that relate to historical observations (expenses incurred and loadings realised). However, no assessment has been made as to whether future losses on expenses are likely to occur and what the impact on the estimate of future cash flows could be. It is useful to have a slightly closer look at expenses. The simplified model used here does not take into account two important drivers that commonly affect the expense result.

The first is the often-present option of the policyholder to surrender his policy (sometimes at fixed, guaranteed terms). Higher surrenders compared with the assumptions affect expense coverage adversely (there are less policies to serve than assumed).

The second relates to expense allocation and the strategic options relating to expenses. Broadly speaking, the expenses of an insurance company consist of distribution expenses, maintenance expenses, cost of asset management and overheads. Some of these expenses are variable, while others are fixed for a certain period. A proper expense allocation will eventually lead to a standard cost per policy. Apart from the success in achieving the proper business volume, cost control and the ability to exercise strategic options are important in order to balance expenses with the available loadings.

Exercising strategic options is closely related to the challenge of finding the drivers behind costs that are identified as overheads or fixed expenses, and learning why staff are present in the enterprise (Kaplan et al, 1991, page 234). This is especially important when, for example, the distribution of new policies surges or when a line of business closes. When such large changes in the structure of the business take place, the assumed cost per policy only remain valid if the company restructures to an expense level that is appropriate to the new scale of operations. In addition to the effect that such changes have on fixed assets (impairment), exercising a restructuring option is never free. Redundancy schemes for staff entail severance payments and long-term contracts have to be settled. In other words, several parties will exercise a put option towards the company. In a situation of uncertainty, such options have a value, even if they are out of the money. It is unusual to take such “real written options” explicitly into consideration when assessing a company’s liabilities. Financial reporting rules even proscribe this due to a lack of legal or constructive obligations. However, in determining a fundamental (or market consistent) value based on uncertain future cash flows, the value of such an option should be taken into account just as all other options.

*Development of the guarantee provision*

Table 4-10 shows the development of the guarantee provision according to the example. The provision is partly affected by the survival experience (see above), which increased the number of guaranteed units. The value of the guarantees would change over time, even if the investment fund developed according to the assumptions. Each year closer to maturity means one year's volatility less.

**Table 4-10: Development of the guarantee provision**

| | 1 | 2 |
|---|---|---|
| Opening value | 111,574 | 107,462 |
| *Change in value:* | | |
| Expected development of investment fund | ( 337) | ( 491) |
| Deviation in expected development of fund | ( 3,828) | ( 3,530) |
| | ( 4,166) | ( 4,021) |
| Change in expected number of guaranteed benefits | 54 | 21 |
| | 107,462 | 103,462 |

The change in value due to the deviation from the expected development of the investment fund is the balance between the net change in option value and all the other changes. The value of the guarantee at the end of each year is estimated on the basis of the Black & Scholes model. This assumes two major future developments:

- The future volatility is equal to the original model assumption, or that derived from recent historical observations or market quotations (implied volatility). This is not necessarily true.
- The value of the investment fund will develop randomly around the real risk-free rate with the value at the end of the financial year as a starting point. This represents the commonly held view on how share prices develop. However, the market value of a financial instrument is sometimes "out of line", but will revert to a specific mean at a certain speed. There is no reason to assume that for long-term arrangements mean reversion assumptions are worse than the Brownian motion assumption of the standard Black & Scholes model. Option values that are estimated using mean reversion techniques show lower fluctuations over time than values using the standard model.

The mortality results and expense results described above emerge from historically recorded events that may also have an impact on future estimates. The change in the guarantee provision as shown in Table 4-7 results from future estimates only. The historical observations that support the estimates (such as volatility, mean reversion factors, etc.) often come from outside the company's records.

*Equity*

In the example, the amount of paid-in capital is based on the restriction of the probability that the company cannot fully meet its contractual obligations to 1%. At the end of each year, the simulation is repeated using the results of the year. The yield on the investment fund in year 1 is more than 8%. This decreases the risk that the company has to make a payment under the terms of the guarantee, which not only decreases the value of the guarantee but also the amount held for solvency to back it. In year 2, the yield is less than 3%, so the risk that the company has to make a payment under the guarantee is somewhat higher again, which affects the amount required to be held for solvency, subject to the 1% restriction set. In other words, the free cash flow available to the shareholders has to be assessed from year to year by estimating the amount of economic capital required to cover the risks over the remaining lifetime of the contracts. If the amount of economic capital left were insufficient to provide a sufficiently high confidence level of meeting commitments, the supervisory agent might require additional capital to be supplied, or part or all of the risks to be hedged or transferred to a third party that has the required capital base. In such a situation, the valuation of the liabilities including the embedded options and guarantees ensure that there are sufficient funds to transfer the risks. In other words, the policyholders' rights are protected at the moment, but may not be over the total lifetime of the policy given the present capital base of the enterprise.

*Solvency adequacy in year 1*

As remarked in section 4.2, standard setters presently tend to base required solvency on Surplus at Risk with a one-year time horizon. Apart from simplification, the reasoning behind this is that at any time the enterprise has the option of transferring all risks out of its balance sheet at the market value at that time. In the example used in this section, the situation would be as summarised in Table 4-11 at the end of year 1 if at the end of that year (and, assuming for the sake of simplicity reasons, at no later time) the enterprise had the option to hedge or reinsure all or part of the risk.

**Table 4-11: Simulated results at the end of year 1**

| | |
|---|---|
| No equity left | 0% |
| Forced to transfer part of the risk exposure or attract new capital | 41% |
| Shareholder earns less than expected margin | 8% |
| Shareholder earns more than expected margin | 51% |
| | 100% |

Table 4-11 shows that the probability that the enterprise would be effectively in default (negative solvency and insufficient assets to back the market value of the liabilities) is negligible. However, the probability that the company would be forced to hedge or reinsure part of the risk exposure, because the 1% default tolerance for the next 19 years was exceeded, is 41%.

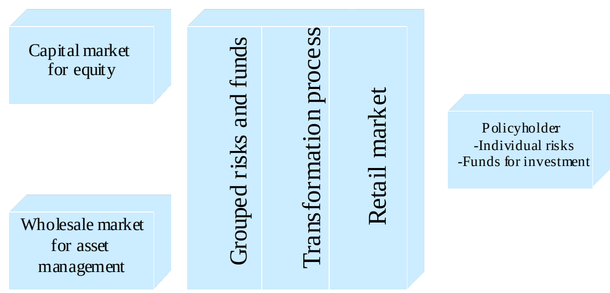
A one-year Surplus at Risk basis for required solvency normally leads to lower solvency requirements than an economic capital base that assumes the full risk exposure until extinguishment of all liabilities. It also assumes, however, that the enterprise has sufficient information to react instantaneously if and when the solvency position falls below certain warning levels and that there is an efficient market where the excess exposures can be hedged or reinsured directly.

### 4.6 What if not all markets are transparent?

One assumption used so far is that all markets are transparent. As a consequence, the weighted average return on equity and insurance liabilities is equal to the return on insurance assets. In that case, the cost of one of the important raw materials for life insurance, i.e. required economic capital, can easily be translated into a margin on insurance products, since all parties can look through all markets. But this transparency does not exist in real life**.** Figure 4-12 shows the highlights of the "manufacturing" process of a life insurance company. On one side is the policyholder with a risk that is individually unacceptable but can be borne when grouped. On the other side is the market for raising equity capital and for management of large funds (wholesale market for asset management). These markets cannot be accessed by individuals.

Many people consider a life insurance contract to be a financial instrument. In my opinion, life insurance is simply a product where the "raw materials" (required solvency capital, investments) are purchased on the relevant markets, assembled (diversification of risk) and sold on other markets. Service, including "standing at risk", is the principal product feature.

**Figure 4-12: Manufacturing process of a life insurance company**




This raises the question of how to treat the margins earned on a life insurance contract for financial reporting purposes. In the example with the transparency assumption (section 4.5.1), we saw that the margin that is required to cover the risk premium in the cost of capital should be released gradually over the lifetime of the contract. If this margin were released directly, the present value of expected future net cash flows would sink below the book value of the equity (or the fair value at which liabilities can be settled would exceed the book value of those liabilities), which intuitively can be considered unacceptable. Releasing the margin according to the correct pattern to the profit and loss account results in a book value of equity that is equal each year to the present value of expected future cash flows from the existing life book, often called *embedded value*.

If there is a margin in excess of the risk premium in the cost of capital, the company has created shareholder value. With respect to the recognition of this value, it is useful to revisit the realisation principle discussed in chapter 3. We saw that realisation of core transactions is a powerful principle in recording and explaining performance and explained performance is important in projecting value, or in adding credibility to value estimates.
Limperg's maxim "without trade no profit" has already been discussed in chapter 3. But an insurance contract is traded before delivery takes place. In such a case, Limperg's view is that "an empty trade does not create income", while income emerges consistently with the creation of a product or service (Limperg, 1965, page 307). Applying such a principle would bring financial

reporting on life insurance contracts close to the revenue recognition that “regular” enterprises apply, i.e. based on the stage of completion.

In summary, we have encountered two methods for profit recognition. The first is recognition of the total shareholder value *achieved* at time of sale, which would display embedded value in the balance sheet[37]. Embedded value is considered attractive because it is often the basis for purchase and sales transactions of books of life insurance contracts.

The second is the traditional “stage of completion”, similar to the method used by most enterprises that deal with the fulfilment of a contractual commitment over a long period. This method usually measures profit consistently in step with the *realisation* of an enterprise’s core activity. This helps to record and explain performance, and is thus value-relevant because it adds credibility to estimates of achieved value: *realisation* is the proof of *achievement*. In the next chapter, the application in practice of both embedded value and “stage of completion” is discussed.

37 There have been many discussions about the calculation of embedded value and the calculation of the fair value of insurance liabilities. Although the methods of calculation differ, the example of Girard shows that both lead to the same answer if the parameters are chosen correctly.

## 4.7 Summary and conclusions

This chapter shows by means of a very simplified example the main issues relating to the value and volatility of a life insurance enterprise. The example demonstrates the impact of giving guaranteed benefits to policyholders at the risk of the shareholders' funds.

The case actually covers two types of example. The first concerns a guarantee on mortality: if more people are alive on the date of maturity, the enterprise pays the extra benefits at its own expense. If fewer people are alive then, the enterprise pays fewer benefits and has made a profit for the shareholder. In order to meet this commitment, the enterprise needs economic capital and the provider of this capital requires a risk premium. Consequently, the cost of solvency is related to this guarantee.

The second concerns a minimum guaranteed return. Apart from the cost of solvency, this guarantee has a cost price. The reason for this is that the proposition as regards this guarantee is asymmetric: all the favourable outcomes are for the benefit of policyholders and all the unfavourable are for the shareholder. The cost price of such a guarantee is somewhat abstract (similar to the average family with its 2.7 children), but an enterprise granting this type of guarantees is likely to incur a loss in real life.

The example demonstrates that the cost of such guarantees and the required economic capital (and thus the cost of solvency) could both be severe. Hedge strategies might reduce the required economic capital, but not the cost of the guarantee. This needs to be factored into the premium calculation in order to prevent an expected loss for the enterprise.

Economic capital is required to give the policyholder reasonable certainty that all commitments will be met. This capital has a cost, which needs to be included in the cost price of an insurance product. If not, the shareholder will not receive the return he requires and the enterprise will not be in a position to attract the required capital.

In a simple example such as the one presented in this chapter, it would be possible to define a hedge strategy that at any time after the issuance of the contract would eliminate virtually all volatility from future cash flows and thus the need for any economic capital. This is the basis for market-consistent valuation techniques. Not the cost of capital, but the fair value of all hedges that eliminate all future cash flow volatility are taken into account. However, such hedges do not exist, because a sufficiently deep market does not exist for every element in an insurance contract. Consequently, the fair value of a contract that would eliminate the risk (e.g. a reinsurance contract) should be assessed by a mark-to-model approach, with the cost of the capital that the assuming party would have to hold being one of the factors taken into consideration.

Unlike the commonly held assumption, the impact of volatility actually becomes greater as the period of time for which a guarantee is granted increases. Smoothing of this volatility should only take place if smoothing (investment) returns over generations of policyholders is possible at the discretion of the enterprise. Insurance products including a discretionary participation element are therefore less risky and require less economic capital than unit-linked products with a minimum guarantee or products with a fixed formula and/or fixed vesting profit share.

The typical standard cost price of an insurance product includes the "technical" cost (in the example: the maturity benefits), the cost of selling and maintenance, the cost of all guarantees and embedded options, and the cost of solvency attached to the product (which is a function of the risk related to the product and the market price of this risk).

In addition, in common with many other enterprises, an insurance enterprise adds shareholder value by selling products (so that it realises a margin above the full standard cost price described above), simply because it bridges the gap between the retail market, where policyholders buy, and the wholesale markets. The usual practice is to recognise such a margin over the period the services are rendered (in this case: the enterprise stands at risk) and there is no reason for a different treatment in the case of an insurance enterprise.

## Appendix 4-I: Description of the model and the simulation used in the example

The features of the life insurance product used in the example are described in section 4.1. The contract period for this product is 20 years and the number of contracts is 10,000. The assumption is that the contract holders are all aged 40. Hence, on maturity, the surviving contract holders are 60 years old. The results on these contracts are simulated using two stochastic processes, i.e.

- Mortality.
- Development of the value of the investment fund.

The expense result is defined as the fee withdrawn from the investment fund less the expenses. The expenses are assumed to be fixed in the example, while the fee is a percentage (0.5%) of the value of the investment fund at the beginning of each year. The value of the investment fund is the value per unit times the number of survivors at the beginning of each year times 100 (see equations below). Consequently, the fee income depends on the mortality and the value-development process. The variables below are relevant to the processes under consideration.

For $t \in [0, T]$, which is the contract period with a length of 20 years, let

$N_t$ = number of survivors at time t.
$U_t$ = number of investment units to be allocated to each policyholder at time t. Here:

$$U_t = 100P(T \mid t) \text{ and}$$
$$U_T = 100$$

where

P(T|t) = the probability that a policyholder will be alive at time T (20 in the example, when the policyholder has reached the age 60) given he is alive at time t.
$M_t$ = the total number of units allocated to policyholders at time t:

$$M_t = N_t \times U_t$$

$S_t$ = value per unit.
$M_t$ $S_t$ = total fund value for the account of policyholders at time t.

***Mortality***

According to the mortality table used, 8,734 men out of $N_0$ =10,000 are expected to be alive at T = 20 (maturity). $U_0$ = 87.34, i.e. at inception, each policyholder has 87.34 units. $U_{20}$ = 100, i.e. by maturity, this has increased to a guaranteed benefit of 100 units. $M_0$ = 873,400.
The number of units to be paid to policyholders on maturity depends on $N_{20}$. If more men are alive than expected, more units (which have to be purchased out of the company's equity) are paid as benefit.

For each year (i.e. for t = 1, 2, … , 20), the "actual" number of deaths is simulated. For this simulation, performed using Microsoft Excel™, we assess the probability of a certain number of deaths by selecting a random number between 0 and 1 from a uniform distribution R on (0,1). To describe this procedure, we note that given $N_t = n_t$ and $d_t \equiv 1 - P(t+1|t)$ the number of deaths during the period between t and t + 1 follows a binomial distribution with parameters $n_t$ and $d_t$. Hence:

$$P\left(N_{t+1} = N_t - k \mid N_t = n_t\right) = \sum_{i=0}^{k} \binom{n_t}{i} d_t^{\,i} (1-d_t)^{n_t - i}\text{, for k = 0,1, …, } n_t.$$

To generate k, given $n_t$, we take a realisation r of R and follow the procedure as described in Hoogduin (2002, page 93). After rounding, we find a realisation k, given $n_t$, from the formula:

$$\tilde{k} = \frac{n_t d_t}{n_t d_t + (n_t - n_t d_t + 1) * F_r},$$

where $F_r$ denotes the *r*-quantile of the *F* distribution with following degrees of freedom:

$$v_1 = 2n_t - 2n_t d_t + 2,$$

$$v_2 = 2n_t d_t .$$

Subtracting the simulated actual experience from the initial number gives the number of survivors at the end of the year and this is the basis for the simulation of the deaths in the next year. The annual mortality result (in units) is calculated for each year as $M_{t+1} - M_t$.

If the actual number of deaths equals the number according to the mortality table (8,734 at the end of year 20), $M_{20}$ equals $M_0$.

The deaths in each year follow a binomial distribution. In addition, the aggregate of the deaths during the total lifetime of the policies, and thus the number of survivors on maturity is binomially distributed, i.e.

$$N_{20} \sim Bin(10000, 0.8734)$$

These binomial probabilities can be accurately approximated by a normal distribution with:

$$\mu = 8734$$

and

$$\sigma = \sqrt{8734(1-0.8734)}\,.$$

This has been used to plot the probability distribution shown in Figure 4-2 in order to validate the simulation model. The only difference from the distribution obtained from the simulation is some random noise. This analysis gives the distribution of the unknown number of survivors and the total mortality result in units. The monetary mortality result depends on the value per unit at the maturity date.

***Development of the value of the investment fund***

The assumption is that the investment instruments are purchased at fair market value, which already reflects its risk profile. For each month subsequent to purchase and until maturity, a value is simulated according to a geometric Brownian motion.

$$S_i = S_{i-1} e^{\left(r - \frac{\sigma^2}{2}\right) \cdot \frac{1}{12} + \frac{\sigma}{\sqrt{12}} \cdot Z_i} \text{, i = 1, 2, … 240,}$$

where:

- $S_i$ = the value per unit of the investment instrument at the end of month i.
- $r$ = annual risk-free interest rate.
- $\sigma$ = volatility of the fund value.
- $Z_i$ = factor from the standard normal distribution, based on independent random numbers between zero and one.

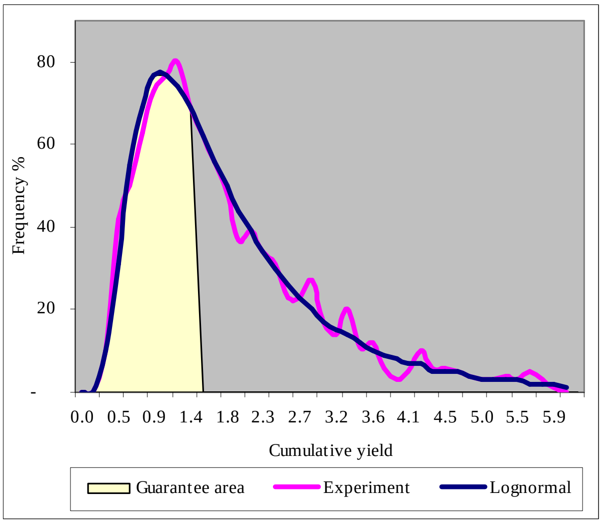
Note that the value per investment unit at the maturity date amounts to $S_{240}$. The initial value per investment unit, $S_0$, is equal to the premium per unit less all expense loadings, i.e. the part of the premium that is invested for the benefit of the policyholder. In the example, this amount is calculated as follows:

$$S_0 = P(1-a)(1-c)^T \text{, where:}$$

- P = single premium per unit of benefit charged to the policyholder at inception (t = 0, i = 0).
- a = acquisition costs as a percentage of the premium.
- c = annual maintenance cost as a percentage of the fund at the beginning of period t.
- T = total lifetime of the policy in years (=20).

The model used implies that $S_{240}/S_0$ (the cumulative yield) has a lognormal probability distribution with mean

**Figure 4-13: Simulated cumulative yield against analytical solution**




$\tilde{\mu} = \left( r - \frac{\sigma^2}{2} \right) T$ and variance $\tilde{\sigma}^2 = \sigma^2 T$. It follows that $S_{240}$ has a lognormal distribution with mean $\mu = \ln S_0 + \tilde{\mu}$ and variance $\tilde{\sigma}^2$.

Figure 4-13 shows that the lognormal distribution of the cumulative yield has a similar shape to the distribution from the simulation process. The difference is some random noise. However, not all the area under the lognormal distribution curve is applicable. The area that is applicable for the guarantee is the area for which $S_{240}/S_0$ is 1.49[38] or less (so $S_{240}$ is 1 or less), because the policyholders will only put their units to the enterprise if and when this is favourable to them (i.e. if the strike price exceeds the value per unit).

The guarantee area in the graph represents the probability of scenarios that all result in a loss for the enterprise. Discounting the expected value of this loss gives the cost to the enterprise of the minimum guarantee given to the policyholder. The process chosen for the simulation model implies that this cost equals the Black & Scholes value of a put option. The average of the discounted guarantee losses per unit according to the simulation model is sufficiently close (bias of between 2% and 4%) to the Black & Scholes value of a put option, so that the simulation model can be considered valid for the demonstration purposes it is used for.

***Calculation of the total cost of the guarantee***

The total cost of the guarantee for the enterprise is equal to the cost of the guarantee per unit multiplied by the number of survivors. In order to solve this analytically, the lognormal distribution of the cumulative yield over the guarantee area has to be combined with the binomial distribution of the number of survivors. As argued earlier in this appendix, the binomial distribution of $N_{20}$ can, for the situation here, be approximated by a normal distribution. First, I divide the lognormal distribution into 50 surfaces, 49 of them representing probabilities of intervals of $S_{240} \leq E$ (E = strike price, i.e. 1 in the example) and one related to the interval (E, ∞).

More precisely, with:

$$a_j := \frac{j.E}{49}, \text{ for j = 0, … 49,}$$

38 I.e. the continuous compound guaranteed interest rate of 2% over 20 years.

we obtain for j = 0, 1, …, 48:

$$p_j \equiv P\left(a_j < S_{240} \leq a_{j+1}\right) = \int_{x=a_j}^{a_{j+1}} \varphi\left(\ln x; \mu, \tilde{\sigma}\right) d \ln x$$

and:

$$p_{50} \equiv P(S_{240} > E) = \int_{x=E}^{\infty} \phi\left(\ln(x); \mu, \tilde{\sigma}\right) d \ln(x)$$

where $\varphi\left(x; \mu, \tilde{\sigma}\right)$ denotes the standard normal density with mean μ and standard deviation $\tilde{\sigma}$ at $x$. Each surface represents the probability that $S_{240}$ is within a certain interval. The value of $a_j$ determines the cost per unit of the guarantee as follows:

$$g_j = \max\left\{\left(E - a_j\right)e^{-20r}, 0\right\}$$

Consequently, the probabilities for all $g_j$ are equal to those of the corresponding $a_j$.

Next, I divide the normal distribution (that approximates the probability distribution of the number of survivors at the maturity date) into 50 surfaces. More precisely, with:

$$b_l = 8734 - \left(3 - \frac{12l}{100}\right)\sigma \text{, for } l = 0, 1, \ldots 50$$

we obtain for $l$ = 0,1,…49:

$$q_l \equiv P\left(b_l < N_{20} \leq b_{l+1}\right) = \int_{x=b_l}^{b_{l+1}} \phi\left(x; 8734, \sqrt{8734(1-0.8734)}\right) dx$$

Finally, the probability for each combination of $g_j$ and $b_l$ is found, by multiplying the separate probabilities $p_j \times q_l$.

The combinations of probability and value are sorted by value and presented as a combined probability distribution. Figure 4-5 demonstrates that this probability distribution has the same shape as the frequency distribution of the simulated values (apart from some random noise).
Note that a similar simulation procedure can be carried out from each starting point in time $t \in [0, 20]$ and not only from time t = 0.

***Calculation of the total mortality result***

The mortality result is the total difference between the expected number of survivors and the actual number of survivors ($b_l$ – 8734), times the number of units, times the unit value at the time of maturity. I took the same approach as described above to determine the probability $p_j \cup q_l$ for each combination of $a_j$ and ($b_l$ – 8734).

Again, sorting all values results in a combined probability distribution. Figure 4-2 compares this distribution with the frequencies from the simulation.

***Expense result***

The expense loading is calculated each year as 50 bp of the opening value of the investment fund. The opening value of the investment fund is equal to the number of policyholders multiplied by the number of units per policyholder times the unit value.

The number of policyholders alive at the end of year *i* is simulated from the number of policyholders at the beginning of year i. This number is the result from the simulation during year *i*-1, using the number of survivors at the beginning of *i*-1. Hence, there is interdependence in the simulated values of the series of years. It is beyond the scope of this study to look for an analytical solution. The frequency distribution of the simulated discounted value of the total expense results is shown in Figure 4-4. This is a sequence of a mix of lognormal and binomial distributions.

***Real world measures***

This section describes very briefly how to deal with the “clash” between real world cash flows and those of the risk-free world where options are priced. The keys to the gate between the real world and the risk-free world are Martingales, the Girsanov Theorem and stochastic deflators.

Martingales are stochastic processes that have a zero expected return (drift). They have the form (Hull, 2003 p. 488):

$$\theta = \sigma dz$$

where θ can be the uncertain value of any variable, σ is the volatility and dz is a Wiener process.

If I have an asset with a value of € f, I can express this asset in units of another asset g instead of euros. Now, if I set the market price of risk equal to the volatility of g and there are no arbitrage opportunities, the ratio f/g is a martingale (hence, a process in which I do not have to worry about expected return, because this is zero by definition) for all values of f (Hull, 2003, p. 488). The market price of risk is defined as:

$$\lambda = \frac{\mu - r}{\sigma}$$

where $\mu$ is the real-world expected value of the future return.

The Girsanov theorem states that if I add a deterministic function to a Brownian motion as defined earlier in this appendix, we can find a new measure under which this Brownian motion plus the deterministic function is also a Brownian motion. This helps us to relate the real-world measure P to the risk-neutral measure Q, since we know the asset price/interest rate dynamics[39] under both measures (Schrager, 2003, p. 4).

A stochastic deflator is a type of discount factor that belongs specifically to the outcome of a certain round of simulating real expected cash flows. This deflator is a function of the market price of risk as defined above and, of course, of time (because it is a discount factor). Furthermore, the model of the deflator depends on the nature of the cash flows and the risk being modelled (interest-rate risk, market risk, credit risk, currency risk or a combination). The Black-Scholes deflator (that models future development of equity investments, assuming no correlation with market interest) has the following appearance (Schrager, 2003 p. 7).

$$D_T = e^{\left(-rT - \frac{\lambda^2 T}{2} - \lambda W_T\right)}$$

where $W_T$ is the outcome of the Wiener process that determined the drift in the specific simulation round to which the deflator was applied. As the stochastic deflator depends on the outcome of the Wiener process that determines the outcome of the SDE, there is a linear relationship between the natural log of the stochastic deflator and the SDE:

$$\ln(D_T) = -\frac{\mu - r}{\sigma^2}\ln\left(\frac{S_T}{S_0}\right) - \left\{\frac{\mu + r}{2} - \frac{\mu^2 - r^2}{2\sigma^2}\right\}T$$

***Development of variance over time***

The variable $\sigma$ represents the volatility in the model and the standard deviation of the possible annual yields, which are normally distributed. The compound development of the value has a lognormal distribution. Given the $\mu$ and $\sigma$ of the normal distribution, the variance of the development in the asset value is as follows (Hull 2003, p. 236):

$$\mathrm{var}(S_T) = S_0^2 e^{2\mu T}\left(e^{\sigma^2 T} - 1\right)$$

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39 Provided that the asset price and the interest rate are quoted on or can be derived from an efficient market.

# 5 Life insurance: financial reporting and value measurement

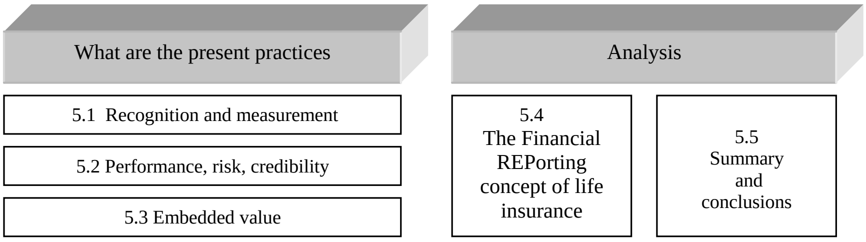
Looking at a balance sheet of an insurance company, I often have the impression that I am holding a balance sheet of a trading or production company up to a mirror. In a production company, the assets (such as plant and inventories) reflect the “cash flow in progress” of investments and disbursements that are meant to create value and eventually lead to a sales transaction and cash. In an insurance company, sales and cash receipts form the starting point and the creation and delivery of the “product” takes place subsequently.

In a trading or production company, investments are made now, while the sales will take place in the future for uncertain quantities at uncertain prices to customers that are often still unknown. In an insurance company, commitments are made often at fixed prices to pay amounts or purchase goods and services at uncertain frequencies for uncertain amounts and sometimes even (third) parties that are unknown initially.

Hence, there is much similarity between insurance companies and other enterprises; only the problems are inverted. Now looking at that balance sheet in the mirror, the technical provisions for commitments to policyholders appear prominently in the place of property, plant, investments, and inventory. They reflect the “cash flow in progress” towards beneficiaries, suppliers, employees, etc. Discussions on financial reporting of insurance companies often focus on the valuation of such technical provisions. The IASB has financial reporting for insurance contracts high on its agenda. It released International Financial Reporting Standard 4 on insurance contracts in March 2004. However, this standard addresses measurement of insurance liabilities only to a very limited extent. Measurement is a project in progress, where fair value (similar to the approach for financial instruments) is still a key word. In the Netherlands, the government took the initiative to form a task force comprising experts on insurance financial reporting to advise on improvements to the financial reporting of insurance enterprises. The task force issued its report in 2001, which proposed changes to the Netherlands Civil Code. The task force’s recommendations focused primarily on the reduction of the omnipresent options for recognition and measurement of assets and liabilities and the enhancement of footnote disclosures. The proposal may be superseded by the international developments, but has been submitted to the Parliament in a somewhat reduced format in order to minimise the differences between IFRS (to be applied by listed enterprises and optional for other enterprises and Dutch Accounting Principles (allowed for non-listed enterprises). The differences between the recommendations and IFRS were generally considered undesirable in relation to international harmonisation, although I find one recommendation clearly superior to IFRS: if insurance liabilities are measured at historical rates, fixed interest instruments is to be measured at amortised cost.

In this chapter, the fundamentals of the previous chapter are compared to present reporting practices and assessed regarding how far they deviate from my financial REPorting.

The road map to this chapter is as follows:




In section 5.1, recognition and measurement is discussed for the major balance sheet lines of life insurance companies, i.e. investments, technical life provisions and related accounts such as deferred acquisition costs and value of business acquired.

Section 5.2 elaborates further on the question of how to measure performance with respect to selling and servicing long-term life contracts, how to measure volatility and how the quality of estimates can be assessed. The section gives an overview of the performance, volatility and credibility indicators to be found in present financial reporting.

Section 5.3 discusses estimates of future cash flows embedded in the existing book of life insurance contracts, i.e. the embedded value. This value is not equal to the fundamental value of an enterprise because it only includes existing life contracts and not the potential of an enterprise to sell new life contracts (the franchise value or structure value). It reflects the realisable value of a life insurance enterprise's "inventory". Embedded value is often reported by life insurance enterprises in order to give supplementary information on value and performance.

Sections 5.1, 5.2 and 5.3 are illustrated by the financial figures of four internationally operating organisations in life business:
- Allianz A.G.
- AXA S.A.
- Prudential Assurance Company Plc.
- Manulife

These organisations have in common that they are listed on the US stock market. Consequently, some financial data based on common principles (financial reporting principles generally accepted in the USA; US GAAP) are available.

Furthermore, these organisations all supply information about their embedded value in some format. Three of the enterprises (Allianz, AXA and Prudential) are members of the CFO Forum of European insurance enterprises. This forum was founded in 2002 to discuss issues relating to proposed new financial reporting regulations for the businesses if its members and how they can create greater transparency for investors. In 2004, the Forum issued a common standard for assessing and disclosing embedded value, The European Embedded Value Principles.

In section 5.4, a high-level application of the Financial REPorting concept for life insurance is described.

Section 5.5 summarises the preceding sections of the chapter and presents the conclusion.

## 5.1 Recognition an measurement

In International Financial Reporting Standards, insurance contracts are covered in IFRS 4 that was issued in March 2004. This Standard defines insurance contracts as follows:

A contract under which one party (**the insurer**) accepts significant **insurance risk** from another party (**the policyholder**) if a **specified uncertain future event** (the insured event) adversely affects the policyholder.

As regards life insurance, the specified uncertain event may be death of a certain person (during his whole life or before a specified date) or survival at a specified date (in the case of endowment), or a series of specified dates (in the case of annuities) during his life or during a specified period. IFRS 4 also addresses investment contracts with a discretionary participation feature[40]. Such contracts are often issued by insurance enterprises, but are not insurance contracts because they do not contain *significant insurance risk*. An example is a contract where the mortality benefit each year is so close to the value of the funds paid in so far by the policyholder that it is practically irrelevant to the financial results of the enterprise whether the policyholder lives or dies.

IFRS 4 does not give much guidance with respect to the measurement of assets and liabilities associated with insurance contracts. The IASB decided to address this in a separate standard. This means that insurance enterprises are allowed recognise and measure insurance assets and liabilities according to their existing practice. There are some exceptions to this, however:

- Catastrophe and equalisation provisions are explicitly proscribed from being included in liabilities.
- At each financial reporting date, a liability adequacy test (this is an inverse impairment test for liabilities) should be carried out. *At least* the contractual cash flows, the related cash flows from handling and maintenance expenses and the expected cash flows from embedded options and guarantees (see 4.1.3) should be taken into account. If such a test shows that the carrying value of the liability is inadequate, the entire corresponding deficit is charged to the profit and loss account.

Many insurance companies in many countries use methods for recognition and measurement of insurance assets and liabilities that are related to rules issued by national insurance supervisors. Such rules are often primarily concerned with prudence related to meeting contractual commitments and not too much with transparently measuring the performance of an insurance enterprise. Consequently, it is possible that in an international group of insurance enterprises insurance assets and liabilities of different members of the group are measured differently. The Netherlands financial reporting legislation explicitly allows this practice (Section 446(3) of Book 2 of the Netherlands Civil Code). The main reason for this is that IT systems that are used to measure insurance liabilities are often based on regulations by national supervisors. Until now,

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40 A discretionary participation feature is defined as a contractual right to receive additional benefits supplementary to the guaranteed benefits. These benefits are likely to be a significant portion of the total. The timing and amount of these supplementary benefits are contractually at the discretion of the issuing enterprise. Discretionary participation rights may be contractually related to the profit or loss of the issuing enterprise in general, to the performance of a specified class of contracts or to the investment returns of a specified pool of assets.

such IT systems have often appeared to be insufficiently flexible to measure insurance assets and liabilities using alternative principles in a reliable way and without undue cost.
The remainder of this section addresses the following subjects:

- Recognition and measurement of insurance liabilities according to US financial reporting standards (US GAAP). I have selected US GAAP because these rules are specifically designed for the purposes of (transparent and relevant) financial reporting rather than for only prudential purposes. They have existed for a number of years. Furthermore, international insurance enterprises that are listed on a US stock exchange are required to give some information based on US GAAP. Consequently, US GAAP is the only "common basis" for certain international insurance groups for which data are available at time of writing.
- Practical applications of recognition and measurement by four international insurance groups. These are all listed on a US stock exchange, which makes it possible to perform some high level analysis of the impact of US GAAP in relation to the national rules that apply to these groups.
- The most common rules for measuring assets in which policyholders' funds are invested in relation to the measuring principles of the insurance groups reviewed.
- A brief description and analysis of the plans of the IASB for a standard on measuring insurance liabilities.

### *5.1.1 Measurement of insurance liabilities in accordance with US GAAP*

Insurance contracts, including the rules about the recognition and measurement of liabilities resulting from such contracts are addressed in several pronouncements of the Financial Accounting Standards Board (FASB).

- FAS 60: Accounting and Reporting by Insurance Enterprises (June 1982).
- FAS 97: Accounting and Reporting by Insurance Enterprises for Certain Long-Duration Contracts and for Realised Gains and Losses from the Sale of Investments (December 1987).
- FAS 120*:* Accounting and Reporting by Mutual Life Insurance Enterprises and by Insurance Enterprises for Certain Long-Duration Participating Contracts (January 1995).

FAS 113 covers reinsurance and is not addressed in this section.

The standards mentioned are designed to apply to insurance enterprises rather than insurance contracts.

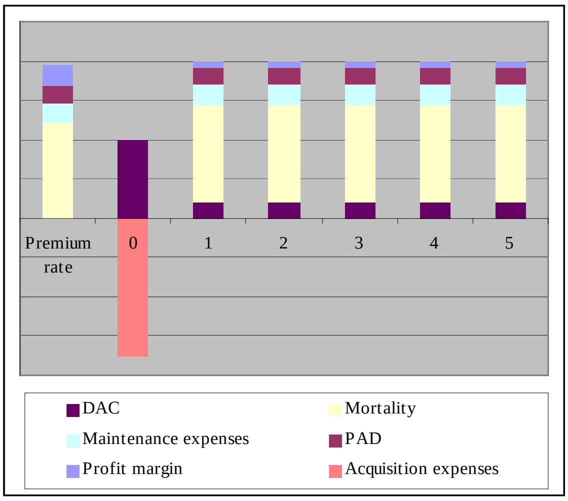
FAS 60 deals mainly with conventional types of insurance where the long-term contracts are assumed to have guaranteed premiums over the lifetime of the contract and provide guaranteed benefits, sometimes with some type of profit participation feature added. The calculations and estimates that determine the measurement of insurance liabilities start at the time of selling the contract. The relevant aspects are:

- The expenses that have already been incurred until the time of sale (product development, marketing, distribution, etc.). Under a pure matching system, all these expenses would be deferred and set off against the profits of the contract sold. However, FAS 60 restricts deferral to those expenses that are primarily related to the sale or renewal of insurance contracts and are sufficiently variable in relation to the sales volume. The expenses that qualify for deferral are amortised over the premium-paying period of the contract.

- The “standard cost price” of an insurance contract, consisting of:
  – Expected cash flows from benefits, based on estimates of expected mortality, morbidity and surrenders.
  – Expected cash flows from expenses to be incurred during the lifetime of the policy.
  – A discount rate based on assumed future investment yields.
  – A provision for adverse deviations (PAD) intended to reflect the uncertainty and volatility regarding the estimated future cash flows and the volatility in the development of the value of funds invested.

Typically, this “standard cost price” of an insurance contract includes a surcharge for risk. As has been discussed in section 4.1, there is a good reason for including such a surcharge. Uncertainty about future cash flows gives rise to the requirement for economic capital. Hence, economic capital is a “raw material” in manufacturing an insurance contract and its cost is an integral part of the “standard cost price”. Section 4.5.1 shows that in fully transparent (insurance and capital) markets, the PADs are equal to the cost of the required solvency. It is fair to say that FAS 60 does not mention this (or any other) reasoning for taking the risk of adverse deviation into account.

**Figure 5-1: FAS 60 recognition of margins**




According to FAS 60, the insurance liabilities are estimated each year as the discounted value of future cash flows from benefits, expenses and *net* premiums. By definition, the insurance liability amounts to zero at the start of the contract, before any premium has been paid (unless the premium would be inadequate, which is discussed below).

The net premium, the assumptions for estimating future benefits and expenses and the discount rate remain the same during the lifetime of the policy. Figure 5-1 shows how margins are recognised over the lifetime of the policy, assuming that all cash flows are equal to the expected cash flows. Mortality and expense PADs are released to the extent the “services are rendered” (i.e. mortality benefits settled, insurance book serviced). The PAD included in the interest rate is released as a margin between the real investment yield and the technical interest rate used. The remaining profit margin is recognised over the total lifetime of the contract. If the premium-paying period is less than the lifetime of the contract, the remaining profit margin is recognised as income in a constant relationship with the insurance business in force (or over the expected period of benefit payment for annuity contracts).

If we compare this approach with International Financial Reporting Standards that are currently available, the profit pattern described here bears great similarity to the profit recognition on construction contracts according to IAS 11 or service contracts according to IAS 18, paragraph 20[41].

Each reporting period, a liability adequacy test is performed by estimating future cash flows on the basis of the most recent information about mortality, morbidity and expenses and by discounting these cash flows using the latest insights into future investment yields. If the discounted value is higher than the recorded liabilities based on the historical assumptions, the recorded liabilities are increased to the higher amount and the difference is recognised immediately as a loss. The new assumptions remain applicable until settlement of the contract or time the next inadequacy is encountered.

In summary, the measurement according to FAS 60 is the inverse of the cost or lower realisable value used for fixed assets or inventory. However, one cost category is missing in the "rate or higher" test. The new, less favourable, assumptions are expected values of parameters without regard to any risk of further adverse deviations. Implicitly, this means that the cost of allocated solvency is not considered an integral part of the standard cost price. Hence, insurance liabilities may be carried at a lower amount than their realisable value (i.e. the price at which an independent party would be willing to assume such liabilities). In my opinion, PADs should be reinstated at the level of the cost of allocated solvency in a situation of inadequacy for the following reasons:

- It recognises that solvency is a raw material in manufacturing an insurance contract for which the expenses should be taken into account when assessing the amounts for which insurance liabilities can be settled.
- It prevents the book value of shareholders' equity from exceeding the part of the fundamental value of the enterprise attributed to in-force business (discounted value of shareholders' cash flows).
- It prevents insurance liabilities from being carried at an amount lower than the value realisable in a transaction to transfer the liability to a third party[42].

As already noted, FAS 60 deals with conventional insurance contracts where conditions remain the same over the lifetime of the contract. One departure, i.e. premium payment during a limited period, has been discussed above. In such a situation, profit is not recognised over the premium-paying period, but over the total lifetime. For more flexible contracts, for which the terms are not fixed and guaranteed, the rigid "locked in" principle of FAS 60 will not work. Such contracts, usually called universal life contracts, may have one of the following features:

- The amounts that accrue to the benefit of the policyholder are based on the development of an investment pool, an index or similar, and may not be guaranteed.
- The amounts charged to the policyholder for expenses, mortality coverage, etc. might not be fixed and guaranteed (see the example in section 4.1, where the expense loading is a percentage of the funds invested).

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41 Recognition of revenue by stage of completion of a transaction.

42 The normal consideration for measuring tangible assets is to look at the highest of direct and indirect realisable value. In this situation involving liabilities, we are looking at the lowest of direct and indirect settlement values. In the situation of insurance liabilities, the direct realisable value will definitely include the cost of solvency. Leaving the cost of solvency out of the indirect realisable value would lead to an imperfect comparison and would leave the shareholders with a risk that has not been properly priced.

- The policyholder has the option to vary the premium from year to year without the consent of the insurance enterprise.

Such contracts are dealt with in FAS 97. According to paragraph 17 of this standard, the insurance liability should be the sum of the following components:

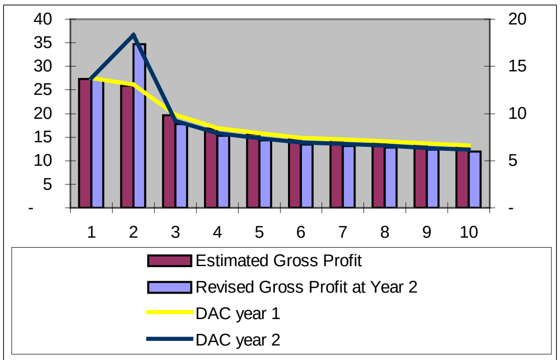
| | |
|---|---|
| a | The balance that accrues to the benefit of policyholders at the date of the financial statements. This can be measured by the account balance communicated to the policyholder, a similar value agreed in the policy contract or the cash surrender value. |
| b | Amounts charged to the policyholder for rendering future services. These amounts include the costs of those future services and a profit margin. |
| c | Amounts charged to the policyholder that are refundable at termination of the contract. |

These types of liability include the unearned profit over the remaining lifetime of the contract. If there is a probable loss/deficiency for the remaining period, this is added to the insurance liabilities and charged to the profit and loss account.

Unearned profit is recognised over the lifetime of the policy in proportion to the services that are rendered (mortality cover, policy maintenance, asset management, etc.). Unlike for conventional insurance contracts:

- Deferred acquisition costs (DACs) are amortised in proportion to the recognition of unearned profits and not relative to the premiums received.
- Estimates of future gross profits have to be evaluated regularly. If the pattern varies from the originally expected pattern, DAC amortisation is adjusted accordingly.

**Figure 5-2: Profit recognition and DAC amortisation FAS 97**




Source: FAS 97, appendix B

Figure 5-2 shows the pattern of DAC amortisation in relation to gross profit recognition. The figure is based on appendix B of FAS 97. Initially, the present value of the total deferrable acquisition costs amounts to 50.3% of the present value of gross profit. In year 2, there are surrenders in excess of the assumptions. This increases the gross profit (surrender profit) for year 2, but decreases the present value of the unrecognised gross profits. The revised ratio of deferred acquisition costs to gross profit is 51.7%. The DAC amortisation in year 2 includes a “back service” amount for adjusting the previous periods to the new pattern.

Similar to the FAS 60 for conventional insurance contracts, FAS 97 applies an “inverse cost or lower” principle; there is no principal difference between those two standards concerning measurement. This implies that, if the insurance liabilities based on the actual best estimate exceeds the balance of policyholders’ liabilities and deferred acquisition costs, a loss is recognised to (first) effect an extra amortisation of DAC and (second) increase the policyholders’ liabilities. Liability Adequacy Tests are performed on homogeneous groups of policies. The adequacy of liabilities is tested against expected values without any prudence margins (even excluding a margin equal to the cost of solvency, which is, in my opinion, an integral part of the costs of an insurance contract).

Recognition of premium income and benefits is aligned to the nature of universal life contracts. Neither the premiums collected nor the return of policyholders' balances is recorded in the profit and loss account. The profit and loss account only includes assessments against the account balance (for mortality covers, expenses, etc.) as income and benefits in excess of the account balance and costs as expenses.

Neither FAS 60 nor FAS 97 gives guidance on how to treat embedded derivatives (e.g. surrender options, guaranteed annuity options, options to increase or decrease the premium) and guarantees (such as the interest floor in the example in section 4.5). Derivatives (including embedded derivatives) are dealt with in FAS 133. This standard scopes out most insurance contracts under FAS 60 and FAS 97, but prescribes unbundling of embedded derivatives under certain circumstances, the most important one being that "*the economic characteristics and risks of the embedded derivative instrument are not clearly and closely related to the economic characteristics and risks of the host contract*" (FAS 133, § 12a). The appendix to FAS 133 discusses a number of examples, such as guaranteed minimum death benefits (the value of the policy depends on the value of the underlying investment, but if the policyholder dies before maturity, the highest of the fund value and the accumulation of premiums plus minimum interest is paid). The FAS concludes that such a GMDB (and a Guaranteed Minimum Income Benefit) is not a derivative that needs to be unbundled because the payment is life contingent, in other words depends on an insurable event. Statement of Position (SOP) 03-1[43], issued in 2004 by the American Institute of Certified Public Accountants, gives additional guidance for the recognition of liabilities if their total exceeds the policyholders' account balance. These additional liabilities are based on the so-called benefit ratio, i.e. the present value of the expected benefits (e.g. death benefits) divided by the present value of the expected charges levied from the policyholders. The preferred way to assess the expected value of benefits and assessments is stochastic. The example in chapter 4 demonstrates that guaranteed benefits lead to a higher expected value than benefits that do not have a minimum guarantee, the difference being the time value of the embedded option. I add a simple example here. Suppose that the benefit for a policyholder is determined by rolling a dice. The expected benefit is the average of 1, 2, 3, 4, 5 and 6, i.e. 3.5. Now, suppose that the minimum guaranteed benefit is 3. The expected benefit is then the average of 3 ,3 , 3, 4, 5 and 6, i.e. 4. The conclusion is that under SOP 03 – 1, US GAAP allows (or even requires) consideration to be given to the time value of embedded options, even if there is no direct liability adequacy issue.

So far, insurance contracts with fixed premiums and guaranteed benefits have been discussed, or contracts with variable premiums and certain elements that are not guaranteed, but all with shareholders involved and shareholders' profits requiring measurement. Remember from the analysis of section 4.2 that, apart from putting shareholders' equity at risk, policyholders' benefits can be guaranteed by simply including a solvency charge in the premium rate. The surplus that is likely to occur is then given to the policyholder as a profit share (in cash or additional benefits) when it is no longer needed to stand at risk. This is the principle mutual insurers apply, although

43 Accounting and Reporting by Insurance Enterprises for Certain Nontraditional Long-Duration Contracts and for Separate Accounts

shareholders (capital) and policyholders (extra premium) often jointly supply the necessary buffers. The special features of this type of insurance contract are addressed in FAS 120. The characteristics mentioned by this standard are:

a The contracts are long-duration participating contracts that are expected to pay dividends to policyholders based on actual experience of the insurer.

b Annual policyholder dividends are paid in a manner that identifies divisible surplus and distributes that surplus in approximately the same proportion as the contracts are considered to have contributed to divisible surplus (commonly referred to in actuarial literature as the contribution principle).

Annual policyholder dividends should be reported separately as an expense in the statement of earnings and should be based on estimates of amounts incurred for the policies in effect during the period (SOP 95-1, paragraph 14).
The net level premium reserve is calculated based on dividend-fund interest rate and mortality rates used in the pricing of the contract. If these are not available, cash surrender values according to the contract should be used.
Terminal dividends should be accrued if the following conditions are met:

- Payment of the dividend is likely.
- The amount can be reasonably estimated.

### *5.1.2 Measurement of investments related to insurance companies*

Most of US GAAP financial reporting rules with respect to financial investments covering insurance liabilities come from FAS 115 and various interpretations of it. IFRS financial reporting rules come from IAS 32 and 39. There are differences between the hundreds of pages of those statements that I would like to leave to the real financial reporting scribes; the following describes the general idea.

Basically, five categories of financial investments are relevant to life insurance enterprises in relation to insurance liabilities.

| **Category** | **Measurement features** |
|---|---|
| Loans and receivables originated by the enterprise (such as mortgage loans). | Amortised cost, i.e. amount at initial recognition:<br>- redemptions<br>+ cumulative amortisation of the difference between initial amount and the maturity amount<br>- impairment/unrecoverability |
| Held-to-maturity investments with a fixed maturity date (the insurance enterprise has the positive intent and ability to hold them to maturity). | Amortised cost |
| Investments available for sale with a fixed maturity date (everything that is not self-originated, held-to-maturity or held for trading). | Fair value. Unrealised differences between fair value and amortised cost[44] included in the statement of changes in equity (US GAAP: Other comprehensive income)[45].<br>Realised differences between fair value and amortised cost in profit and loss account. |

[44] Amortisation of any premium or discount is recorded in the profit and loss account. In other words interest on available for sale investments with a fixed maturity is recorded at the effective yield.

[45] IFRS also permit to include unrealised results on available for sale assets in the profit and loss account.

| Category | Measurement features |
|---|---|
| Other financial investments available for sale (such as shares). | Fair value. Unrealised differences between fair value and cost included in the statement of changes in equity (US GAAP: Other comprehensive income)[46]. Realised differences between fair value and cost in profit and loss account. |
| Held for trading. | Fair value. Realised and unrealised gains and losses through profit and loss account. |

Under certain circumstances, IFRS permit designation of an investment as “fair value through profit and loss” (similar to held for trading). Such investments are carried at fair value and all unrealised and realised results are included in profit and loss. This category is useful for insurance enterprises that carry investments for the account and risk of policyholders in their balance sheet. In this situation, the movement in insurance liabilities includes unrealised gains and losses and is recorded in profit and loss. Recording the corresponding unrealised gains and losses on the investments in the statement of changes in equity would lead to a needless financial reporting mismatch.

This is not the only mismatch that could occur. Fair value accounting for certain classes of assets without recording the matching movement in insurance liabilities leads to the recording of a volatility in earnings that only exists in accounting and has no economic meaning. This is one of the major criticisms of financial reporting rules by the insurance industry. Before going deeper into this, it is useful to look at the major influences on fair value.

**Table 5-1: Main forces affecting fair value**

| Influence | Investments with a fixed maturity date | Other financial investments (equity investments, etc.) |
|---|---|---|
| Market interest | Fair value | Fair value and<br>Risk premium |
| Expected cash flows | Possible impairments | |
| Volatility of expected cash flows | Credit spread | |
| Preferences | Yield curve<br>Credit spread | |

If there is an active market, the forces mentioned in Table 5-1 result in fair market values that are free of risk and arbitrage. Only a movement in the risk-free yield curve can be expected to have a direct effect on insurance liabilities. For the other movements, the effects depend upon profit sharing and bonus arrangements.

46 The standards also permit to include unrealised results on available for sale assets in the profit and loss account.

***Investments with a fixed maturity date***

The insurance industry has a long history of measuring investments with a fixed maturity date at amortised cost. This matches the measuring systems for conventional life insurance contracts, which use historical assumptions (including a historical discount rate). Hence, in the situation where insurance liabilities are matched at inception with fixed interest investments with the same duration as the liabilities, market interest rates can move in any direction, but the cash flows that are needed to meet the commitments are not affected.

For investments that are held-to-maturity, this system still works. However, most insurance enterprises hold investments with characteristics that are in harmony with the insurance liabilities until the maturity of those liabilities, but these investments do not necessarily consist of unchanging titles. During the lifetime of the insurance liabilities, investment titles are exchanged because of realignment of the quality or the duration of the portfolio, or simply because it is profitable. Consequently, for most fixed interest instruments the majority of insurance enterprises do not meet the restrictions that standards impose on fixed interest instruments for them to qualify as being held to maturity and most fixed interest instruments covering insurance liabilities are classified as available for sale (Example: Allianz reports in its financial statements for 2003 only € 4 billion held-to-maturity bonds. Allianz's available-for sale-bonds amount to € 211 billion). In the theoretical situation that an insurance liability perfectly matches the covering fixed interest investment:

- A movement in equity occurs if and when market interest rates change, whereas that movement in equity should not exist, because it is offset by an unrecorded movement in insurance liability.
- A movement in profit and loss occurs if and when the investment is sold after the change in market interest rates, whereas that movement should not exist, because the sale does not change any net value.

These effects can be neutralised by letting the insurance liabilities move with market interest rates. The implementation of such a rule is not simple, because active markets blend the factors mentioned in Table 5-1 to form a risk-neutral and arbitrage-free price. Insurance liabilities whose expectation and volatility in cash flows move to some extent independently from the assets have no active markets, so the factors mentioned have to be modelled to reflect a risk-neutral and arbitrage-free value.

The effects of impairments and defaults are recorded in the profit and loss account irrespective of whether the investments are classified as held-to-maturity or available-for-sale. Movements in the fair market value of fixed interest investments cannot always be identified as possible impairments or defaults because movements in credit spreads cannot always be separated into temporary movements and non-temporary movements. However, the points of attention in identifying an impairment or default are the same for each category of asset. The challenge is to identify changes in the uncertainty about future cash flows (reflected in higher credit spreads) that increase the risk of default, but may represent a temporary effect, and the changes in the expected value of cash flows from the investment instrument (which for fixed interest instruments means that probably not all interest and redemptions will be received), which often has a permanent effect. Both effects are autonomous and cannot be related to the value of insurance liabilities unless such liabilities are linked to the value of the assets under review.

***Equities***
Equity investments are often held for the account and risk of the policyholder, but also in the general account or a with-profit fund, because shares often give an attractive yield over the long term. This attractiveness is partly due to the fact that equities are a reflection of the real economy and therefore contribute to the protection against inflation.

Annual movements in equity investments are often erratic in relation to the long-term trend (see chapter 4, Figure 4-10), which has often lead to dissatisfaction in the insurance industry about reporting on annual results. There have been many attempts to separate the real earnings trend from the random movements. Until now, a number of insurance companies in the Netherlands took all realised and unrealised net gains to equity and recycled them to the profit and loss account based on a long-term historical average yield. This method is often associated with income smoothing, but look at it from a different angle. In the example used in chapter 4, we saw that we could split the life insurance liabilities into the value of the underlying investments and a written put option that represents the risk that *on maturity* the value of the investments is insufficient to meet the guaranteed minimum[47]. If the value of the investments goes down, the value of the put option goes up, thereby reflecting the increased risk that the investment fund will be insufficient to meet the guarantee. The volatility in earnings and equity is captured by the value of the option. In the example, it has been assumed that the underlying value develops according to a Brownian motion, with each year's yield developing independently from other years. If this assumption is replaced by the assumption that underlying values revert with a certain speed to a certain long-term mean (e.g. the Ornstein – Uehlenbeck mean reversion process), the volatility in the option value (and consequently, the effect of annual movements in the value of equity investments) is dampened. Clearly, such option valuation models are superior to the retrospectively oriented approach described above. However, the outcome may in certain circumstances be the same, with the main parameters in an option-pricing model (volatility, reversion speed and mean to be reverted to) being based on historical observations. There is empirical evidence of mean reversion tendencies of real after-inflation stock returns (see a.o. Siegel, 1998, page 32) for long holding periods. Whether the holding period of equity investments is long and stays long depends on the options that the policyholder has (for surrender, switch of investments, etc.) and the extent to which the underlying equities are linked to the benefit. If there is a full link, the holding period decreases from year to year as maturity nears and the volatility increases. If the enterprise has a discretionary right to smooth the yield on equities over a period of time and to transfer investments between generations of policyholders (i.e. the timing of liquidation of certain investments is not linked to a certain benefit), volatility may be kept at a lower level that is associated with long-term holdings.

In the UK (Prudential is an example, see section 5.1.3), with-profit life insurance contracts are a popular form of cover. These are contracts with a low guarantee relative to the premium rate. The surplus in the premium is initially retained and, if and when it is no longer needed to back the guarantees, is divided between the policyholders and the shareholders in contractual or regulated proportions. The distribution takes the form of terminal bonuses and (often-smoothed)

[47] In the case of a general investment account for policies with a guaranteed benefit and a profit share, the model is more complicated because the insurance enterprise has the option of aligning the investment mix to the situation from time to time, and the timing of the sharing in the surplus in excess of the guaranteed minimum by the policyholders is often at the discretion of the enterprise.

reversionary bonuses. This allows the insurance enterprise to invest more heavily in real values, because the peaks and surges are smoothed by the bonus policy (Booth et al. 1999, page 179). Since the surpluses for the shareholders become available at the time the bonuses are vested or distributed to the policyholders, these have the same smoothed pattern. Many proprietary life insurance enterprises record the undistributed surpluses in with-profit funds in a fund for future appropriation. Profit for shareholders is recognised at the time of distribution from this fund, which depends on the surplus accumulated, the amount of required solvency and a "contractual" smoothing process. Such a fund for future appropriation indisputably includes a part that is for the benefit of the shareholders. However, this cannot be touched before it has served its purpose to back guarantees and policyholders' reasonable expectations, and becomes available for distribution. The movements in the shareholders' portion of the fund for future appropriation (FFA) are far more volatile than the annual unlocking from the FFA.
In Canada (Manulife is an example, see section 5.1.3) life insurance enterprises top off the annual volatility in certain categories of investment by using a moving average of market values instead of the market value at a certain balance sheet date. Realised gains are deferred and recognised in the profit and loss account according to a pattern that creates a long-term moving average of yield on equity investments. Other enterprises look for alternative earnings measurements instead of net profits. These are discussed in section 5.2.

***Real estate***
Real estate is often a substantial category of investments held against long-term insurance liabilities. Here, US GAAP is different from IFRS. IFRS has a separate rule for investment property. This rule permits an enterprise to measure investment property at fair value with all realised and unrealised gains and losses to be presented in the profit and loss account. According to US GAAP, all real estate is to be measured at historical cost less depreciation and impairments. Realised gains and losses are presented in the profit and loss account.

### *5.1.3 Measurement of insurance liabilities and related assets by selected enterprises*

The selected enterprises report their equity and results on a national or (Allianz) IFRS basis and on a supplementary US GAAP basis. Allianz measures its insurance liabilities according to US GAAP and its investments covering insurance liabilities in accordance with IFRS. The purpose of this section is to identify the main differences between national methods and US GAAP and to highlight some special considerations. Table 5-2 summarises the differences for equity and for insurance liabilities and investments respectively.

For Prudential, the difference between US GAAP equity and their financial statements equity is relatively large. This is mainly caused by the fund for future appropriation with respect to the with-profit funds. These with-profit funds are to be seen as a joint venture between the shareholder and the policyholder. The shareholder supplies some equity and services the book of insurance business. The policyholder pays a certain surplus in his premium. Equity and surpluses remain at risk within the fund until they are no longer necessary as security for the insurance liabilities. At that time, any surplus is allocated according to a contractual formula to the shareholders fund or distributed to the policyholders in the form of bonuses, additional benefits or some other form. For local purposes, the surpluses are drawn from the with-profit funds when they are distributed.

**Table 5-2: Main differences from US GAAP**

| | Allianz | | | Axa | | | Prudential | | | Manulife | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 |
| Equity according to balance sheet | 30,828 | 28,592 | 21,674 | 26,157 | 23,401 | 23,711 | 6,071 | 4,651 | 5,554 | 14,282 | 5,703 | 5,286 |
| US GAAP equity | 33,380 | 30,825 | 22,836 | 30,431 | 24,918 | 23,857 | 8,406 | 7,276 | 7,499 | 16,604 | 7,265 | 6,853 |
| Difference | 8% | 8% | 5% | 16% | 6% | 1% | 38% | 56% | 35% | 16% | 27% | 30% |
| Life insurance liabilities balance sheet | 355,195 | 311,471 | 305,763 | 272,160 | 259,532 | 263,172 | 148,864 | 143,556 | 165,760 | 86,047 | 35,623 | 38,480 |
| Identified US GAAP differences | | | | 187 | 205 | ( 290) | 9,718 | 7,500 | 6,935 | ( 3,123) | ( 1,028) | ( 2,115) |
| As a % of balance sheet value | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | (0.1%) | 6.5% | 5.2% | 4.2% | (3.6%) | (2.9%) | (5.5%) |
| Investment assets balance sheet | 217,098 | 196,335 | 189,172 | 222,902 | 204,350 | 204,359 | 183,882 | 170,602 | 177,204 | 104,117 | 46,433 | 47,476 |
| Identified US GAAP differences | ( 226) | ( 42) | ( 76) | 4,483 | 2,270 | 408 | ( 6,720) | ( 4,329) | ( 4,978) | 6,400 | 3,256 | 2,763 |
| As a % of balance sheet value | (0.1%) | (0.0%) | (0.0%) | 2.0% | 1.1% | 0.2% | (3.7%) | (2.5%) | (2.8%) | 6.1% | 7.0% | 5.8% |

US GAAP requires that the enterprise's share in the surpluses shall be recognised if such future benefits are likely and can be measured in a reasonably accurate way. IFRS 4 permits discretionary participation rights as described above to be included in equity on a separate line (since it is solvency that remains at risk for meeting insurance commitments for as long as necessary) or under liabilities. Prudential, in its US GAAP difference analysis, makes the following comment on its considerations regarding with-profit funds:

As most investments of with-profits operations are accounted for on a trading basis, the shareholders' 10% share of the pre-bonus earnings is likely to be highly volatile from year to year as a result of the fluctuations in investment markets.

AXA is also to some extent in with-profit business and reports the same difference from US GAAP.

The negative difference in the value of investments of Prudential is to a large extent due to the valuation of real estate (US GAAP: historical cost less depreciation and impairments). The most typical differences in insurance liabilities are:

- Deferred profits for future services on limited premium paying contracts and universal life type products (lower US GAAP equity by € 3,320).
- Amortisation of DAC in accordance with expected gross profit for universal life products (higher US GAAP equity by € 2,305).

The difference in the valuation of investments has an impact on the technical provision as can be seen from the total difference in Table 5-2. Depending on the terms of the insurance contracts, a part of the value changes is for the account of policyholders.

AXA measures its investments at (amortised) cost. The US GAAP adjustment to fair value no doubt has an effect on the insurance liabilities, but this effect is probably dampened by the adjustment of the with-profit fund for future appropriation.

Manulife measures equities and real estate at a moving average of their market value. This suppresses the annual volatility. At balance sheet date, the carrying value was below the fair value, which causes the positive difference in US GAAP equity. Typical for the measurement of liabilities is that the assumptions are not locked in:

Assumptions are updated regularly and the effects of any changes in assumptions are recognised in income immediately.
The provisions for adverse deviations are recognised in income over the term of the liabilities as the risk of deviation from estimates declines.

### *5.1.4 IFRS and measurement of insurance liabilities*

At the end of the 20th century and the beginning of the 21st, the IASB held extensive discussions on the measurement of insurance liabilities. Their target is fair value. However, there is no active market for insurance contracts that produces a risk-free and arbitrage-free value. Consequently, such a fair value should be derived from other parameters (market yield curve, risk premium, etc.) and both complexity and room for volatility is huge.

IASB has not yet come out in favour of embedded value, even though it is often the basis on which blocks of insurance policies are traded and is a management tool for many insurers, which means that it has good odds for producing reliable key performance indicators.

If embedded value were the basis for the measurement of insurance business in-force (i.e. the complex of insurance liabilities, assets and the maintenance organisation of the enterprise), all profits except the cost of solvency would be recognised at the moment of sale. This would be inconsistent with the treatment of transactions such as under construction contracts and service contracts, where the profit is recognised “as the transaction fills” (Limperg, 1967, 307). Again, the conceptual reason for such a treatment is that the realisation principle follows the performance of the enterprise relating to its core activities and realised performance is key information for users who are interested in value.

In its basis for conclusions to IFRS 4, the IASB currently puts forward the following tentative conclusions for the measurement of insurance contracts:

Assets and liabilities from insurance contracts should be measured at their fair value with the following two caveats:

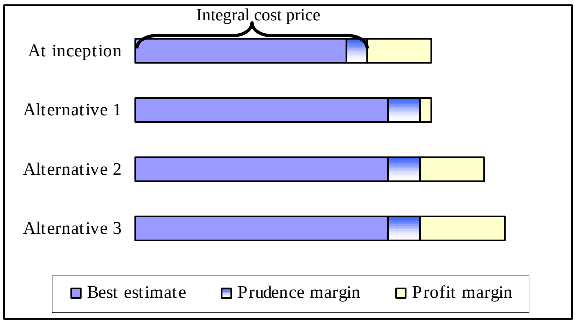
i Recognising the lack of market transactions, an entity may use entity-specific assumptions and information when market-based information is not available without undue cost and effort.

ii In the absence of market evidence to the contrary, the estimated fair value of an insurance liability shall not be less but may be more, than the entity would charge to accept new contracts with identical contractual terms and remaining maturity from new policyholders. It follows that an insurer would not recognise a net gain at inception of an insurance contract, unless market evidence *[e.g. following a reinsurance arrangement, ngj]* is available.

Some initial remarks can be made about this tentative conclusion. With such an approach, not all gains are realised at inception, which makes profit recognition more in line with other kinds of contracts (e.g. construction contracts). I would prefer that the available market evidence be further restricted to situations where reinsurance transactions or similar transactions giving the market evidence are effectively concluded.

The "entry market" fair value as suggested by the IASB is not always easy to obtain. Insurance enterprises do not sell contracts with all types of maturities (e.g. if a 20 year endowment is sold in year 1, a quotation for a 19 year policy in year 2 is not necessarily available. Furthermore, incidental discounts due to market circumstances or special occasions may play a role.

**Figure 5-3: Changes in measurement**




The fair value tentatively defined by the IASB is not a value that will ever be the basis for a purchase and sale transaction of a block of insurance business between knowledgeable, willing parties. It has (and most probably unintentionally) more characteristics of replacement value, but it is definitely an interesting starting point.

An important element is that the margins embedded in the products (see section 4.6) are (as with any other transaction by any other business) recognised when the services are rendered. This gives rise to an interesting measurement issue that is shown in Figure 5-3. This figure shows a technical liability at inception that has been bifurcated into an integral cost price (as defined earlier, this consists of a best estimate of future cash flows, increased by a prudence margin required by the market, consistent with the cost of allocated capital) and an expected profit margin. The figure further shows what happens if at any valuation moment the integral cost price is higher (e.g. due to a decrease in the interest rate).

Alternative 1 sets the increase off against the available margins. Consequently, there is no measurement effect unless the margins become negative. However, future profits will be lower.

Alternative 2 records the increase in the integral cost price and leaves the margin unchanged.

Alternative 3 restates the total liability to fully reflect the sales price at the moment of measurement. Hence, if products are sold with a higher margin, the unrecognised margins of products sold earlier are increased accordingly.

Alternative 1 has a disadvantage if assets are carried at fair value: it retains the "false volatility" in equity and earnings that US GAAP and IFRS have at present, because the value of assets may move, while the value of liabilities stands still.

Alternative 3 measures the total liability at its "replacement value". Apart from the fact that such replacement values may be hard to obtain for all lifetimes of liabilities, it shifts margins between the future and the period of remeasurement. It may even mean that a loss is incurred in the period of remeasurement at the benefit of future profits, which is counterintuitive or may be even wrong.

Alternative 2 seems to be the most practical solution. The parameters and assumptions to perform an "unlocking" can be assessed in an objective way and it does not change the pattern in the recognition of margins. Equity and results are only affected by the net volatility in assets and insurance liabilities. A question remaining is what to do with the surpluses and deficits that result from the net mismatch between insurance liabilities and the relating investment assets. Should they be recognised as gains or losses or be set-off against the "stock of profit margins" until these are negative and a liability adequacy issue arises?

The last option would be consistent with current international financial reporting standards for other industries and other types of contracts: inventories, work in progress, long-term service contracts are measured at (amortised) cost and the results of truing up of estimates are recognised prospectively unless they affect the assets or liabilities at a certain date (i.e. there is an impairment or a liability adequacy issue).

However, applying the first option will give information about the "real volatility" that results from the enterprise's choice of the nature and duration of assets against the liabilities. This information is exceptionally relevant to the user of financial statements.

Later in this chapter, the financial REPorting concept for life insurance is demonstrated. In view of the step-by-step approach of this concept, the information according to both options is provided.

## 5.2 Performance, credibility and risk measurement

When analysing the annual records of historical events of a life insurance enterprise, the following questions are relevant:

- What is the short-term progress in relation to fulfilling the terms of (long-term) contracts and other plans?
- Which fluctuations are observed in variables and events that are beyond the control of the enterprise?
- What are the differences between previous periods' estimates and actual developments?

IFRS 4 only deals directly with the last two questions and focuses on identifying and explaining amounts from insurance contracts and understanding the amount, timing and uncertainty of future cash flows from them. In the basis for conclusions the IASB states that IFRS does not require the disclosure of key performance indicators. The IASB adds to this:

> However, such disclosures might be a useful way for an insurer to explain its financial performance during the period and to give an insight into the amount, timing and uncertainty of its future cash flows.

I would add to this that reporting on performance is always important in order to explain which part of the realised cash flows and operational profits is due to core activities of the enterprise (and are likely to show a future trend) and which part is expected to follow a random walk (see also chapter 3).

Appendix 5-III summarises the main disclosure topics required by IFRS 4 and compares these with the disclosures required by the European Embedded Value Principles, which are further discussed in section 5.3. The appendix shows the topics and the most typical subjects to disclose according to the implementation guide. The standard requires risks to be looked at "though the eyes of management", but does not define fixed reporting formats. The consequence is that the quality of business control and the identification and management of risk has a direct relationship to control over financial reporting, and a strong integration between operational processes and the financial statements' closing process is needed to supply these disclosures successfully.

I further elaborate on some typical disclosures below.

*Roll forward schedule of insurance liabilities*

Table 5-3_shows a roll forward schedule of insurance liabilities as suggested by IFRS and the format used in the annual returns by life insurance enterprises to the Netherlands Insurance Supervisor (DNB).

The bold lines in the second column indicate movements that are based on historical events without any judgmental element. Credited investment income includes minimum guaranteed interest, movements in investment funds for the account and risk of policyholders, contractual bonuses and discretionary bonuses (vested and unvested), which may have a different character for which further disclosure is appropriate.

**Table 5-3: Roll forward schedule**

| Implementation guide IFRS 4 | Return DNB |
|---|---|
| Opening balance | Opening balance |
| +/+Additional insurance liabilities arising | **+/+Premium income** |
| | **-/- Expense loadings** |
| -/-Cash paid | **-/-Benefits paid** |
| +/-Income and expense during the period | +/+ Investment income credited |
| | +/- Technical results |
| +/-Acquired from or transferred to other insurers | **+/-Acquired from or transferred to other insurers** |
| +/-Exchange differences | **+/-Exchange differences** |
| Closing balance | Closing balance |

Technical results involve experience results (which are based on historical observations versus earlier assumptions) and changes in assumptions about future cash flows). Such information could be further refined to a performance indicator (the underwriting skills to create a positive technical margin) and a credibility indicator (the accuracy of financial reporting estimates). An analysis such as this directly interacts with the planning and control cycle of a life insurance enterprise (see Booth et al., 1999, page 258). This is what standard setters obviously want to see "through the eyes of management".

*Non-linearity in sensitivity analysis*
A sensitivity analysis can be performed on various variables. One could measure the sensitivity of net income, book value of the equity, fair value of the assets, or fair value of assets less liabilities to the movement of an indicator (such as market interest). When sensitivity is measured against net income or book value of the equity, it is possible that a change below a certain level does not have any material effect, whilst a slightly higher movement does. For example, a 0.5% decrease in long-term investment income may not affect the insurance liabilities because of sufficient PADs. A 1% change may cause the carrying value of liabilities to fall below integral costs based on realistic assumptions, thereby creating a material difference. The implementation guide of IFRS 4 requires taking such non-linearity into account. The risk management paragraph in the MD&A of Manulife for 2003 includes a disclosure that gives an indication of the level to which interest rates would have to move in order to affect the book value of the equity. (In the financial report for 2004, this information is not given in this format; instead, the sensitivity to shareholders' economic value is presented.)

…….. The actuarial reserves held by the Company as at December 31, 2003 were sufficient to provide for its liabilities, on the assumption that long maturity risk-free interest rates do not fall, or remain below 4.5 per cent in Canada, 4 per cent in the U.S., 4 per cent in Hong Kong and 1.6 per cent in Japan for a prolonged period of time, and in the case of U.S. fixed annuities, that short maturity risk-free interest rates do not fall more than 0.5 per cent below December 31, 2003 levels.

*Market risks*
IFRS 4 requires information about the sensitivity to market risks. The US Securities and Exchange Commission has already been specifying this requirement for a number of years, but outside the financial statements (in a separate item 11). The four enterprises selected to illustrate this chapter all identify and evaluate market interest rates (a parallel shift in the relevant yield curves), equity markets (a specific decrease in equity market indices) and currency rates (a movement of foreign exchange rates against the reporting currency) to disclose on market risk. They all give this disclosure in the form of a sensitivity analysis. AXA gives a high-level

specification of its life insurance liabilities by class of vulnerability to market risks (see Table 5-4). This information indicates the amounts exposed to a certain intensity of risk.

**Table 5-4: AXA disclosure on risk exposure of life insurance liabilities**

| | % of liabilities | |
|---|---|---|
| | 2004 | 2003 |
| No market risk because investments are for the account and risk of the policyholder | 23% | 22% |
| Guaranteed rates for the period of 1 year | 11% | 10% |
| Guaranteed interest rates, but no guaranteed cash value on surrender | 17% | 19% |
| Surrender and long-term interest crediting rate guarantees | 38% | 39% |
| Separate account insurance with guaranteed crediting rates | 11% | 10% |
| | 100% | 100% |

Allianz and Prudential both perform their sensitivity analyses in relation to the market value of their assets. AXA and Manulife present a net sensitivity (involving the life insurance liabilities).

**Table 5-5: Summary of AXA's sensitivity reporting**

| | 2004 | 2003 | 2002 | 2001 | 2000 | Measured against: |
|---|---|---|---|---|---|---|
| Impact on fair value assets/liabilities of upward shift yield curves 100 bp | (700) | (500) | (400) | (1,300) | (1,000) | Economic value |
| 10% decrease stock markets | n/a | (1,600) | (1,700) | (1,600) | (2,300) | Economic value |
| 20% decrease stock markets | (3,300) | (3,300) | (3,300) | (3,100) | (4,600) | Economic value |
| 10% increase of euro against all other currencies | (36) | 19 | (48) | (11) | (240) | Net income |

Interest rate risk 2002 compared with 2001 due to change in scope (certain classes of business included for the first time).
Interest rate risk 2001 compared with 2000 due to increase in portfolios.
Equity price risk 2001 compared with 2000 due to depressed market values in 2001.
Foreign currency risk 2003 compared with 2002 due to dollar hedging programme in 2003.
Foreign currency risk 2001 compared with 2000 due to lower net level of non-euro income.

Table 5-5 shows a summary of AXA’s net sensitivity reporting. Measuring sensitivity against the fair value of the balance of assets and liabilities implies that at least some information on the fair value of insurance liabilities is available.

As stated before, IFRS 4 hardly addresses information on performance. The IASB only states in the justification for its conclusions that information on performance may be important to explain future cash flows. It is my opinion that performance information is crucial to understand the amounts, timing and uncertainty of future cash flows, because it reflects the enterprise’s core competence for which the future repetition factor is the factor most under the control of the enterprise. I repeat my postulate from chapter 2, i.e. that a measurement of (fair) value as a function of estimated future cash flows starts with an analysis of past performance.

There is considerable dissatisfaction among insurance enterprises and users of financial statements about the present profit and loss accounts as indicators of performance.

As can be seen from Appendix 5-I, the profit and loss accounts and the technical accounts for life insurance are dominated by the net change in a balance sheet line, i.e. the insurance liabilities. A roll forward analysis on these insurance liabilities would be necessary to separate the cash movements and the credibility, volatility and performance indicators. A useful format for reporting results can be found in the financial statements of Manulife (see Table 5-6).

**Table 5-6: Statement of Manulife's sources of earnings**

| (In millions of Canadian $) | For the years ended December 31 | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2004 | 2003 | 2002 | 2001 | 2000 | 1999 | 1998 |
| Expected profit from in force business | 2,089 | 1,190 | 1,068 | 918 | 805 | 747 | 665 |
| Impact of new business | ( 324) | ( 183) | ( 119) | ( 195) | ( 82) | ( 242) | ( 99) |
| Experience gains | 715 | 362 | 215 | 118 | 69 | 136 | 11 |
| Changes in actuarial methods and assumptions | ( 157) | ( 78) | ( 9) | ( 131) | ( 93) | ( 3) | ( 24) |
| Earnings on surplus funds | 895 | 571 | 527 | 645 | 649 | 538 | 398 |
| Income before income taxes | 3,218 | 1,862 | 1,682 | 1,355 | 1,348 | 1,176 | 951 |
| Income taxes | ( 874) | ( 316) | ( 304) | ( 196) | ( 273) | ( 302) | ( 241) |
| Net income attributed to shareholders | 2,344 | 1,546 | 1,378 | 1,159 | 1,075 | 874 | 710 |

Manulife describes the sources of earnings as "one of the key tools in understanding and managing our business". However, their management's discussions and analysis follows the "traditional" reporting with occasional reference to performance indicators (such as lapses and surrenders).

Experience gains are not discussed by profit drivers (mortality, morbidity, expense margin, investment spread, net surrender profits). Nevertheless, Table 5-6 tells a lot that would otherwise be concealed. The expected profit from in-force business reflects the expected margins in the premium rate or the insurance liabilities at inception. This amount is a function of the business volume and the margins embedded in the past sales transactions. Both are indicators of performance.

The negative impact of new business (on the annual results, not on the achieved value) is explained by the fact that part of the acquisition costs is recognised immediately as expense, but also by the "conservative actuarial practices ……….. strong initial reserves on new business". There is no information as to whether these strong initial reserves on new business exceed the full standard cost (including cost of solvency) as defined in section 4.2.

Consistently positive experience indicates that the expected values for the assumptions have been chosen prudently. This means that the expected profit from in-force business reflects a margin on already prudent estimates rather than the "bare bones" expectation by the company.

In 2004, the Canadian Institute of Actuaries issued an educational note with recommendations about the preparation of and the reporting on sources of earnings. The format of the recommended disclosure is to a large extent similar to the reporting of Manulife and includes:

- Expected profit: This would include the release from the provisions for adverse deviations (no distinction is made between the cost element of the PADs and the real profit margin, as in section 4.1 and 4.5), net management fees, spread on deposits, etc.
- Impact of new business. This is not the value of new business as reported in an embedded value roll forward, but the new business strain caused by the fact that not all acquisition costs can be absorbed in the first year's premium or deferred and the fact that (regulatory) valuation may be different from pricing. Hence, impact of new business may give a false signal that has to be counteracted by disclosing value (added or otherwise) of new business.
- Experience gains and losses. Here, the difference between the best estimate and the experience is supposed to be reported. Consequently, experience gains and losses are supposed to show a random walk rather than a trend or a consistently positive or negative

amount. The educational note explains how to deal with unexplained variances and limits the extent to which they are acceptable (no material unexplained variances, no trend or consistent direction, which would indicate structural omissions from the analysis). This indicates that (as is still common practice) that a retrospective analysis is still assumed. An accounting system that records earnings by source per transaction or documented event may enhance the analysis, improve control over reported earnings and provide a better starting point for the MD&A regarding earnings. In chapter 6, a proposition is given for how such an accounting system might look.

- Changes in assumptions and other changes. This may involve best estimate changes, but also changes in margins for adverse deviations due to a change in the credibility of experience data. No explicit reference is made to the cost of risk (cost of solvency) that would increase the integral cost price of an insurance product.
- Income on surplus.
- Taxes.

An important principle with respect to analysing earnings by source is consistency with the manner in which earnings are reported and described and the way the business is managed. Here, too, a "look through the eyes of management" is meant to be given.

The dissatisfaction of life insurance enterprises with present financial reporting focuses to a large extent on annual changes in the fair value of assets. In this respect, I would make a distinction between fair value changes as a result of changes in the market interest and other changes affecting fair value.

*Changes in the market interest*
Many fixed interest instruments held by life insurance enterprises cover life insurance liabilities with a fixed interest guarantee. Although they often do not meet the strict criteria of standard setters to qualify as held-to-maturity, it is a misconception that they are available for sale. At best, they are available for swapping. Once they are sold before maturity of the liabilities, another instrument that also fits the asset liability model has to replace it. Neither the realised result on sale, nor the unrealised result when remeasuring to fair value have any meaning without considering the compensating effect the insurance liabilities have. The "old Dutch" solution[48] is to carry all fixed interest instruments at amortised cost. When an instrument is sold before settlement of the liabilities (in other words, it is swapped for another instrument), the difference between the sales price and the amortised cost is amortised over the remaining lifetime of the *original* instrument. This practice, often mistakenly seen as income smoothing, ensures that investment yields preserve their historical pattern, which is correct in a situation where insurance liabilities are based on their historical yield assumptions. Nevertheless, this accounting practice is not permitted under IFRS (or US GAAP) and life insurance enterprises are forced to use fair value for most of their fixed interest instruments that are not self-originated. Without considering the movement in insurance liabilities due to market interest changes, equity and (to a lesser extent) net results show a wrong tendency: they show volatility that only exists in relation to accounting, but does not properly reflect the impact of historical events, is not a good explanation and is not an appropriate predictor of future value.

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48 This option is expected to be removed from the Netherlands Civil Code in order to minimise the differences between IFRS and Dutch GAAP.

*Changes in other market factors*
When an insurance liability with a guaranteed interest is perfectly matched to a fixed interest instrument, movements in the market interest have a zero net effect on equity and results, and that is what financial statements should reflect. With changes in other market factors (e.g. on equity markets) this is only true if all movements in the investment value (positive and negative) are for the account of the policyholder. In other situations, the connection between a change in equity values and insurance liabilities is tenuous. Recall the example in section 4.1 and 4.5, where we took one of the possible approaches to measuring insurance liabilities for policies with an interest guarantee, i.e. the value of the underlying investment fund plus the put option that entitles the policyholder to exchange his share in the investments on maturity (or at death or surrender if that is agreed) for a fixed agreed sum. The value of that option fluctuates from year to year; if the value of the investments decreases, the option value increases. If this approach to measuring insurance liabilities is taken, the value fluctuation of the option is the net hit in equity and/or income. The extent to which the option value fluctuates with the value of the investments depends on the term to maturity, the volatility assumed and the future movement pattern (random walk or reversion to a specified mean at a specified speed). The pricing of options such as the one discussed involves a certain amount of subjectivity. However, new business in similar products with similar investments provides a reference. If a proper standard-cost price is available, the “replacement value” of an option or guarantee is known and forms an objective basis for measuring the option component in insurance liabilities.

Taking all the circumstances described above into account, the annual fluctuation in income and equity caused by fluctuations in market values due to causes other than changes in the market interest reflect a fact. Maybe this fact is not always relevant in measuring the progress in servicing long-term insurance contracts, but it is a fact that is easy to verify. In my opinion, the proper approach is to record the fluctuations that have been observed and explain their relevance in relation to long-term developments over the total lifetime of the policies/insurance liabilities.

In the financial statements of *Manulife*, the value fluctuations from investments are already smoothed by the use of a moving average value. The approach of the other enterprises with respect to value fluctuations and other “out of trend” elements in the financial statements is described below.

*Allianz* measures almost all investments (only a minor part is designated as held-to-maturity) at fair value. Unrealised gains and losses are included in the statement of changes in equity (US GAAP: other comprehensive income). On realisation, the difference between sales price and (amortised) cost are recognised as a gain or a loss. Volatility in equity is partly dampened by recognising the latent share of policyholders in the unrealised results (shadow accounting). In its analyst presentation of life investment yield, the company includes only realised gains, losses, and impairments. Movements are not pinpointed as causing a distortion to trends. The same presentation provides a breakdown of results that Allianz considers extraordinary (Table 5-7).

**Table 5-7: extraordinary items Allianz 2003**

| | Recurring | Extraordinary | Total |
|---|---|---|---|
| Profit before tax, goodwill and minority interests | 1,155 | | 1,155 |
| Amortisation goodwill | (174) | (224) | (398) |
| Taxes | (161) | (428) | (589) |
| Minority interests | (216) | | (216) |
| Net profit | 604 | (652) | (48) |

Extraordinary amortisation of goodwill relates to the operations in Korea.
Extraordinary tax burden relates to the effect of the German tax reform.

*AXA* measures investments at amortised cost. Consequently, unrealised gains and losses do not result in a movement in its balance sheet, unless they are the result of non-temporary impairments. Furthermore, the company uses two alternative earnings measurements that, in its opinion, better reflect AXA's operating performance.

Adjusted earnings are defined as net income before goodwill amortisation and exceptional operations (which in 2003 included the profit on the sale of certain operational units).

Underlying earnings are defined as adjusted earnings before costs related to 9/11 events and net capital gains to the shareholders. Underlying earnings still include elements that could be considered non-recurring (such as reserve strengthening).

A reconciliation of underlying earnings, adjusted earnings and reported net earnings is summarised in Table 5-8.

**Table 5-8: Alternative AXA earnings measurements**

| | 2004 | 2003 | 2002 | 2001 |
|---|---|---|---|---|
| Underlying earnings life and savings | 1,603 | 1,301 | 1,636 | 1,647 |
| Underlying earnings other segments | 1,121 | 734 | 51 | (114) |
| Total underlying earnings | 2,724 | 2,035 | 1,687 | 1,533 |
| Net investment results distributable to shareholders | 178 | (585) | (240) | 229 |
| Costs related to 9/11 events | - | - | (89) | (561) |
| Adjusted earnings | 2,902 | 1,450 | 1,358 | 1,201 |
| Impact of exceptional operations | 267 | 148 | 235 | – |
| Goodwill amortisation | (649) | (593) | (643) | (681) |
| Net income | 2,520 | 1,005 | 950 | 520 |

Adjusted earnings are defined as net income before goodwill amortisation and exceptional operations (which in 2003 included the profit on the sale of certain operational units).

Underlying earnings are defined as adjusted earnings before costs related to 9/11 events and net capital gains to the shareholders. Underlying earnings still include elements that could be considered non-recurring (such as reserve strengthening).

*Prudential* gives supplemental earnings information that is based on the part of long-term investment income distributable to shareholders. It defines long-term investment income as follows:

> The expected long-term rates of return are intended to reflect historical real rates of return and, where appropriate, current inflation expectations adjusted for consensus economic and investment forecasts.

Table 5-9 shows the reconciliation with the reported income before tax and minority participations. The earnings volatility due to volatility in the investment return during the financial year is concentrated in one line.

**Table 5-9: Supplemental Prudential earnings information**

| | 2004 | 2003 | 2002 |
|---|---|---|---|
| Operating profit based on long-term investment return before amortization of goodwill | 859 | 517 | 715 |
| Amortization of goodwill | ( 143) | ( 142) | ( 156) |
| Operating profit based on long-term investment return | 716 | 375 | 559 |
| Short-term fluctuations in investment returns | 337 | 132 | ( 326) |
| Profit sale discontinued operation | ( 96) | - | 565 |
| Profit before tax | 957 | 507 | 797 |

## 5.3 Embedded value

Embedded value is the present value of the cash flows available to shareholders that arise from existing insurance contracts. Such cash flows involve:
- Premiums and fees
- Investment income
- Benefits (on maturity, death or surrender)
- Expenses
- Taxes
- Net change in required solvency

Embedded value involves cash flows available to the shareholders and not cash flows generated by the enterprise. Cash flows available to shareholders can also be calculated as the strictest of:
- Statutory results plus or minus the net change in regulatory solvency capital.
- GAAP results plus or minus the net change in economic capital.

With respect to the solvency allocated to in-force insurance business, three approaches can be followed in order to estimate embedded value:
- Investment income on allocated solvency and the annual net change in allocated solvency are included in the estimated future cash flows to be discounted. The total discounted cash flow is the embedded value (EV).
- The present value of the discounted amounts is assessed as the Present Value of Future Profits of in-force business (PVIF). The cost of the allocated capital (CAC) is calculated as the present value of the difference between the forecasted investment yield and the Risk Discount Rate on the required solvency during each year of the projection. PVIF + Net Asset Value – CAC = EV. The net asset value can be subdivided into required solvency (RS) and free surplus (FS). Embedded value can then be written as PVIF + FS + RS – CAC = EV. This is the definition that the CFO Forum uses in the embedded value principles, where they assume that the cost of embedded options and guarantees (O&G) are projected in the PVIF.
- The present value of all margins in excess of the standard cost price[49] of in-force policies. Adding this present value to the (adjusted) net asset value, also gives the embedded value. This approach can play an important role in controlling the "stock of margins" described in chapter 6.

As a courtesy to the reader, the explanation of the abbreviations is repeated on each page of this section.

Basically, the fair value of assets minus embedded value gives the fair value of insurance liabilities[50]. Girard's (2001) analysis discussed in section 4.5.1 shows that in fully transparent financial markets, this approach using consistent assumptions and parameters gives the same answer as a direct estimation of the fair value of the liabilities.

49 Based on the most recent assumptions. In chapter 4 we concluded that this standard cost price should include the cost of solvency.

50 Provided that embedded value has been estimated in a market-consistent way. This is not necessarily the case. European embedded value principles are a major step forward in this respect, because they pay regard to the cost of guarantees and embedded options. However, the development of market-consistent embedded value estimation methods has only recently begun.

| | |
|---|---|
| AC: | Allocated Capital to covered business |
| ANAV: | Adjusted Net Asset Value |
| CAC: | Cost of Allocated Capital |
| EEVP: | European Embedded Value Principles |
| FS: | Free Surplus |
| O & G: | Options and Guarantees |
| PVIF: | Present Value Future Profits In-Force |
| RS: | Required Solvency |

The basis for conclusions of IFRS 4 expresses reservations with respect to embedded value measurement in the balance sheet. A summary of these reservations are:

- Lack of regulation and diversity of practice.
- Based on a single best estimate that does not take into account embedded guarantees and options. "Much attention is now being devoted to these options and guarantees, and embedded value methods may begin to address them more rigorously, but that development is not yet complete".
- The method reflects future investments margins.
- The method reflects contractual rights to future investment management fees that exceed their fair value, which is implied by a comparison with the current fees charged by other parties for similar services.

The first two reservations are of a practical nature. In 2004, the CFO Forum[51] laid down a methodology in 12 principles in order to make external embedded value disclosure consistent, comparable, transparent and sufficiently robust. They define embedded value as:

The present value of shareholders' interests in the earnings distributable from assets allocated to the covered business after sufficient allowance for the aggregate risks in the covered business.

The second two have more of a principle nature. With respect to investment margins, the IASB introduced a "rebuttable presumption that the insurer's financial statements become less relevant and reliable if it introduces an accounting policy that reflects future investment margins in the measurement of insurance contracts". With respect to contractual rights to future investment management fees, IFRS 4 states that an insurer may not introduce a new accounting policy where such future fees are measured at an amount that exceeds fees that would currently be charged by other market parties.

IFRS imply that applying the realisation principle gives more relevant and reliable information than abandoning it. However, the IASB did not generalise this in the way they did in their tentative conclusions for phase 2, where they state that they are not looking at a measurement of insurance liabilities that recognises all margins at the point of sale of the contract. I would welcome a measurement of insurance liabilities where margins are recognised to the extent the services (maintenance, benefits) are rendered, because it would reflect recording of the historical development and be a starting point for explaining the credibility of earlier estimates. Certainly, embedded value is the most relevant information to present in a financial report, but it is primarily a projection that derives its credibility from the Recording of historical events and Explanation of trends, difference analysis with earlier projections and performance.

Embedded value has been disclosed by life insurance enterprises for several decades. O'Keeffe et al. (2005) give a brief overview of the history of its use. Initially, the disclosure around the

51 The CFO Forum defines itself as "a high-level discussion group formed and attended by the Chief Financial Officers of major European listed, and some non-listed, insurance companies. Its aim is to discuss issues relating to proposed new accounting regulations for their businesses and how they can create greater transparency for investors".

methodology and assumptions were very limited and the format used was not comparable between enterprises and over time.

| | |
|---|---|
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In December 2001, the Association of British Insurers (ABI) introduced the supplementary reporting method for long term insurance business (the achieved profit method). This method prescribes a format for presenting embedded value and embedded value profit (achieved profit) and covers elements such as solvency, risk margins and disclosure. The achieved profit method is explained later in this section using Prudential's reporting as an example.

In addition, European Embedded Value Principles (EEVP) require explicit regard to be given to guarantees and options embedded in the insurance policies. The members of the CFO Forum have agreed that they will publish supplementary information according to EEVP, at the latest for the 2005 financial year.

The next step in process of being made is Market Consistent Embedded Value (MCEV). The difference with the more traditional embedded value practice is that many types of risk are no longer allowed for by an implicit surcharge in the discount rate, but are translated into explicit surcharges for frictional costs. An example of frictional costs relates to the possible future restructuring costs to reduce expenses. If you simulate 1,000 scenarios, as in the example of chapter 4, some of these scenarios result at a certain stage in a small number of in-force policies, which forces the enterprise to reduce expenses in order to keep the cost per policy under control given the lower volume. The frequency of such scenarios (or probability of such a scenario happening) times the cost of restructuring represent the frictional costs. In other words, MCEV defines possible future restructuring as a real put option. Another characteristic of MCEV is that it specifically addresses the covariance between the various assumptions (e.g. between surrenders and the development in the fund value).

None of the enterprises reviewed uses embedded value as a basis for (indirect) measurement of the insurance liabilities in the balance sheet. The approach to estimating and reporting on embedded value differs by company.

*Embedded value presentation by Allianz*
Allianz announces embedded value in the presentation to analysts. Until 2003, embedded value was calculated as PVIF + AC – CAC:

$$6,888 + 6,919 - 2,150 = 11,657$$

In 2004, Allianz took a step in the direction of EEVP, primarily by including the cost of options and guarantees in the embedded value. At the end of 2004, embedded value was calculated as PVIF – O & G + FS + RS – CAC:

$$7,177 - 534 + 1,364 + 5,982 - 1,600 = 12,389$$

The report of the external actuary states on the approach:

The values are primarily based on deterministic projections of future after-tax profits, with explicit allowance for risk using a single risk discount rate by country and an explicit adjustment for the cost of holding capital. Explicit allowance has been made for the cost of embedded options and guarantees.

| | |
|---|---|
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| CAC: | Cost of Allocated Capital |
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| FS: | Free Surplus |
| O & G: | Options and Guarantees |
| PVIF: | Present Value Future Profits In-Force |
| RS: | Required Solvency |

The capital requirement has been set to such an amount that there is a high probability that the enterprise maintains at least an A rating over a period of one year. The embedded value is estimated from statutory figures rather than IFRS figures. The allocated IFRS equity is higher than the allocated statutory equity. The excess of embedded value over IFRS capital amounts to € 2,748 million. The external actuary reports on the methodology, the assumptions and reasonable checks for the most important operational units.

*Embedded value presentation by AXA*
AXA presents embedded value in a supplement to the financial report. This section discusses the value of new business, the PVIF and the allocated capital. The allocated capital is a proportion of adjusted net asset value (ANAV), which is the total equity according to the balance sheet adjusted for net unrealised capital gains, intangible assets related to life operations, life insurance cost of capital (2,544) and some other adjustments. For the total enterprise, the embedded value can be calculated as PVIF + ANAV[52] – CAC or:

$$18{,}454 + 19{,}885 - 2{,}593 = 35{,}746$$

For life business only:

$$18{,}454 + 10{,}982 - 2{,}593 = 26{,}843$$

The required capital is based on currently maintaining an AA rating.

AXA gives an analysis of the net change in the PVIF and in the embedded value. The excess of embedded value over the published net asset value[53] amounts to € 3,452 million (2003: € 1,198 million). The actuary reports on the methodology, the assumptions and the reasonableness of the calculations, using on some high level checks. On the methodology, it states:

The values are based on deterministic projections of future after-tax profits, with allowance for risk through the use of risk discount rates and an explicit adjustment for the cost of capital. Explicit allowance for the cost of equity-based product guarantees in the life business has been made using stochastic projections on a realistic basis.

The embedded options and guarantees, to which the explicit allowances apply, are minimum interest guarantees, guaranteed minimum benefits and guaranteed annuity options.

In the auditors' report, the auditors state that they verified the consistency of the embedded value figures discussed in the MD&A against the report of the external actuary.

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52 For reasons of consistency with Allianz, I add back the cost of allocated capital to the book equity allocated to the life operations).

53 The equity adjusted for net unrealised gains.

*Embedded value presentation by Prudential*

| | |
|---|---|
| AC: | Allocated Capital to covered business |
| ANAV: | Adjusted Net Asset Value |
| CAC: | Cost of Allocated Capital |
| EEVP: | European Embedded Value Principles |
| FS: | Free Surplus |
| O & G: | Options and Guarantees |
| PVIF: | Present Value Future Profits In-Force |
| RS: | Required Solvency |

Prudential provides information about embedded value in a separate supplement to their financial statements. This information was prepared in accordance with the Achieved Profit Method. The purpose of this method is to show the shareholders of a proprietary insurance enterprise the profit (or shareholder value) that arises at the time of sale of an insurance contract. The profit is the discounted value of future cash flows arising from such a contract, as specified at the beginning of this section. For the purpose of assessing the investment income, the assets backing the long term insurance business are defined. These backing assets cover the long-term business provisions, calculated in accordance with the local supervisory requirements and an amount to back the required solvency. The latter may be the solvency required by the national supervisor or another measure of economic capital. The highest of the sum of statutory provisions and statutory solvency, or alternative provisions and economic capital, are appropriate for determining the annual free cash flows. This approach includes the cost of solvency directly in the calculation. In Prudential's case, most of the required solvency is supplied by the fund for future appropriation. The value of future profits is based on the future cash flows released for the benefit of the shareholders, and is consequently net of cost of solvency. With perfect foresight, the achieved profit would consist of:

- Annual unwinding of the discount rate on the opening balance of achieved profits on shareholders' funds.
- New-business profit.

The lack of perfect foresight adds some elements, i.e.:

- Change in relevant external economic circumstances beyond the control of management and the associated changes to the valuation basis.
- Changes in the value of business in force, due to:
  - Experience (on mortality, morbidity, etc.) being different from the assumptions underlying the previous year's projection of future cash flows.
  - Changes in the assumptions relating to this year's future cash flows (other than the changes in economic circumstances mentioned above).
  - Change in other factors (shareholders' proportion, surrender basis, etc.).

The estimates should contain margins for risk that "a third party, operating in a similar tax and regulatory environment, would require in order to determine the value at which it would be willing to assume the liabilities and supporting assets of the block of in-force policies". Risk margins can be created by:

- A risk premium in the discount rate. This decreases the present value of the projected cash flows.
- The projected amount of backing assets for each projection period. This pushes the cash flows available for the shareholder backwards and thus reduces their present value.
- Explicit margins in the projected cash flows in circumstances where the variability of outcomes is unrelated to the passage of time. If this type of margin is created, the "perfect foresight profit" on in-force business comprises not only the unwinding of the discount rate but also a release of margins.

All types of risk margins are allowed in the Achieved Profit Method, but double counting should be avoided. Because the method focuses on (achieved) profit measurement, the presentation is before corporate income tax, whereas the other enterprises' presentations are after tax.

| | |
|---|---|
| AC: | Allocated Capital to covered business |
| ANAV: | Adjusted Net Asset Value |
| CAC: | Cost of Allocated Capital |
| EEVP: | European Embedded Value Principles |
| FS: | Free Surplus |
| O & G: | Options and Guarantees |
| PVIF: | Present Value Future Profits In-Force |
| RS: | Required Solvency |

The Achieved Profit Method is very similar to the economic concept of profit discussed in chapter 3. One difference is that the economic concept of profit looks at the enterprise as a whole (including the capacity to sell new business in the future), while the Achieved Profit Method considers the in-force business. The limitation of achieved profit is that it is actually the difference between two discounted values of estimated cash flows. Consequently, achieved profit cannot play a role in historical checks of validity of such estimates, unless the various parts of achieved profit separately indicate performance, credibility of past estimates and volatility with respect to circumstances that the enterprise cannot control.

**Table 5-10: Nature of various achieved profit components**

| | |
|---|---|
| New business profit | Performance indicator |
| Change in time values and margin release | Performance indicator |
| Experience results | Credibility indicator<br>Performance indicator |
| Effect of experience on revision of assumptions | Credibility indicator<br>Performance indicator |
| Changes in external economic circumstances | Volatility indicator |

Table 5-10 summarises the nature of the main components of achieved profit. Experience results and the consequence of observed patterns for assumptions can be a credibility indicator as well as a performance indicator. They may indicate how accurate (or unbiased) the past estimates were and what "learning effect" has been included in new estimate, but they may also indicate how successful the enterprise was in achieving certain targets (e.g. improving persistency or reducing expenses).

Prudential's additional shareholders' interest in the consolidated balance sheet at the end of 2004 amounted to € 5.6 billion compared with a total embedded value (achieved profits basis shareholders' funds) of € 11.7 billion. However, this additional amount includes the part of the fund for future appropriation that is expected to be for the benefit of shareholders. According to the US GAAP reconciliation, this is approximately € 3.4 billion.

With respect to the methodology, the supplementary information in the notes to the achieved profits basis states:

The achieved profits basis results incorporate best estimate assumptions of future rates of investment return, proprietor's spread (in the case of Jackson National Life), policy discontinuances, mortality, expenses, expense inflation, taxation, bonus rates, surrender and paid up bases, and statutory valuation bases. In adopting these assumptions, account has been taken of recent experience and general economic conditions, together with inherent uncertainty. It has been assumed that the bases and rates of taxation, both direct and indirect, will not change materially in the countries in which the Group operates.

Prudential's external auditors issued a separate report on the supplementary information for the achieved profits basis. Their opinion is that this supplementary information was properly prepared in accordance with the ABI guidance and the methodology and assumptions included in the supplementary information.

*Embedded Value Presentation by Manulife*

AC: Allocated Capital to covered business
ANAV: Adjusted Net Asset Value
CAC: Cost of Allocated Capital
EEVP: European Embedded Value Principles
FS: Free Surplus
O & G: Options and Guarantees
PVIF: Present Value Future Profits In-Force
RS: Required Solvency

Manulife gives information in a separate supplement to the financial report. This supplement includes a roll forward of the embedded value and an explanation of the economic assumptions and of the method for estimating the future profit stream. It is interesting to look at the embedded value roll forward in relation to the source of earnings information shown in the previous section. The embedded value roll forward includes the achieved profit. The source of earnings information shows the margins on in-force business realised during the year. This information is a credibility indicator for the estimated future cash flows.

The surplus of embedded value over the net asset value amounts to € 4 billion; the surplus over US GAAP equity amounts to € 2.2 billion.

**Table 5-11: Reported return on embedded value in comparison with the CFO Forum principles**

| **Proposed EV model return according to EEVP** | Allianz | AXA | Prudential | Manulife |
|---|---|---|---|---|
| Capital raised | √ | 1) | √ | √ |
| Capital distributed | | | √ | √ |
| New business contribution | √ | √ | √ | √ |
| Return on in-force business | | | | |
| Expected return | √ | √ | √ | √ |
| Experience variances | √ | √ | √ | √ |
| Operating assumption changes | | 2) | √ | |
| Development costs | n/a | n/a | √ | n/a |
| Expected return on free surplus | X | X | √ | X |
| Operating return before [after] tax and [before] exceptional items | | | | |
| Investment return variances | 3) | √ | √ | 4) |
| Effect of currency movements | √ | √ | √ | √ |
| Effect of economic assumption changes | 3) | 2) | √ | 5) |
| Exceptional items | n/a | n/a | √ | |
| Return on EV before [after] tax | | | | |
| Attributed tax* | X | X | √ | |
| Return on EV after [before] tax | | | | |

1) From 2004
2) Presented: changes in investment and other assumptions
3) Presented as one figure
4) Equity market impact
5) Discount rate changes

√ = Information presented.
X = Information not presented.

The presentation format for embedded value, roll forward schedules and achieved profits were different for the enterprises under review. The level of detail is not always available to ensure a consistent content of each line in the schedule presented in Appendix 5-I, but over time, the information becomes better. In particular, the experience variances and the changes in economic and non-economic assumptions are not treated consistently and given in full detail, and have therefore been grouped in the appendix. In my opinion, a separate disclosure of experience in relation to assumption measures and the effect of changes in assumptions is relevant information, because of their different natures and purposes. The first *records* reality against previous standards and expectations, while the second *projects* the effect of change in future assumptions.

Disclosures become more elaborate and consistent as time passes. In 2004 especially, embedded value reporting moved closer to the European Embedded Value Principles. In Table 5-11, the

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information about the return on embedded value given by the sample companies is compared to the suggested analysis of return on EV that is suggested in Principle 12 of the CFO Forum. Unfortunately, this principle leaves the breakdown of the reconciliation between opening and closing embedded values to the discretion of the enterprise and only gives suggestions. In my opinion, this information is so crucial to understanding the credibility of previous years' estimates, the performance and the volatility in the embedded value that a stricter rule would be appropriate.

In its supplement to the financial statements, AXA discloses the development in the present value of future profits and in the embedded value. This enables the construction of the information presented in Table 5-12, a table rich in information.

**Table 5-12: AXA 2004 embedded value result**

| | PVPF | ANAV - CaC | Embedded value |
|---|---|---|---|
| Unwinding of discount rate | 1,133 | 371 | 1,504 |
| Model profit | (1,870) | 1,870 | - |
| Experience results | 62 | (68) | (6) |
| Change in operating assumptions | 382 | 53 | 435 |
| *Value of new business:* | | | |
| PVIF of new business | 1,926 | | 1,926 |
| Cost of allocated capital | | (172) | (172) |
| Distribution costs | | (983) | (983) |
| | 1,926 | (1,155) | 771 |
| EV operating profit | 1,633 | 1,071 | 2,704 |
| Current year investment experience | 614 | 1,199 | 1,813 |
| Change in future investment assumptions | (453) | 26 | (427) |
| Foreign currency result | (733) | (118) | (851) |
| Embedded value result | 1,061 | 2,178 | 3,239 |
| Opening value | 16,192 | 5,556 | 21,748 |
| Base differences | 365 | (251) | 114 |
| Embedded value result | 1,061 | 2,178 | 3,239 |
| Acquisitions | 836 | 459 | 1,295 |
| Change in allocated capital | | 447 | 447 |
| | 18,454 | 8,389 | 26,843 |

The model profit is the margin embedded in the existing business based on the standard cost that is realised in the financial year. It is comparable to the expected profit of in-force business presented by Manulife (seeTable 5-6). In fact, the PVIF can be considered a stock of future margins. Each year, part of this stock is used and "delivered" to the net asset value. The stock is replenished by new business. PVIF is positive, so the production is inherently profitable. PVPF less cost of allocated capital is positive, so the production includes the minimal required margin (see section 4.5.1). PVIF of new business less CaC and distribution costs is positive, which means that new business created shareholder value. The volume of new business was sufficient to absorb the fixed acquisition costs and the margin in new business was sufficient to cover the total acquisition costs. At each level, the information on new business is relevant to understanding the performance.

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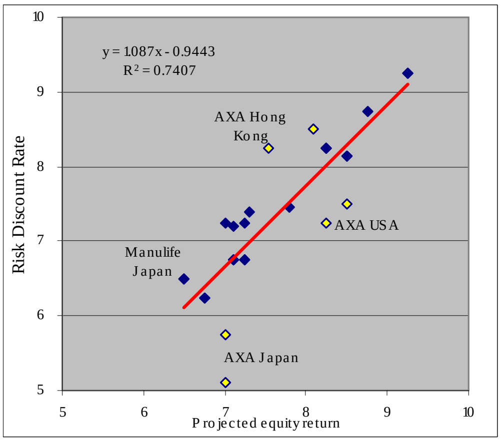
Experience results give insight into the credibility of previous years' estimates. The change in assumptions reflects structural changes. AXA explains this as a reduction in unit costs as a result of *realised* cost savings, a decreased annuitisation rate in line with the observed patterns and improved morbidity consistent with the experience. These disclosures are partly performance indicators (for cost saving and underwriting) and partly credibility indicators (variances from earlier estimates).

Current year investment experience is clearly a volatility indicator, because it measures the investment result for the year against the long-term investment result. This comparison says nothing about investment performance (which is measured by comparison with benchmarks or other criteria), but rather indicates the sensitivity to changes in the economic circumstances.

The principal economic assumptions have been included in Appendix 5-II. These often differ from country to country. The major countries in which the enterprises operate and the countries for which comparative figures are available are shown.
Two important economic assumptions are the projected (pre-tax) return on equity investments and the risk discount rate. These assumptions have in common that they consist of a risk-free element and a risk surcharge. The risk surcharges in the two assumptions are not necessarily equal. First, return on equity investments represents the return on the fair value, being the return on a share in the total value of the underlying enterprises. Embedded value is only the value of existing business and does not include the value of the potential to write future new business; consequently, the risk related to the latter element is not priced.

**Figure 5-4: Relation between risk discount rate and equity return**




Furthermore, enterprise-specific risk elements are concentrated in the risk discount rate. In the market-consistent embedded value that the industry has under development, these enterprise-specific elements are priced separately. Nevertheless, both assumptions have enough in common to make it worthwhile to examine the correlation between them. Figure 5-4 shows this relationship. The visual outliers have been marked.

In most embedded value reports, special attention is paid to the value of new business (or the achieved profit from new business). As discussed using the AXA example, there are three levels to evaluate regarding the value of new business. The first is the PVIF of new business. A positive PVIF indicates that there are positive margins in new business. The second level includes the cost of allocated capital. If the margin is still positive, the contracted premiums are at least the integral cost price as defined in section 4.2. The third level includes the distribution expenses. A positive margin at this point may mean:

- The margins in the product make the selling effort worthwhile.
- The distribution and selling activities are sufficiently efficient and effective.
- The sales volume is sufficient in relation to the distribution and sales organisation.

Hence, value of new business/achieved profit from new business gives, when properly analysed, a very powerful indication of distribution performance. However, this indicator is to a large extent based on future cash flows, which could make this relevant indicator less reliable or less objective. The more traditional reporting on actual cash flows and margins actually realised during the period of servicing the book of life insurance contracts is necessary to measure the credibility of future cash flow estimates: *realisation is the proof of achievement*.

Table 5-13 shows the value of new business reported by the enterprises reviewed. Allianz and AXA report the value of new business both before and after cost of capital. Prudential reports the capital charge (which is minor due to the fact that for a large part of the business the fund for future appropriation gives the solvency base).

**Table 5-13: Value of new business**

| | Allianz | | | Axa | | | Prudential | | | Manulife | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 |
| Before allocation of capital: | | | | | | | | | | | | |
| Value of new business | 793 | 456 | 501 | 943 | 675 | 648 | | | | | | |
| Margin of total expected premium | 2.9% | 2.2% | 2.2% | 2.4% | 1.9% | | | | | | | |
| Margin of APE | n/a | 13.6% | 15.5% | 19% | 15% | 15% | | | | | | |
| After allocation of capital | | | | | | | | | | | | |
| Value of new business | 611 | 231 | 265 | 771 | 512 | 515 | 462 | 583 | 804 | 674 | 571 | 447 |
| Margin of total expected premium | 2.2% | 1.1% | 1.2% | 1.9% | 1.4% | | | | | | | |
| Margin of APE | n/a | 6.9% | 8.2% | 16% | 12% | 12% | 24% | 25% | 27% | | | |

Allianz and AXA give the value of new business as a percentage of total expected premiums, which in my opinion is the only correct way to calculate it, because this reflects the total lifetime of the policies sold (see also Booth et al. page 252). It is also the method prescribed in principle 8 of the European Embedded Value Principles.

Three of the four enterprises reviewed measure the sensitivity of the embedded value in relation to the assumptions used. AXA measures sensitivity against both economic and non-economic assumptions (such as mortality, expenses, asset return on unit-linked funds). The other companies consider only economic assumptions. Table 4-1 shows an extract from the sensitivity analyses of the enterprises reviewed.

**Table 5-14: Sensitivity analysis**

| | 1% lower return | | | 1% lower discount rate | | |
|---|---|---|---|---|---|---|
| | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 |
| Allianz | -28% | -23% | -29% | 6% | 15% | 20% |
| AXA | -15% | -15% | -19% | 5% | n/a | n/a |

## 5.4 The Financial REPorting concept for life insurance

Let us try out the financial REPorting concept for life insurance and start at the recording of the only financial reporting variable that did not yet lose its innocence, i.e. cash flow.

**Table 5-15: From cash flow to operating profit**

| | Basic cash flows | Operating noise | Adjusted cash flows | Technical adjustments | Life operating result |
|---|---|---|---|---|---|
| *In-force business* | | | | | |
| Premium received | + | a | + | | + |
| Interest and dividend received | + | b | + | | + |
| Results on investments sold | .+/- | | .+/- | | .+/- |
| Benefits paid | - | c | - | | - |
| Expenses paid | - | d,e | - | | - |
| Investments purchased | - | | - | | - |
| Investments sold (amortised cost) | + | | + | | + |
| Difference net investments/required backing assets | | | | g | .+/- |
| Operating cash flow in-force business | 1 | | 1' | | 1" |
| | | | | | |
| *New business* | | | | | |
| Premium received | + | a | + | | + |
| Expenses paid | - | d,e | - | | - |
| Investments purchased | - | | - | | - |
| Difference in net investments /required backing assets | | | | g | .+/- |
| Operating cash flow from new business | 2 | | 2' | | 2" |
| | | | | | |
| Purchase of capital equipment | - | e | 0 | | 0 |
| Taxes paid | - | f | - | | - |
| | 3 | | 3' | | 3" |
| Enterprise's cash flow/operating profit life operations | 1+2+3 | | 1'+2'+3' | | 1"+2"+3" |

The left column of Table 5-15 shows historically recorded cash flows from life insurance operations. In order to increase relevance, the direct method for preparing a cash flow statement has been used. Apart from some expense allocation issues, this information is based on unambiguous observed historical facts. The second column eliminates the “operating noise” from the cash flows by introducing accruals for:

a premiums due, in the process of collection
b accrued interest and amortisation of discount and premiums
c benefits in the process of disbursement
d accrued expenses
e replacement investments by depreciation
f accrual for corporate income tax

The next step is to assess the difference between the actual net change in investments against life business and the investments that should have been made (see Table 5-16). This difference has been included in **g**. The decision on what amounts should be invested is taken by the enterprise, based on regulatory requirements and internal standards. Such a decision is partly based on subjective considerations, but once it is taken, reporting on this decision is an objectively observable fact.

After this adjustment, the right column gives the life operating profit, before remeasurement of assets and liabilities (restatement to fair value and recording the results of reserve adequacy tests).

The sum of net investments during the period and the difference from the required backing assets is the net change in insurance liabilities (before restatements).

**Table 5-16: Adjustment to life operating profit**

| |
|---|
| Premiums (+) |
| Benefits (-) |
| Investment income (+/-) |
| Expense loadings (-) |
| Experience results and margins released (-) |
| Target net change in investments (= change in life insurance liabilities net of DAC). |
| Net change in investments |
| Difference from cash flows (g) |

The life operating income in Table 5-15 is based on historical facts with as few subjective elements as possible. As a basis for explanation, it can also be written as presented in Table 5-17.

**Table 5-17: Comparison with expected margins**

| | Realised | Expected | Variance |
|---|---|---|---|
| Investment income | | | |
| Credited to insurance liabilities | | | |
| Result on investments | | | |
| | | | |
| Investment based expense loadings | | | |
| Other expense loadings | | | |
| Expenses | | | |
| Amortisation of acquisition costs | | | |
| Result on expenses | | | |
| | | | |
| Result on mortality | | | |
| Development result | | | |
| Result on morbidity | | | |
| Result on lapses and surrenders | | | |
| Total technical result | | | |
| | | | |
| Income on investments allocated to equity | | | |
| | | | |
| Discretionary profit participation | | | |
| | | | |
| Life operating profit before taxes | | | |
| Taxes | | | |
| Life operating profit after taxes | | | |

The expected margins are the margins that result from the product-pricing model and are comparable to the source of earnings presentation by Manulife (see section 5.2). Variances are to be explained (qualitatively or quantitatively) in performance (where did the enterprise achieve sustainable improvements in efficiency or otherwise), credibility (what is the meaning of the variances in relation to previous period's projections and estimates) and volatility (which movements take place due to factors beyond the control of the enterprise). As shown in section 5.2, insurance enterprises currently report volatility by indicating only the *estimated* sensitivity to changes in economic conditions (interest, stock market, etc.). The explanation discussed here shows the *observed* sensitivity to such conditions and adds credibility to the estimate of future sensitivities. In general, the variance analysis serves as a justification for changes (or omission of such changes) in assumptions underlying estimates and projections.

**Table 5-18: Present value of future profits**

| | Opening balance | Unwinding discount rate | Expected margins | Difference in-force policies | Change in assumptions: Asset related | Change in assumptions: Other | Closing balance |
|---|---|---|---|---|---|---|---|
| ***Discounted value of future:*** | | | | | | | |
| Investment income | | | | | | | |
| Credited to insurance liabilities | | | | | | | |
| Cost of options and guarantees | | | | | | | |
| Investment-based expense loadings | | | | | | | |
| Other expense loadings | | | | | | | |
| Expenses | | | | | | | |
| Amortisation of acquisition costs | | | | | | | |
| Result on mortality | | | | | | | |
| Development result | | | | | | | |
| Result on morbidity | | | | | | | |
| Result on lapses and surrenders | | | | | | | |
| Total technical result | | | | | | | |
| Discretionary profit participation | | | | | | | |
| Taxes | | | | | | | |
| PVIF | | | | | | | |

Table 5-18 shows the movements in the present value of future profits, a component of embedded value[54]. The first four columns are reasonably factual. The changes in assumptions include subjective elements, but these are underpinned by the explanation of variances discussed above. The roll-forward schedule according to Table 5-18 is reasonably in line with the presentation of embedded value (see section 5.3), with one important exception. I put all the asset related changes in assumptions into one column. This column shows the net change.

If interest rates change, the future interest credited to policies with a guarantee does not change. For cash flows of investments that match those liabilities, there is no change either. A change is limited to the mismatch between assets and liabilities.
If values of equity investments change (other than those for the account and risk of policyholders), this may affect the value of options and guarantees and future profit participation.

The asset-related net change to assumptions shows the observed sensitivity of the embedded value to changes in the economic environment that affected the fair value of assets during the reporting period. In my opinion, this sensitivity and not only the movement in the fair value of certain classes of assets, is relevant for presentation in the financial report. When certain assets in the balance sheet are restated to fair value, the carrying value of insurance liabilities should in my opinion be restated by:

54 The movement due to new business has been omitted from this table.

Asset related (net) change to assumptions + unrealised gains and losses on assets

This introduces a subjective element of projecting the future in the balance sheet, but this element can be easily identified and is supported by a sound Recording of historical facts, Explanation in relation to expectations and trends, and Projection of future cash flows.

The introduction of such a dominant subjective, future-oriented element at the face of the balance sheet is the choice between Scylla and Charybdis. The present practice, where the majority of instruments that are measured at fair value have quotations in an active market (or whose fair value can be reliably derived from quotations in an active market) leads to a misrepresentation of the volatility of equity and income. Applying the method described above measures the volatility as it should be, but this measurement depends on the choice of assumptions and parameters. For example, we saw earlier that the volatility in equity of an enterprise selling unit-linked policies with a minimum guarantee is not driven by the movement in the fair value of the equity investments, but by the value of the put option representing the guarantee. Such an option value moves up and down with the market value of the underlying equities, but the extent to which it moves depend upon parameters such as volatility, the selected mean to which prices can be expected to revert and the reversion speed. The differences in the choice of the assumptions may result in materially different answers. The primary issue here is not whether the assumptions and models selected lead to the "one true assessment" of future cash flows (these were, are and will remain unknown), but whether they are consistent and credible.

Consistency is, for example, relevant between assumptions used for in-force business and for pricing of new policies. Credibility is obtained from observations from the past and analysis of those observations. Credibility of the sensitivity to future changes in economic conditions such as interest is gained by an analysis of the observed sensitivity to past changes in economic conditions. Credibility of mortality assumptions is supported by the observed trends in mortality. Credibility in lapses and surrenders is supported by the observed movement in the book of insurance business and in the response to the measures taken by the enterprise to enhance persistency.

The elements mentioned can be found in some format in current financial reporting, partly in the financial statements, in the MD&A, in separate supplements or in analyst presentations. However, the prominent role of future estimates and projections in financial reporting requires a transparent trail from recording facts via explaining those facts to projections that is adequate for users to make their own judgments.

## 5.5 Summary and conclusions

The current practice of life insurance enterprises to measure liabilities is not too far removed from the practice applied by "regular" enterprises. Such enterprises recognise profits according to their delivery pattern and losses when they become apparent. Representative reporting rules for life insurance require the same (see section 5.1.1) and the example used in section 4.1 shows that this is conceptually correct. In this respect, insurance liabilities are treated as "tangible liabilities", rather than provisions or financial instruments, and in my opinion this is the correct treatment.

As with other industries, a sound standard cost price for each insurance product is essential for control over financial reporting. Solvency is a raw material in the manufacturing process of an insurance product, so the cost of solvency should be an integrated part of the standard cost price. In liability adequacy tests, the book value of liabilities should be compared to the integral costs, including cost of solvency. This creates an additional liability that is expected to be for the benefit of the shareholder and would on its own not meet the definition of a liability, but does have the specific nature of a life insurance product. Again, it is a practice that is consistent with that of "regular" enterprises with respect to quasi-tangible and tangible fixed assets. The fact that the fair value of such assets, when using a mark-to-model approach, is based on discounted cash flows using a weighted average cost of capital reflects the principle that equity should be held to fund such assets and that the cost of such equity should be considered when assessing the fair value.

Life insurance backing assets are closely related to life insurance liabilities. For assets that are for the account and risk of policyholders, movements in the assets do not lead to movements in the enterprise's equity. This should also be the case when expected liability cash flows are exactly matched by cash flows from assets. The net impact on the enterprise's equity and income should be limited to the effects of mismatches and of options and guarantees that are embedded in the insurance contract.

Recording movements in assets without considering the compensating movements in insurance liabilities is incorrect. It disregards the existing relationship (either by contract or by asset liability management) between backing assets and the insurance liabilities and it records a volatility in earnings and equity that does not exist. Until now, financial reporting principles for assets have been applied that evade this volatility (such as measuring at cost or amortised cost, measuring at moving average market value, deferring realised and unrealised gains, etc.). As application of these principles is no longer allowed (neither US GAAP, nor IFRS permits them for most of the assets backing insurance liabilities), the only possibility to avoid a misrepresentation of volatility is to remeasure insurance liabilities for the relevant market movements. This would mean the introduction of a significant degree of judgment in their measurement. While most assets' fair value can be measured by using market prices of the instruments themselves or of equivalent instruments, the compensating effect in insurance liabilities can, in most cases, only be determined if pragmatic rules with respect to unrecognised margins are applied.

Embedded value as discussed in section 5.3 is a measurement that recognises all margins at the point of sale. The emergence of conventions and principles such as EEVP make embedded value more and more suitable for financial reporting purposes. Nevertheless, embedded value is entirely based on projected future cash flows and should derive its credibility from the confrontation with historical events. In other words, it should be embedded in the financial REPorting concept.

The application of the financial REPorting concept to life insurance enterprises has been explained in section 5.4. Basically, it can be concluded that all the ingredients are already available in present-day financial reporting (if we introduce the supplementary embedded value information). Financial REPorting presents them in such a way that the user can clearly distinguish estimates and projections from information based on historical records and receives sufficient information on credibility and volatility that he can interpret the information in relation to his own beliefs about future developments and to his risk appetite.

A major challenge for the enterprise is to keep control over this kind of financial reporting. As noted earlier (see chapter 3 and section 5.2), standard setters and supervisors require more and more disclosure on performance (e.g. SEC rules regarding MD&A) and risk (IFRS 4 and 7) through the eyes of management. Control over this part of financial reporting requires that management information systems and financial reporting systems are seamlessly integrated. Chapter 2 concludes that financial reporting has historically been based largely on double entry accounting, which results in robust and consistent recording of historical events. It has never been designed, however, to focus on the future. In the next chapter, attention will be paid to accounting systems that provide a focus on the future and enable the recording of the impact on future events transaction by transaction.

**Appendix 5-I: Summary of financial data used (in millions of euros)**

## Balance sheets

| | Allianz | | | Axa | | | Prudential | | | Manulife | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 |
| Intangible assets | 15,147 | 16,262 | 18,273 | 16,045 | 16,244 | 18,332 | 1,939 | 2,287 | 2,466 | 5,567 | 363 | 383 |
| Investments | 325,384 | 301,509 | 296,685 | 268,949 | 250,521 | 250,933 | 183,882 | 170,602 | 177,204 | 104,117 | 46,433 | 47,476 |
| Investments for the account of policyholders | 15,851 | 32,460 | 25,657 | 113,786 | 101,002 | 90,458 | 33,797 | 28,265 | 24,232 | 71,814 | 44,021 | 35,547 |
| Reinsurers | 22,310 | 25,061 | 28,420 | 7,897 | 8,489 | 9,930 | 1,444 | 1,311 | 1,794 | 2,342 | 987 | 1,063 |
| Other assets | 616,006 | 560,620 | 483,098 | 74,284 | 72,977 | 75,004 | 26,479 | 26,999 | 27,957 | 2,552 | 954 | 1,202 |
| | 994,698 | 935,912 | 852,133 | 480,961 | 449,233 | 444,657 | 247,539 | 229,464 | 233,653 | 186,392 | 92,757 | 85,671 |
| | | | | | | | | | | | | |
| Insurance reserves | 355,195 | 311,471 | 305,763 | 272,160 | 259,532 | 263,172 | 148,864 | 143,556 | 165,760 | 86,047 | 35,623 | 38,480 |
| Insurance reserves account policyholders | 15,848 | 32,460 | 25,687 | 113,998 | 101,069 | 90,011 | 34,232 | 28,654 | 24,607 | 71,814 | 44,021 | 35,547 |
| Other liabilities | 583,296 | 555,022 | 490,695 | 66,440 | 62,762 | 64,951 | 34,606 | 34,509 | 25,785 | 14,249 | 7,410 | 6,358 |
| Unallocated cumulative surpluses | - | - | - | - | - | - | 23,665 | 17,943 | 11,780 | - | - | - |
| Minority interests | 9,531 | 8,367 | 8,314 | 2,206 | 2,469 | 2,812 | 101 | 152 | 166 | - | - | - |
| Shareholders' equity | 30,828 | 28,592 | 21,674 | 26,157 | 23,401 | 23,711 | 6,071 | 4,651 | 5,554 | 14,282 | 5,703 | 5,286 |
| | 994,698 | 935,912 | 852,133 | 480,961 | 449,233 | 444,657 | 247,539 | 229,464 | 233,653 | 186,392 | 92,757 | 85,671 |
| | | | | | | | | | | | | |
| Investments life assurance: | | | | | | | | | | | | |
| General account | 217,098 | 196,335 | 189,172 | 222,902 | 204,350 | 204,359 | 183,882 | 170,602 | 177,204 | 104,117 | 46,433 | 47,476 |
| For the account of policyholders | 15,851 | 32,460 | 25,657 | 113,786 | 101,002 | 90,458 | 33,797 | 28,265 | 24,232 | 71,814 | 44,021 | 35,547 |
| Life insurance reserves: | | | | | | | | | | | | |
| General account | 278,570 | 233,908 | 224,673 | 227,888 | 215,234 | 217,916 | 148,864 | 143,556 | 165,760 | 86,047 | 35,623 | 38,480 |
| For the account of policyholders | 15,848 | 32,460 | 25,687 | 113,998 | 101,069 | 90,011 | 34,232 | 28,654 | 24,607 | 71,814 | 44,021 | 35,547 |
| | | | | | | | | | | | | |
| US GAAP equity | 33,380 | 30,825 | 22,836 | 30,431 | 24,918 | 23,857 | 8,406 | 7,276 | 7,499 | 16,604 | 7,265 | 6,853 |

## Profit and loss accounts and changes in equity

| | Allianz | | | Axa | | | Prudential | | | Manulife | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 |
| Premium and fee income | 56,789 | 55,978 | 55,133 | 67,454 | 67,626 | 69,341 | 23,710 | 19,527 | 26,187 | 10,075 | 6,667 | 7,260 |
| Net investment income | 16,393 | 19,155 | 21,957 | 12,184 | 11,671 | 12,260 | 10,287 | 9,845 | 10,621 | 4,839 | 2,885 | 2,852 |
| Indirect investment gains and losses | 1,717 | ( 873) | ( 7,752) | 13,378 | 15,264 | ( 20,973) | 10,234 | 11,774 | ( 17,574) | | | |
| Other income | 12,192 | 10,083 | 10,580 | 4,833 | 4,364 | 5,027 | 121 | 67 | 668 | 1,880 | 984 | 1,022 |
| Total income | 87,091 | 84,343 | 79,918 | 97,849 | 98,925 | 65,655 | 44,352 | 41,213 | 19,901 | 16,795 | 10,536 | 11,135 |
| Benefits paid (net) | 40,577 | 42,100 | 40,326 | 51,444 | 49,599 | 53,142 | 19,318 | 16,991 | 21,787 | 11,235 | 5,902 | 6,980 |
| Change in insurance reserves (net) | 12,749 | 8,332 | 9,463 | 26,765 | 32,831 | ( 4,697) | 20,887 | 20,803 | ( 5,816) | ( 703) | 726 | 207 |
| Acquisition and administrative expenses | 22,240 | 22,117 | 24,502 | 14,397 | 13,867 | 14,589 | 3,047 | 2,770 | 2,976 | 4,048 | 2,664 | 2,728 |
| Other expenses | 5,178 | 7,520 | 6,098 | | | | | | | 87 | 73 | 92 |
| Total expenses | 80,744 | 80,069 | 80,389 | 92,606 | 96,297 | 63,034 | 43,252 | 40,564 | 18,948 | 14,667 | 9,364 | 10,007 |
| Profit before tax and goodwill amortisation | 6,347 | 4,274 | ( 471) | 5,243 | 2,628 | 2,621 | 1,100 | 648 | 953 | 2,127 | 1,171 | 1,128 |
| Amortisation goodwill | 1,164 | 1,413 | 1,162 | 1,031 | 844 | 877 | 143 | 142 | 156 | | | |
| Profit before tax | 5,183 | 2,861 | ( 1,633) | 4,212 | 1,784 | 1,744 | 957 | 507 | 797 | 2,127 | 1,171 | 1,128 |
| Tax | 1,727 | 146 | ( 807) | 1,372 | 536 | 426 | 342 | 208 | 67 | 541 | 200 | 205 |
| Minority interest | 1,257 | 825 | 670 | 321 | 243 | 368 | ( 15) | ( 3) | ( 14) | | | |
| Net result | 2,199 | 1,890 | ( 1,496) | 2,519 | 1,005 | 950 | 630 | 301 | 745 | 1,587 | 972 | 923 |
| | | | | | | | | | | | | |
| Foreign currency translation differences | ( 840) | ( 1,699) | ( 1,247) | ( 750) | ( 985) | ( 1,197) | ( 237) | ( 366) | ( 401) | ( 975) | ( 639) | 34 |
| Unrealised gains and losses | 1,649 | 2,179 | ( 6,930) | | | | | | | | | |
| Other | | ( 4) | | 1 | 154 | 34 | | | | | | |
| Comprehensive income | 3,008 | 2,366 | ( 9,673) | 1,770 | 174 | ( 213) | 393 | ( 65) | 344 | 611 | 333 | 956 |
| | | | | | | | | | | | | |
| Opening balance equity | 28,592 | 21,674 | 31,613 | 23,401 | 23,711 | 24,780 | 4,651 | 5,554 | 6,370 | 5,703 | 5,286 | 5,891 |
| Comprehensive income | 3,008 | 2,366 | ( 9,673) | 1,770 | 174 | ( 213) | 393 | ( 65) | 344 | 611 | 333 | 956 |
| Capital raised | 86 | 4,562 | 16 | 1,662 | 197 | 262 | 1,679 | 43 | 64 | 8,537 | 8 | ( 680) |
| Change in treasury stock | ( 59) | 1,413 | ( 157) | - | - | - | | | | | | |
| Dividends | ( 551) | ( 374) | ( 364) | ( 676) | ( 680) | ( 1,117) | ( 533) | ( 463) | ( 826) | ( 435) | ( 368) | ( 285) |
| Convenience translation difference | | | | | | | ( 119) | ( 418) | ( 397) | ( 134) | 444 | ( 597) |
| Other | ( 248) | ( 1,049) | 239 | 1 | ( 1) | ( 1) | | | | | | |
| | 30,828 | 28,592 | 21,674 | 26,158 | 23,401 | 23,711 | 6,071 | 4,651 | 5,554 | 14,282 | 5,703 | 5,286 |
| | | | | | | | | | | | | |
| US GAAP Net income | 2,881 | 2,245 | ( 1,260) | 3,235 | 3,673 | ( 2,588) | 134 | 963 | ( 649) | 1,624 | 987 | 615 |

## Technical accounts life and health

| | Allianz | | | Axa | | | Prudential | | | Manulife | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 |
| Premium and fee income | 18,596 | 18,701 | 18,675 | 46,272 | 46,293 | 48,064 | 23,710 | 19,527 | 26,187 | 10,075 | 6,667 | 7,260 |
| Net investment income | 11,549 | 11,450 | 11,226 | 10,986 | 10,539 | 10,997 | 10,113 | 9,861 | 11,038 | 4,839 | 2,885 | 2,852 |
| Indirect investment gains and losses | 1,260 | ( 1,702) | ( 3,734) | 12,727 | 15,234 | ( 21,681) | 10,224 | 11,782 | ( 17,476) | - | - | - |
| Other income | 2,810 | 1,879 | 1,269 | 821 | 532 | 532 | - | - | - | 1,880 | 984 | 1,022 |
| Total income | 34,215 | 30,328 | 27,436 | 70,806 | 72,598 | 37,912 | 44,047 | 41,169 | 19,749 | 16,795 | 10,536 | 11,135 |
| Benefits paid (net) | 17,385 | 17,085 | 15,541 | 39,380 | 36,025 | 38,641 | 19,311 | 16,985 | 21,779 | 11,235 | 5,902 | 6,980 |
| Change in insurance reserves (net) | 9,018 | 6,171 | 5,743 | 23,056 | 29,817 | ( 7,971) | 21,174 | 20,803 | ( 5,816) | ( 703) | 726 | 207 |
| Acquisition and administrative expenses | 4,399 | 3,713 | 4,263 | 5,773 | 5,254 | 5,674 | 2,923 | 2,669 | 2,873 | 4,048 | 2,664 | 2,728 |
| Other expenses | 1,608 | 2,204 | 1,806 | | | | | | | 87 | 73 | 92 |
| Total expenses | 32,410 | 29,173 | 27,353 | 68,209 | 71,096 | 36,344 | 43,408 | 40,457 | 18,837 | 14,667 | 9,364 | 10,007 |
| Profit before tax and amoritzation goodwill | 1,805 | 1,155 | 83 | 2,597 | 1,502 | 1,568 | 639 | 712 | 912 | 2,127 | 1,171 | 1,128 |
| Goodwill amortisation | 159 | 398 | 174 | 342 | 423 | 319 | | | | | | |
| Profit before tax | 1,646 | 757 | ( 91) | 2,255 | 1,079 | 1,249 | 639 | 712 | 912 | 2,127 | 1,171 | 1,128 |
| Tax | 469 | 589 | 67 | 758 | 289 | 119 | | | | 541 | 200 | 205 |
| Minority interest | 369 | 216 | ( 177) | 107 | 119 | 68 | | | | | | |
| Net result | 808 | ( 48) | 19 | 1,390 | 671 | 1,062 | 639 | 712 | 912 | 1,587 | 972 | 923 |

## Development in embedded values

| | Allianz | | | AXA | | | Prudential | | | Manulife | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 | 2004 | 2003 | 2002 |
| Unwinding of discount rate and yield on surplus | 945 | 935 | 874 | 1,504 | 1,188 | 1,403 | 889 | 921 | 1,049 | 1,112 | 699 | 802 |
| Experience and assumptions variances | 76 | (57) | (251) | 429 | - | (243) | (277) | (465) | (275) | 231 | 169 | 305 |
| In-force operating EV profit | 1,021 | 878 | 623 | 1,933 | 1,188 | 1,160 | 613 | 456 | 774 | 1,344 | 868 | 1,107 |
| Value of new business | 611 | 265 | 231 | 771 | 512 | 515 | 976 | 876 | 1,232 | 674 | 571 | 447 |
| Total operating EV profit | | | | | | | 1,588 | 1,332 | 2,005 | | | |
| Taxes | | | | | | | (472) | (465) | (538) | | | |
| | 1,632 | 1,143 | 854 | 2,704 | 1,700 | 1,675 | 1,116 | 867 | 1,467 | 2,018 | 1,439 | 1,554 |
| Investment variances and assumption changes | 103 | 408 | ( 1,384) | 1,386 | 198 | ( 1,050) | 539 | 58 | ( 1,967) | 315 | 355 | ( 291) |
| Foreign currency translation differences | ( 206) | ( 687) | - | ( 851) | ( 1,376) | ( 2,138) | ( 355) | ( 576) | ( 532) | ( 1,020) | ( 1,326) | 16 |
| Other | ( 87) | ( 14) | ( 32) | - | - | - | 60 | | | | | |
| Embedded value result | 1,442 | 850 | ( 562) | 3,239 | 522 | ( 1,513) | 1,360 | 349 | ( 1,031) | 1,313 | 468 | 1,279 |
| Opening embedded value | 11,657 | 10,977 | 9,559 | 21,748 | 22,755 | 24,736 | 10,304 | 10,899 | 12,355 | 9,496 | 9,072 | 9,945 |
| Restatement re options and guarantees | ( 414) | | | | | | | | | | | |
| Base differences | 562 | 1,159 | 583 | 114 | - | - | | | | | | |
| Investments / divestitures | 287) | 224) | - | 1,295 | - | - | | | | 6,669 | 8 | 79 |
| Embedded value result | 1,442 | 850 | ( 562) | 3,239 | 522 | ( 1,513) | 1,360 | 349 | ( 1,031) | 1,313 | 468 | 1,279 |
| Capital injections (repayments) life business | ( 571) | ( 1,105) | 1,397 | 447 | ( 1,529) | ( 383) | 135 | ( 100) | 350 | ( 376) | ( 222) | ( 676) |
| Convenience translation differences | | | | | | | ( 91) | ( 845) | ( 774) | ( 105) | 170 | ( 1,556) |
| | 12,389 | 11,657 | 10,977 | 26,843 | 21,748 | 22,840 | 11,708 | 10,304 | 10,899 | 16,997 | 9,496 | 9,072 |

## Appendix 5-II: Major assumptions (%) for embedded value estimates

| | 2004 | | | | 2003 | | | | 2002 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AL | AX | PR | MA | AL | AX | PR | MA | AL | AX | PR | MA |
| Germany | 6.75 | 6.25 | | | 8.15 | 6.75 | | | 8.15 | 7.00 | | |
| France | 6.75 | 6.25 | | | 8.15 | 6.75 | | | 8.15 | 7.50 | | |
| USA | 7.45 | 7.25 | 7.20 | 8.25 | 8.15 | 7.50 | 7.40 | 8.25 | 8.15 | 7.50 | 7.00 | 8.00 |
| UK | | 7.00 | 7.40 | | | 7.25 | 7.40 | | | 7.00 | 7.10 | |
| Canada | | | | 8.25 | | | | 8.75 | | | | 8.75 |
| Hong Kong | | 8.25 | | 9.25 | | 8.50 | | 9.25 | | 8.00 | | 9.00 |
| Japan | | 5.74 | | 6.50 | | 5.11 | | 6.50 | | 6.00 | | 6.00 |

| | Risk-free return | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | | | | 2003 | | | | 2002 | | | |
| | AL | AX | PR | MA | AL | AX | PR | MA | AL | AX | PR | MA |
| Germany | 3.60 | 3.75 | | | 4.30 | 4.25 | | | 4.40 | 4.50 | | |
| France | 3.60 | 3.75 | | | 4.30 | 4.25 | | | 4.40 | 4.50 | | |
| UK | | 4.50 | 4.60 | | | 4.75 | 4.80 | | | 4.50 | 4.50 | n/a |
| USA | 4.30 | 4.75 | 4.30 | 4.25 | 4.30 | 5.00 | 4.30 | 4.25 | 4.20 | 5.00 | 3.90 | n/a |
| Canada | | | | 4.25 | | | | 4.75 | | | | |
| Hong Kong | | 4.75 | | 4.25 | | 5.00 | | 4.25 | | 5.00 | | n/a |
| Japan | | 2.91 | | 1.50 | | 2.11 | | 2.50 | | 2.80 | | n/a |

| | Equity return | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | | | | 2003 | | | | 2002 | | | |
| | AL | AX | PR | MA | AL | AX | PR | MA | AL | AX | PR | MA |
| Germany | 7.10 | 6.75 | | | 8.50 | 7.25 | | | 8.50 | 7.25 | | |
| France | 7.10 | 6.75 | | | 8.50 | 7.25 | | | 8.50 | 7.50 | | |
| USA | 7.80 | 8.25 | n/a | 8.25 | 8.50 | 8.50 | n/a | 8.25 | 8.50 | 8.50 | n/a | n/a |
| UK | | 7.00 | 7.1 | | | 7.25 | 7.30 | | | 7.50 | 7.00 | |
| Canada | | | | 8.25 | | | | 8.75 | | | | |
| Hong Kong | | 7.54 | | 9.25 | | 8.10 | | 9.25 | | 8.10 | | n/a |
| Japan | | 7.00 | | 6.50 | | 7.00 | | 6.50 | | 6.00 | | n/a |

## Appendix 5-III: Disclosures

| IFRS 4 | | | Similar EEVP disclosure (principle 12) |
|---|---|---|---|
| § | **Basis for measurement/estimates** | **Risk/volatility** | |
| 36 | *To identify and explain the amounts from insurance contracts* | | *Description of covered business* |
| 37 | Process to determine the assumptions that have the greatest impact on measurement (best estimates or including PADs, source of data, consistency with observable market prices).<br>Quantified disclosure of those assumptions. | The effect of changes in assumptions used to measure insurance assets and liabilities. | Principal assumptions and the discount rate.<br>How economic and other business assumptions are determined. |
| | Description of how past experience, current conditions and other relevant benchmarks are taken into account in developing benchmarks and assumptions.<br>Description of methods to develop future trends. | Explanation of reasons for using assumptions that differ from past experience (if any) and the extent of the differences. | Identify and explain all variance between the actual experience and that anticipated in the projection assumptions. |
| | | Roll forward schedules of insurance assets and liabilities and related DAC. | Opening and closing embedded values together with a breakdown of the change in EV over the period. |
| 38 | *To understand the amount and timing of future cash flows* | *To understand the uncertainty of future cash flows* | |
| 39 | | Risk management objectives and policies relating to insurance contracts. | |
| | Contract attributes (including participation features) that have a material impact on the amount and timing of future cash flows. Such information may include the part of the recognised liabilities falling due within one year and the part falling due later.<br>Information on lapse and surrender options if applicable (note: information about cash flows and not on cash flows is required).<br>Average discount rates implicit in the measurement of insurance liabilities. | Contract attributes (including participation features) that have a material impact on the uncertainty of future cash flows. This information should outline the extent to which a risk exposure is altered by the relationship among the assets and liabilities. If necessary, further information on this point is given. | Methodology used for estimating embedded value. |
| | | Insurance risk (information given “through the eyes of management”).<br>(gross and net of reinsurance).<br>(classification by more dimensions, like investment and mortality risk)<br>Sensitivities (preferably also | Sensitivities |

| IFRS 4 | | | Similar EEVP disclosure (principle 12) |
|---|---|---|---|
| § | **Basis for measurement/estimates** | **Risk/volatility** | |
| | | quantitative)<br>(focus on summary indicators, i.e. results and equity)<br>Concentration (Exposure to unexpected changes in trends):<br>- human mortality;<br>- policyholder behaviour)<br>(Exposure to major changes interest rates, etc.)<br>- (Geographical and sectoral concentration)<br>- Estimation volatility | |
| | | Interest rate risk and credit risk as required for financial instruments. | Sensitivities. |
| | | Exposures to interest rate risk or market risk of embedded derivatives not measured at fair value. | Sensitivities. |
| | | | New business and new-business margins.<br>Consistency of disclosures of new-business premiums with the EEVP new-business definition. |

# 6 Creating and recording value

In previous chapters, it has been concluded that information on value and volatility is crucial to large groups of users of financial statements. This underlines the relevance of future cash flows that *may be* for the benefit of certain users (owners), as well as the relevance of the degree of certainty that an enterprise will generate the minimum amount of cash flow necessary to meet its commitments.

Thus, both value (based on future cash flows) and volatility (the possible outcomes of future cash flows) are future-oriented, and information on value and volatility has no meaning unless it has a robust and transparent basis in the historical development and in the strategy and intentions of an enterprise.

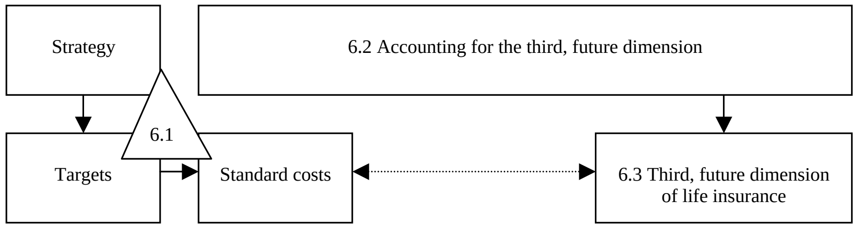
Historically, accounting systems have primarily been designed to record historical events and to satisfy legal reporting requirements. Kaplan et al. (1991, page 129) mention this as an indication that financial accounting systems do not provide the information required to support management decisions. They use this argument primarily in the context of cost accounting that mainly supports the statutory valuation of inventory, etc. and does not necessarily support management decisions on the use of resources. In the past, management information systems often developed apart from accounting systems, because of the difference in information requirement and because of the "instability" of management information requirements that may vary from situation to situation and demand a high degree of flexibility. Enterprise Resource Management systems increasingly integrate the financial and the management accounting systems, providing a combination of the robustness of the traditional recording of historical events and the flexibility to meet all information requirements.

Future-oriented information has gradually slipped into external financial reporting and disclosures on the assumptions underlying the estimates have become more and more important. As regards assumptions, an explanation relating to past experience and external data is often required by standard setters (IFRS 4, see section 4.4). When explaining risk (IFRS 4 and 7 and SEC rules on item 11) and performance (SEC rules on management discussions and analysis), standard setters and supervisors require a view "thru the eyes of management" to be provided. The latter in particular depends on enterprise information systems that have the flexibility of management accounting systems and the robustness of the traditional financial accounting systems.

Strategy and intentions unavoidably play a role in future-oriented information. Realisation of past strategy and intentions adds credibility to future-oriented information.

The Financial REPorting concept introduced in the previous chapters abandons the idea of preparing a balance sheet and (comprehensive) income statement that include everything on solvency, liquidity and profitability and introduces a concept in which sequentially historically Recorded events are summarised and presented, past performance, volatility and credibility are Explained, and Projections are presented in a consistent and transparent way. In section 4.6, this concept has been explained for insurance enterprises. The present chapter examines the enterprise and investigates how accounting systems can be further enhanced to support the Financial REPorting concept.

The road map to this chapter is as follows:




Section 6.1 describes the principal value drivers of an insurance enterprise in order to obtain a basic understanding of risk indicators and performance indicators that play a role in explaining the financial affairs of a life insurance enterprise.

Section 6.2 describes a bookkeeping method developed by Yuri Ijiri (1982) that attempts to formalise the gathering and recording of information about the future and integrate it into a single model with the recording of historical events. The method is called Triple Entry Bookkeeping. It redefines the two dimensions in double entry bookkeeping (debit and credit) into historical development and current breakdown of wealth, and adds a third dimension that captures the future.

Section 6.3 investigates the extent to which triple entry bookkeeping is applicable to insurance enterprises.

Section 6.4 gives a summary and provides conclusions.

## 6.1 Principle strategic value drivers of life insurance enterprises

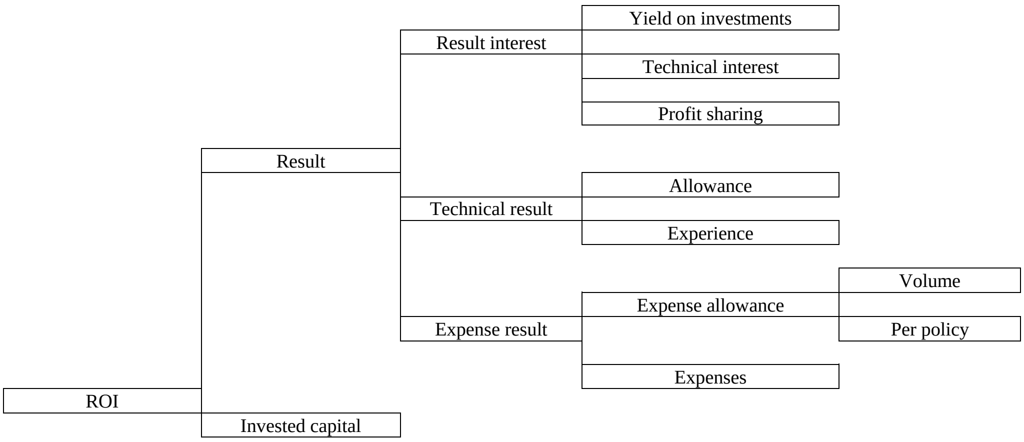
Strategy and intentions are important for estimating and evaluating future developments. Allan Kay (one of the inventors of the Smalltalk programming language and one of the fathers of the idea of Object Oriented Programming) once said:

Don't worry about what anybody else is going to do... The best way to predict the future is to invent it. Really smart people with reasonable funding can do just about anything that doesn't violate too many of Newton's Laws!

Strategy sets the general target of an enterprise. For a commercial enterprise, it has a dimension of “how much”, of “how” and of “when”. The relationship between strategy and projected future cash flows is obvious: if you have the intention to go somewhere, have demonstrated the skills to get where you intend to be and have evaluated the circumstances that are beyond your control, your target is the best possible prediction of your position at a certain future moment.

There have been many methods for evaluating strategy. A well-known one is the Return on Investment chart (Kaplan et al., 1991, page 16). Figure 6-1 shows the first nodes of an ROI chart of a life insurance enterprise.

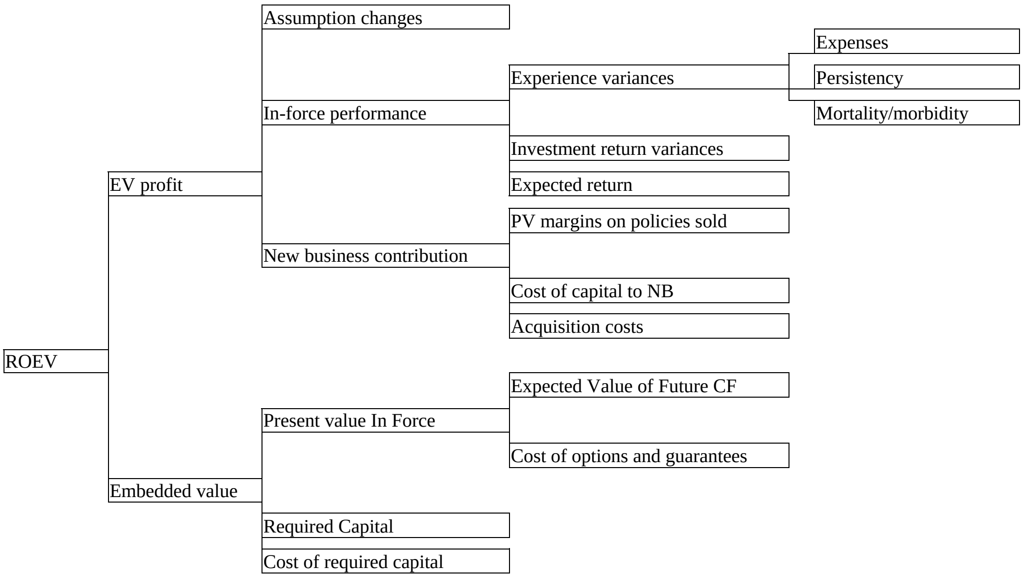
**Figure 6-1: ROI Life insurance enterprise**




As noted earlier, ROI for a life insurance enterprise is often an unsatisfactory performance indicator. One of the reasons is the “new business strain” in the year of sale due to restrictions of standard setters and regulators on the deferral of acquisition costs and minimum technical reserve requirements. An example has been shown in section 4.4. It is therefore possible that a commercially successful enterprise shows a worse ROI than a low-selling enterprise and that without further explanation a successful enterprise cannot be distinguished from an enterprise that performs poorly because of inadequate pricing.
Figure 6-2 shows a similar schedule for the Return on Embedded Value[55].

55 Embedded value as defined in the principles published by the European CFO Forum.

**Figure 6-2: Return on embedded value**




On the one hand, this chart has some attractive features. It directly measures performance on the sale of new business in relation to the expenses incurred in generating it. Furthermore, it measures the variances on earlier assumptions. These variances may relate to volatility indicators (as is often the case with investment return variances), credibility indicators (how accurate or how biased were earlier estimates) or performance indicators (how successful was the enterprise in meeting targets on, for example, expense or persistency). Finally, the denominator includes required capital. If a theoretically sound measure for economic capital were used, all risk factors that affect future cash flows would be taken into account. Greater uncertainty about estimated future cash flows would then automatically translate into higher economic capital and a lower ROEV. Alternatively, risk management strategies (e.g. hedging of exposures) may increase the ROEV, even if they have a cost that decreases the in-force performance.

However, caution is advised. Value of In-Force Business and Value of New Business represent the present value of unknown future cash flows and are only as good as their predictions are. Since it has been claimed above that "the best way to predict the future is to shape it", it is useful to have a closer look at the strategy that drives future cash flows.

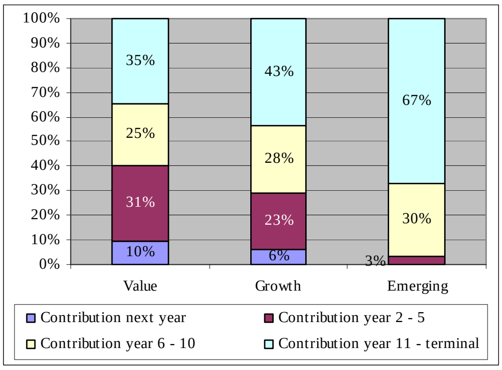
A well-known method for measuring performance comprehensively is the balanced scorecard. It has been widely adopted, not only as a measurement system but also as a strategic management system (Kaplan et al., 2004). The balanced scorecard measures performance from four perspectives:

- Financial perspective: ability to satisfy the owner/shareholder.
- Customer perspective.
- Internal perspective.
- Learning and growth perspective.

These perspectives play a role in the development of a strategy map. Kaplan et al. (2004, page 10) state that strategy balances contradictory forces.

Investing in intangible assets for long-term revenue growth usually conflicts with cutting costs for short-term financial performance. The dominant objective for private sector organisations is the creation of sustained growth in shareholder value. This implies a commitment to the long-term.

**Figure 6-3: Development of shareholder value**




The truth of this statement is supported by the example presented in Figure 6-3,which shows the fundamental valuation (future discounted cash flows) of a value stock (equal cash flows in each year), a growth stock (10% growth during 10 years) and an emerging stock (positive cash flows start after year 5 and grow rapidly in the first years thereafter).

The figure demonstrates that even in the case of the value stock more than half of the value relates to the period after year 5. In other words, short-term targets that do not provide a sustainable position have only limited relevance and sacrificing long-term goals to the short run conflicts with the creation of shareholder value[56].

With respect to the *customer perspective*, Kaplan et al. mention value proposals such as low total cost, product innovation and leadership, complete customer solutions and lock-in. For an insurance enterprise, a low cost strategy has a strategic[57] and regulatory boundary with respect to safety margins. As demonstrated in chapter 4, the standard cost price of an insurance product should include at least a certain margin for absorbing the market price of risk, represented by the cost of required capital. Cost can be kept low by controlling maintenance and distribution strategies, by limiting the risks and thus the required economic capital (which normally means less benefits for the policyholders), or through innovative risk management techniques. Cutting distribution costs, in particular, is also subject to strategic and regulatory boundaries. Customers are looking for a solution (protection, provision for old age, etc.) and may not always see the connection between this solution and the relevance of the insurance products offered. Economising on acquisition costs without regard to the side effects may lead to sales targets not being met or miss-selling practices (which may, in turn, result in regulatory sanctions or lapse and surrender numbers higher-than-expected).

In certain circumstances, costs of benefits can be kept low by well-developed acceptance procedures or by creating preferential rates for certain classes of policyholders (e.g. a non-

56 See also the Revised Conditional Normative Accounting Theory explained in section 2.6.4.

57 Strategic boundaries are one of the levers of control identified by Simons (1995). They represent borders that the enterprise or its employees may not cross. Such borders may be certain risk exposures that shall not be exceeded, illegal or unethical behaviour, certain types of investments that shall not be held, etc.

smokers rate for term insurance). The total cost of a life insurance contract can also be kept low by superior investment performance (the higher the expected investment yield, the lower the discounted value of benefits and costs, so the lower the premium rate can be). This is also strategically bound by the maximum risk exposure that may be taken. In a well-managed insurance enterprise, a larger risk appetite directly translates into more allocated capital (causing capital to become more expensive).

With respect to product innovation and leadership, it should be emphasised that the basic life insurance products include a limited number of species. They pay out on death and /or survival, lump sums or regular amounts, in exchange for single premiums or annual premiums. They may offer profit participation; they may leave part or all of the investment risk for the policyholder to bear.

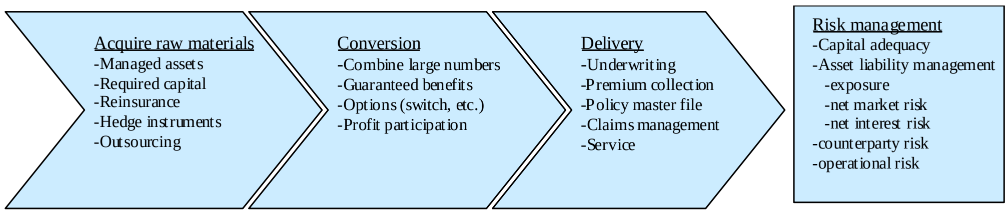
However, as stated above, most customers have no direct need for an insurance product; they more likely seek a solution that fits their personal financial situation, which may vary by event (marriage, birth of a child, purchase of a house) and over time (due to demographic developments). The challenge of product innovation and leadership is often to assemble as many solutions as possible from a limited number of basic product modules.

Complete customer solutions relating to life assurance often involve a comprehensive pension plan, a mortgage loan with a linked endowment to provide for redemption and protect the principal during the lifetime of the loan, etc.

Lock-in strategies relate to strategies to keep customers tied. Life insurance policies often have a surrender charge in order to accomplish this. Such a charge mitigates the cost of a surrender guarantee or similar embedded option in a life insurance policy.

In the *internal perspective*, Kaplan et al. distinguish operations management, customer management, innovation and regulatory/social processes. Most of the financial flow of an insurance enterprise is the responsibility of operations management. Figure 6-4 shows the clusters identified by Kaplan et al. within operations management that are linked to the relevant content for life insurance enterprises.

**Figure 6-4: Operations management**




Risk management has a central function within an insurance enterprise, because the product and the source of added value is the assumption of risk. Risk management monitors that the strategic boundaries (unacceptable exposures, unacceptable risk types, etc.) are not violated and that capital is allocated in proportion to the risks assumed (which ensures that the cost of assuming risk is properly reflected in the “raw materials”). Key performance indicators that should be included in the diagnostic control system[58] to measure the success of managing operations are expected margins and experience variances, together with the underlying financial and non-financial analyses. Measurement of investment performance is somewhat more complicated and an extensive discussion is beyond the scope of this section. Investment yield and movements in investment value are largely determined by economic conditions that are beyond the control of the enterprise. Aggregate annual investment income is primarily a volatility indicator. Two key questions have to be answered when evaluating investment performance:

- How does the performance relate to predetermined external measures (benchmarks)?
- How far was the net movement in value due to changes in economic variables in relation to previously estimated sensitivities?

Customer management processes interact with some of the key performance indicators mentioned above. Improper selection of the class of potential customers may, for example, lead to higher mortality benefits than assumed. Improper selling practices or inadequate after-sales support may cause policies to lapse, resulting in a loss of value that exceeds assumptions.

Innovation relates to the development of product/solution combinations. Solutions supplied by insurance enterprises are very sensitive to technological innovation (offering flexibility in premium payments, switching between investment categories, management and documentation of hedging programmes, etc.).

Regulatory and social processes interact strongly with the regulation of the insurance industry in most countries. Supervision of insurance enterprises may involve:

- Prudential supervision: is the probability that commitments towards policyholders cannot be met sufficiently remote? This has a strong relationship with risk management discussed earlier and the availability of sufficient economic capital.
- Supervision on conduct: are the commitments and arrangements agreed with policyholders sufficiently relevant?

Finally, the learning and growth principle relates to human capital, information capital and organisational capital, in other words, the "real" intangible assets that make strategy work. The question is:
Are employees, information collections and systems and organisational structure sufficiently ready to:

- make the internal processes work in order to:
- make the right value proposal to customers, so that:
- the intended growth in (shareholder) value is achieved.

An example of creating human capital readiness within an insurance enterprise is giving advisors the training they need when integrated solutions for pension plans (including financial planning, tax aspects) are to be offered.

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58 Diagnostic control systems form another lever of control identified by Simons (1995, page 59). They are defined as the formal information systems that managers use to monitor organisational outcomes and correct deviations from preset standards of performance.

Examples of creating information capital readiness are:
- Databases and data mining functionality needed to generate sales leads.
- Functionality that is necessary to record the exposures resulting from options and guarantees embedded in policies and to manage, record and control the hedge instruments for mitigating such exposures.

Turning back from strategy and targets to embedded value estimates, the following observations can be made. The financial aspects of the strategy are documented from period to period in the planning and control cycle. Integrating this planning and control cycle with embedded value estimates enhances the estimates because the strategic drivers are pushed down to the estimates. Consider the following equality of the profit budget for the next year:

Budget profit = Budget In-force profit + Budget New Business result

Now consider the table in Figure 6-5 that shows the expected development of the embedded value for next year.

**Figure 6-5: Schedule of expected development of embedded value**

| | Opening value | Budget IF profit | Expected IF return | New business | Δ required capital | Assumption changes | Closing value |
|---|---|---|---|---|---|---|---|
| PVIF | A | (E) | F | I | | M | A-E+F+I+M |
| Required capital | B | E | G | (K) | (L) | | B+E+G-K-L |
| Cost of required capital | C | | (H) | J | | O | C-H+J+O |
| Embedded value, excl. free surplus | A+B-C | 0 | F+G+H | I-J-K | (L) | M-O | S |
| Free surplus | D | | N | | L | | D+L+N |

E is the expected accounting profit for the year under review, relating to existing business. F is the unwinding of the discount rate on the opening value of the PVIF. G represents the expected investment income on required capital. H is the difference between the expected and the required return, adjusted for the unwinding of the discount rate on the cost of required capital itself. Consequently, the sum F + G + H represents the unwinding of the discount rate on the opening value of the embedded value.

K represents the effects of the "new business strain", i.e. acquisition costs that cannot be deferred, PADs that have to be formed for supervisory or other reasons, etc. Depending on the financial reporting principles applied (e.g. the degree to which acquisition costs are deferred), there is an interrelation between I, K and L.

L represents the transfer from required capital to free surplus or vice versa. A transfer from required capital to free surplus is due to a decrease in the amounts at risk in the existing business and the profits that become available; a transfer from free surplus to required capital is due to new business or an increase in the amounts at risk in existing business.

M represents the changes in the embedded value assumptions due to the sustainable change identified in the planning and control process.

N is the expected return on free surplus.

Dividends (a decrease in free surplus), DAC impairments and technical reserve reinforcements (a decrease in required capital, offset by a higher transfer from free surplus) are ignored in this schedule.

As can be seen, the comprehensive accounting profit according to the budget can be represented by the following formula:

$$Acc\,\mathrm{Pr} = E + G - K + N$$

Although considerations with respect to the budget are relevant to the cash flows/profits that "lock out" in the next reporting period (E, K, G and N), the need to reconsider the "stock of future cash flows" that the PVIF represents (M) may also arise. Applying all the considerations resulting from the planning and control cycle to the embedded value estimate pushes strategy towards the estimate and enhances its quality.

As mentioned in section 5.3, the European CFO Forum of insurance enterprises issued 12 principles for reporting on embedded value. Appendix 6-I summarises the requirements for information systems and control measures that would be necessary to adhere to those principles in a sufficiently robust way.
The next sections will investigate the possibilities to account for embedded value as a "stock of earnings" that is updated event by event. Applying such a method enables analysis of the development in embedded value, allowing a clear picture to be given of which development are based on objective observations and which developments involve judgment and estimation of future developments.

A key factor relates to processes that support robust accounting estimates. The best approach to creating this support is to focus on processes that align with the execution and monitoring strategy, because these are the processes that help "shape the future". The following processes are relevant.

- Activity Based Costing (ABC), because this ensures the most relevant allocation to acquisition and maintenance cost by product. A proper cost allocation and assessment of the degree of variability helps to predict future cash outflows and assists in the analysis of experience in relation to assumptions. Consequently, it supports accounting estimation processes such as liability adequacy tests and embedded value estimates.
- Standard cost pricing. Proper integral technical standard cost prices (including the cost of all options and the cost of solvency) help to measure the consequences of the sale of new policies (new business margins), help prevent inadequate pricing or help in measuring the accounting consequences.
- Asset Liability Management, because it helps to reduce the risks of a mismatch between assets and liabilities, but also to measure it and support the disclosures on sensitivities and the measurement of economic capital.
- Experience to assumption analysis. This tool for assessing the credibility of previous future estimates has a solid place in management information, but has been underemphasised in external financial reporting. However, in financial reporting disclosures (IFRS 4, § 37, see appendix III of chapter 5) and in European Embedded Value Principles, this information is gradually obtaining the place it deserves.
- Reassessment of assumptions. This process is to ensure that the learning from past experience and the knowledge on changing circumstances are properly reflected in the estimates of future cash flows.

## 6.2 Recording the future: triple-entry bookkeeping

In chapter 2, I have discussed (double-entry) bookkeeping as a source for financial reporting. It was found that double-entry bookkeeping does not provide all the required information. In particular, the information to make estimates regarding information about the future is lacking. The process of gathering and recording this information (e.g. the estimated future cash flows supporting the embedded value) is often not formally linked to the processes discussed at the end of the previous section and does not have the robustness of the "traditional" accounting system. The importance of future estimates in financial reporting raises the need for a more formalised recording of such estimates and the changes in them.

Yuri Ijiri (Triple-Entry Bookkeeping and income momentum, 1982) attempted to formalise the gathering and recording of information about the future by adding a dimension to traditional double-entry bookkeeping. The third dimension is meant to record historical documented events that capture information about the future.

In traditional double-entry bookkeeping, each transaction is entered as a debit and a credit. Negative numbers are normally avoided. Ijiri redefines the two (debit and credit) dimensions as:

1. Wealth. For the time being, I define this (the same as Ijiri, 1982) as assets minus liabilities. Assets are recorded positive and liabilities with a minus sign. This static (stock) dimension describes the content of the wealth.
2. Capital. This dynamic (flow) dimension explains the historical development, i.e. the cumulative results and transactions with the owner.

Wealth is an answer to the question: "What do I own?" For example, the assets consist of 5,000 in cash and a building worth 200,000. There is also a loan of 100,000. My wealth is then 105,000.

Capital is an answer to the question: "Where does what I own come from?" For example, last year my wealth was 100,000. During the year, I had rental income of 20,000, interest expenses of 5,000 and other expenses of 10,000. My incremental capital flow is then 5,000 and my accumulated capital flow is 105,000.

Ijiri adds a third dimension to the bookkeeping system, i.e. the future, as shown in Figure 6-6.

**Figure 6-6: The third dimension**

**Past = Present** ◄────────────► **Present = Future**

By adding the third dimension, the present (wealth) is explained not only by the past developments, but also by the future developments. Given the observation made in chapter 2, that wealth measured as subjective value is explained by future developments (cash flows), this is an interesting thought. If one were able to record anticipated future developments objectively journal entry by journal entry (as historical developments are recorded journal entry by journal entry), complex estimation processes such as embedded value could be formalised and the measurement of wealth/subjective value could be improved.

Ijiri distinguishes two applications of adding a third dimension to bookkeeping, i.e.:

- Temporal triple-entry bookkeeping;
- Differential triple-entry bookkeeping.

### 6.2.1 Temporal triple-entry bookkeeping

Temporal triple-entry bookkeeping adds budget as a third dimension. This leads to an equation as shown in Figure 6-7.

**Figure 6-7: Temporal triple entry equation**

**(Estimated future wealth – Budget) = Present wealth = Capital Stock = Past realisation**

Hence, an opening balance includes not only the details of wealth and the capital stock, but also the budget and thus the target wealth at the end of the future period. The concept is explained using an example of a real estate company that owns one building. As the enterprise just started, the building is not fully occupied and a loss for the next year is budgeted. Using Ijiri's formats, the opening balance resembles Table 6-1.

**Table 6-1: Opening balance temporal triple entry bookkeeping**

| | Budget | | Wealth | | Capital |
|---|---|---|---|---|---|
| Target wealth | 97,583 | Cash | 5,000 | Capital stock | 105,000 |
| Budget rental income | (6,250) | Building | 200,000 | | |
| Budget expenses | 13,667 | Loan | (100,000) | | |
| | 105,000 | | 105,000 | | 105,000 |

Journal entries are also made in three dimensions, as Table 6-2 shows. Ijiri christened the budget column in the journal "trebit".

**Table 6-2: Triple journal entries**

| | Debit | Credit | Trebit |
|---|---|---|---|
| Rental contract A: | | | |
| Cash | 5,850 | | |
| Rental income | | 5,850 | |
| Estimated rental income | | | 5,850 |
| Rental contract B: | | | |
| Cash | 800 | | |
| Rental income | | 800 | |
| Estimated rental income | | | 800 |
| Rental contract C: | | | |
| Cash | 375 | | |
| Rental income | | 375 | |
| Estimated rental income | | | 375 |

| | Debit | Credit | Trebit |
|---|---|---|---|
| Expenses: | | | |
| Cash | (1,500) | | |
| Fixed expenses | | (1,500) | |
| Estimated fixed expenses | | | (1,500) |
| Depreciation: | | | |
| Depreciation expenses | | (7,667) | |
| Fixed assets | (7,667) | | |
| Estimated depreciation expenses | | | (7,667) |
| Interest expenses: | | | |
| Cash | (4,500) | | |
| Interest expenses | | (4,500) | |
| Estimated interest expenses | | | (4,500) |
| Redemption loan: | | | |
| Cash | (4,000) | | |
| Loan | 4,000 | | |
| | (6,642) | (6,642) | (6,642) |

The company made a loss of 6,642 during the first year. The budgeted loss amounted to 7,417. The lower loss is due to actual rental income being better than forecast. Hence, the closing balance is as summarised in Table 6-3.

**Table 6-3: Closing balance temporal triple entry example**

| | Budget | | Wealth | | Capital |
|---|---|---|---|---|---|
| Target wealth | 97,583 | Cash | 2,025 | Capital stock | 105,000 |
| Estimated rental income | 775 | Building | 192,333 | | |
| Estimated expenses | - | Loan | (96,000) | Revenue | 7,025 |
| | | | | Expenses | (1,500) |
| | | | | Depreciation | (7,667) |
| | | | | Interest | (4,500) |
| | | | | | (6,642) |
| | 98,358 | | 98,358 | | 98,358 |

This closing position shows not only the change in wealth (which is negative as expected) but also the degree to which the enterprise met its targets.

Ijiri is not fully satisfied with this method and calls it a double entry system applied twice rather than a triple entry system. I would add that this system only captures part of the future (the budget) period. Consequently, the equation:

$$\text{Future} = \text{Present}$$

does not hold.

Nevertheless, the method formalises the comparison of budget and realisation in the financial accounting system by recording each relevant documented event as a change or usage of the budget. This improvement in *systematic recording* facilitates better *analysis*, and may lead to better *predictions* and accounting estimates.

### 6.2.2 *Differential triple entry bookkeeping*

In two-dimensional bookkeeping as redefined by Ijiri, the stock of wealth (the individual components of wealth) and the flow (the historical development of wealth) both play a role. Next, Ijiri defines a stock of earning power (income momentum), i.e. the result per period that the entity would earn if everything remained the same. Ijiri bases this income momentum upon documented historical events, such as acquiring new customers, newly purchased assets, new maintenance contracts, changes in purchase prices, etc. In other words, income momentum is a historical measurement of income that, ceteris paribus, will repeat in the future (see also the discussion between Bernoulli and von Leibniz described in chapter 2).

The changes in the income momentum (which is a flow) are called impulses. These can be changes in the environment of the entity and actions by its management. The relationship between income momentum and impulses is shown in Figure 6-8.

**Figure 6-8: relationship between income momentum and impulses**

| | | | | |
|---|---|---|---|---|
| Income momentum beginning of period | +/- | Impulses:<br>• Environment<br>• Actions | = | Income momentum end of period |

In fact, the impulse value of the actions (i.e. the response to the actions in terms of change in the income momentum) would be an important measurement of management's performance. Such actions include the reactions to changes in the environment (such as competitors' behaviour, etc.).

Ijiri (1982, page 49) states the following on the implementation of differential triple-entry bookkeeping:

> Development of differential triple entry bookkeeping is significantly more difficult *[than temporal triple-entry bookkeeping]*, mainly because it requires a set of new concepts, accounts, and measurements in the third dimension that have not been explored before. Perhaps the best way of implementing the triple-entry system is to take a small company as a prototype and to concentrate on identifying and measuring income momentum.

In the next section, the embedded value of a life insurance enterprise is considered to test the applicability of differential triple entry bookkeeping. But first, we have to deal with some issues. In the first place, consider the example of the small real estate company. It purchased a building at 200,000 with a lifetime of 30 years, including certain fixtures and fittings with a lifetime of 15 years. After 30 years, it is worth zero irrespective of whether it has been occupied. The purchase has partly been financed by a loan of 100,000, at 4.5% and repayable after 20 years. In the first year, part of the building is rented out for 7,025. The lifetime of the lease contract is 10 years. These three transactions have an income momentum of 7,025 (rental income) – 7,667 (depreciation) – 4,500 (interest) or -5,142. Needless to say, this presentation is highly unsatisfactory. The building was expected to have a limited occupancy in the first year and concluding that the earning force of the enterprise is negative until the next friction (e.g. the conclusion of other lease contracts) does not reflect economic reality at all.

But there is a second issue. Ijiri assumes a non-friction future. If an event that causes expenses or income occurs, this event is supposed to occur with the same interval (momentum) in future until the next friction. However, it is known that friction will arise. Loans mature, clients gained will eventually leave, contracts expire, etc. Often, the next friction moment is known or can be estimated. Moreover, the friction for cash inflows almost always differs from the friction for cash outflows.

Consider the example in Table 6-4.

**Table 6-4: Committed earning force and projected earning force**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | … | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Expected income | | 12 | 18 | 22 | 14 | 26 | 30 | 30 | 30 | 30 | 30 | … | 30 | 30 | 30 | 30 |
| Expected expenses | ( 3) | ( 3) | ( 3) | ( 3) | ( 3) | ( 3) | ( 3) | ( 3) | ( 3) | ( 3) | ( 3) | … | ( 3) | ( 3) | ( 3) | ( 3) |
| Committed income | 6 | 6 | 6 | 6 | 6 | 6 | | | | | | | | | | |
| Committed expenses | ( 15) | ( 15) | ( 15) | ( 15) | ( 15) | ( 15) | ( 15) | ( 15) | ( 15) | ( 15) | ( 15) | … | ( 15) | ( 15) | ( 15) | ( 15) |
| Net income momentum | ( 12) | - | 6 | 10 | 2 | 14 | 12 | 12 | 12 | 12 | 12 | … | 12 | 12 | 12 | 12 |

This example shows both the expected future earnings and the committed future earnings and combines it to a "stock of future earnings". The concept is attractive, because it shows the total stock of future earnings, but it also shows the extent to which cash inflows and cash outflows are committed to. And risk can to great extent be defined as the difference in frictions between cash inflows and cash outflows.

Embedded value can be considered a stock of future earnings. In the next paragraph the applicability of a transaction-for-transaction accounting of this stock, in a kind of *perpetual value recording method* will be further investigated.

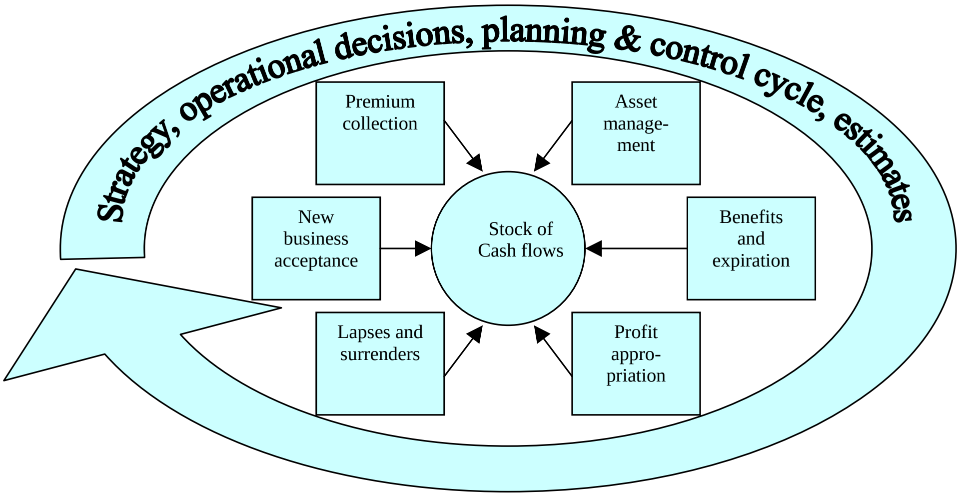
## 6.3 Triple entry bookkeeping for life insurers

The former paragraph ended with a *perpetual value recording method* for embedded value or other future oriented reporting on insurance contracts. This is a variation on the *perpetual inventory recording method* approach with respect to stocks. Remember the ancient approach described in chapter 2 that Grammateus recommended for determining annual results: consider the opening balance of stocks, add the purchases, deduct the sales and determine the balance. Count the stocks at the end of the period, value them at purchase price and determine the total stock value. The difference between this value and the aforementioned balance is the profit or loss for the period.

*Perpetual inventory recording method* means that sales are not deducted at sales price but at purchase price (average, FIFO or LIFO) and that all other movements (scrap, breakage, decay or other causes of loss) are recorded by individual transaction. In that case, accounting records permanently give a picture of what the stock should be. Physical stock records were developed for the purpose of control rather than as a tool to determine the results, and logistic processes take their place in control over financial reporting. Segregation of functions plays a key role in these controls, and the accounting system, in which purchases, receipts of goods, sales, delivery of goods and all other changes in the quantities and value of stocks are recorded by type and transaction, reflects these controls and provides analytical proof.

*Perpetual value recording* attempts to consider a book of life insurance contracts as a stock of cash flows. This stock of cash flows is updated transaction by transaction and event by event.

**Figure 6-9: Stock of cash flows, transaction flows, planning and control cycle**




The recording involves estimated future cash flows rather than observed realised cash flows. Bookkeeping itself (including triple entry bookkeeping) does not solve the issue of preparing estimates, but shows the effect of each transaction, event and decision. Decision-making on product introduction, standard cost prices of insurance products, asset (liability) management, distribution channels, the initiation and recording of transactions and the evaluation of observed reality in relation to the original plans and forecasts follows the natural segregation of duties within an enterprise. Leveraging these controls over the business cycle increases the credibility of estimates and helps to use all information available. Figure 6-9 summarises this view. Where double entry bookkeeping captures each documented event that changes the size and/or content of the stock of wealth, triple entry bookkeeping aims to capture each documented event that changes the size and/or content of the earning capacity (Blommaert, 1994, p. 123) or the "stock of cash flows".

The example below demonstrates how life insurance business can be recorded as a stock of cash flows/stock of margins. In order to concentrate on the accounting aspects, the estimates themselves are considered given. As note earlier, a key factor in controlling life insurance business and making proper estimates (thus controlling financial reporting) is a correct technically driven integral standard cost price.

The example assumes a required yield of 10% on required capital and an expected invested yield of 6%. The risk-free rate amounts to 3%[59] and the enterprise grants the policyholders a profit share of 90% of all investment income above the income at the risk-free rate. As a result, the enterprise expects to achieve an investment margin of 30 bp.

**Table 6-5: Data example**

| | PV[60] | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Benefits | | 100.0 | 110.0 | 120.0 | 130.0 | 150.0 | 200.0 | 300.0 | 500.0 | 700.0 | 1,200.0 |
| Margin | | 2.0 | 2.2 | 2.4 | 2.6 | 3.0 | 4.0 | 6.0 | 10.0 | 14.0 | 24.0 |
| | 2,763.9 | 102.0 | 112.2 | 122.4 | 132.6 | 153.0 | 204.0 | 306.0 | 510.0 | 714.0 | 1,224.0 |
| Expenses | | 10.0 | 15.0 | 20.0 | 25.0 | 25.0 | 25.0 | 30.0 | 35.0 | 35.0 | 35.0 |
| Margin | | 5.0 | 7.5 | 10.0 | 12.5 | 12.5 | 12.5 | 15.0 | 17.5 | 17.5 | 17.5 |
| | 308.4 | 15.0 | 22.5 | 30.0 | 37.5 | 37.5 | 37.5 | 45.0 | 52.5 | 52.5 | 52.5 |
| Costs of guarantee | 16.6 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| Allocated capital | | 50.0 | 150.0 | 250.0 | 350.0 | 350.0 | 300.0 | 275.0 | 200.0 | 100.0 | - |
| Required return | | 5.0 | 15.0 | 25.0 | 35.0 | 35.0 | 35.0 | 30.0 | 27.5 | 20.0 | 10.0 |
| Expected return | | 3.0 | 9.0 | 15.0 | 21.0 | 21.0 | 21.0 | 18.0 | 16.5 | 12.0 | 6.0 |
| Cost of solvency | 78.2 | 2.0 | 6.0 | 10.0 | 14.0 | 14.0 | 14.0 | 12.0 | 11.0 | 8.0 | 4.0 |
| Premium | 3,167.1 | 436.3 | 392.7 | 370.9 | 367.1 | 363.5 | 359.8 | 356.2 | 352.7 | 349.2 | 345.7 |

The enterprise wishes to include the cost of solvency explicitly in the premium rate. The "trade" margins on benefits, expenses and investment income serve to cover the acquisition expenses and to add shareholder value. The benefits assume an annual decrease in the book of business (mortality, maturity, lapse and surrender) of 10% in year 2, 5% in year 3 and 1% in each subsequent year[61].

The basic data needed for the example have been summarised in Table 6-5. The total present value (3,167.1) is what the premium would be if levied as a single premium. The annual premiums have been calculated taking into account the projected annual decrease. The

59 In order to avoid unnecessary complexity in this example, a flat yield curve is assumed.

60 At the risk-free rate.

61 All percentages of first year's premium.

assumption is that premiums are received at the end of the year and all other cash flows also take place at the end of the year. Adding all annual premiums (without discounting) gives an amount of 3,694.

**Table 6-6: Example of standard cost and margins**

| | |
|---|---|
| Estimated guaranteed benefits | 3,510.0 |
| Estimated non-guaranteed benefits | 345.3 |
| Estimated maintenance expenses | 255.0 |
| Estimated hedge and guarantee cost | 20.0 |
| Expected yield policyholders' funds | (767.4) |
| Total cash flows | 3,362.9 |
| Required yield shareholder | 237.5 |
| Expected yield shareholders' funds | (142.5) |
| Cost of solvency | 95.0 |
| Total standard cost of insurance | 3,457.9 |
| Mortality margin | 70.2 |
| Expense margin | 127.5 |
| Investment margin | 38.4 |
| Total nominal value of margins | 236.1 |
| Sum of premiums | 3,694.0 |

Table 6-6 gives a breakdown of the total "stock of premiums" by the nominal value of all elements. The expected investment income has been projected as future cash flows, which makes discounting unnecessary and makes the figures easy to handle in a "stock accounting" system. Apart from a "stock of cash flows", a stock of margins is presented, i.e. the minimum required margin to meet the cost of solvency and the additional margins that cover acquisition costs and add shareholder value.

**Table 6-7: Development of acquisition costs**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Opening balance | | 101.5 | 99.8 | 94.8 | 86.2 | 76.7 | 65.9 | 53.2 | 37.3 | 20.2 | |
| Deferral | 100.0 | | | | | | | | | | |
| Interest | 6.0 | 6.1 | 6.0 | 5.7 | 5.2 | 4.6 | 4.0 | 3.2 | 2.2 | 1.2 | |
| Amortisation | (4.5) | (7.8) | (11.0) | (14.2) | (14.7) | (15.4) | (16.7) | (19.1) | (19.3) | (21.4) | (144.1) |
| Closing balance | 101.5 | 99.8 | 94.8 | 86.2 | 76.7 | 65.9 | 53.2 | 37.3 | 20.2 | - | |

In order to sell the block of business in the example, acquisition costs amounting to 100 have been incurred. Any acquisition costs that are not borrowed externally are borrowed from the policyholders' funds. Either way, they have to be repaid (amortised) including interest. Suppose that amortisation ("repayment to the policyholders' funds") takes place in proportion to the expected gross margins. The way to do this is to discount these margins at the expected investment return, resulting in an amount of 229.7 and a k-factor (see chapter 5) of 44%.

A summary of the movement schedule of acquisition costs is given by Table 6-7[62].

We can now write the total stock of cash flows and stock of margins and the anticipated movements for the first year, as shown in Table 6-8. The amounts included in Table 6-8 are

62 The cash outflow of acquisition costs takes place at the beginning of the projection. Amortisation of acquisition costs is not cash outflow. However, the enterprise has to "borrow" the disbursements for acquisition costs from the funds to be invested. When the margins emerge, the "amount borrowed" is paid back to the investment fund including interest. In this respect, amortisation should be treated as cash flow. If acquisition costs were borrowed externally and repaid in accordance with the amortisation schedule, the effect would be the same.

nominal amounts of cash flows and margins when the required return on equity is paid (or reinvested) annually. The only exception is the cost of solvency that is embedded in the margins, which is a presentation item that is added to the technical liabilities as part of the minimum required amount and deducted from the margins[63].

**Table 6-8: Movement in stock of cash flows and stock of margins**

| | Opening position | Transactions beginning of year | Position after BoY transactions | Transactions end of year | Closing position |
|---|---|---|---|---|---|
| **Stock of cash inflows** | | | | | |
| Premiums receivable | 3,694.0 | (436.3) | 3,257.7 | | 3,257.7 |
| Investment income | 865.8 | | 865.8 | (23.2) | 842.6 |
| | 4,559.8 | (436.3) | 4,123.5 | (23.2) | 4,100.3 |
| **Stock of cash outflows** | | | | | |
| Guaranteed benefits | 3,510.0 | | 3,510.0 | (100.0) | 3,410.0 |
| Profit sharing | 345.3 | | 345.3 | (11.8) | 333.5 |
| Acquisition expenses | 100.0 | (100.0) | - | | - |
| Maintenance expenses | 255.0 | | 255.0 | (10.0) | 245.0 |
| Guarantees and hedge costs | 20.0 | | 20.0 | (2.0) | 18.0 |
| | (4,230.3) | 100.0 | (4,130.3) | 123.8 | (4,006.5) |
| **Net stock of cash flows** | 329.4 | (336.3) | (6.9) | 100.6 | 93.7 |
| **Stock of equity servicing** | | | | | |
| Expected return on equity | 142.5 | | 142.5 | (3.0) | 139.5 |
| Cost of solvency | 95.0 | | 95.0 | (2.0) | 93.0 |
| | (237.5) | - | (237.5) | 5.0 | (232.5) |
| Cost of solvency in margins | (44.5) | | (44.5) | 4.7 | (39.8) |
| Liability adequacy level | 47.4 | (336.3) | (288.9) | 110.3 | (178.6) |
| **Stock of margins** | | | | | |
| Mortality | 70.2 | | 70.2 | (2.0) | 68.2 |
| Expenses | 127.5 | | 127.5 | (5.0) | 122.5 |
| Investments | 38.4 | | 38.4 | (1.3) | 37.1 |
| Gross stock of margins | 236.1 | - | 236.1 | (8.3) | 227.8 |
| Needed for acquisition costs | (144.1) | | (144.1) | 4.5 | (139.7) |
| Cost of solvency in margins | (44.5) | | (44.5) | 4.7 | (39.8) |
| Net stock of margins | 47.4 | - | 47.4 | 0.9 | 48.3 |
| Book value of asset (liability) | (0.0) | (336.3) | (336.3) | 109.4 | (226.9) |

As a consequence of this presentation, the net stock of margins equals the present value of future profits less cost of capital. The reserve adequacy level equals the expected value of future cash flows (4,100.3 – 4,006.5 – 139.5 results in a liability of 45.8) and the minimum required margin, based on the cost of solvency (93.0 + 39.8 equals 132.8), in total 178.6.

The closing position of cash flows provides the following information:

- The technical reserves, determined by discounting all future net premiums (excluding margins), benefits and expenses at the technical interest rate, would amount to 328.4. Deducting the closing balance of deferred acquisition costs of 101.5 (see Table 6-7) gives 226.9, which is the stock of net cash flows at the end of the period. Hence, the stock of cash

63 This amount would be zero if future margins could be discounted at the risk-free rate. Some supporters of market-consistent embedded value argue that this is the case, because risks related to margins would be fully diversifiable and therefore shareholders would not require any risk surcharge. In my opinion, entrepreneurial risks are attached to an enterprise's margins (consisting of revenues and costs that are not all committed to the same extend). I therefore find it appropriate that margins are discounted with a rate that includes a risk surcharge, unless the potential cost of friction between future revenues and costs has been captured in another way.

flows accounting system is actually a sub-accounting system of the book value of technical reserves carried at amortised cost/“stage of completion” method. This emphasises the treatment of policyholders’ liabilities as a tangible liability as suggested in chapter 5.

- The net stock of margins is a positive amount. If this amount were negative, there would be a reserve adequacy and/or DAC recoverability issue that would be shown directly by the stock accounting system.
- The stock of margins is based on the nominal value of the projected annual margins. This represents the future earning force referred to by Ijiri, but takes into account the knowledge that the force will not be the same in each accounting period. A stock of margins that consists of the nominal values of those margins could be positive, even if the present value of those margins were negative. This can happen if the margins are negative in the early years and positive in later years. By making the presentation adjustment for the cost of solvency embedded in the margins, the net stock of margins always equals the present value of future profits less the cost of allocated capital. If the net stock were negative, the book value of the liabilities would be inadequate. Consequently, the stock accounting system always sends the correct signal for liability inadequacy. Discounting all shareholders’ cash flows gives the same amount for the present value of future profits less cost of allocated capital. This is demonstrated in Table 6-9.

The PVIF according to this table is net of cost of capital (i.e. the present value of the annual differences between hurdle rate and expected earnings on required capital invested). In the definitions of the CFO Forum, this amount is visibly deducted. Discounted at 10%, it is 56.7, which is equal to the present value of all net capital transfers to covered business (141.7) less the expected investment income on required capital (85). In the example, the cost of capital relates to the capital allocated at inception and to the capital to be allocated in future due to the growth of funds.

**Table 6-9: Present Value of shareholders' cash flows**

| | PV (10%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Face value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Premium received | 2,308.0 | 436.3 | 392.7 | 370.9 | 367.1 | 363.5 | 359.8 | 356.2 | 352.7 | 349.2 | 345.7 | 3,694.0 |
| Benefits paid | (1,713.5) | (100.0) | (110.0) | (120.0) | (130.0) | (150.0) | (200.0) | (300.0) | (500.0) | (700.0) | (1,200.0) | (3,510.0) |
| Acquisition expenses incurred | (90.9) | (100.0) | | | | | | | | | | (100.0) |
| Expenses incurred | (143.3) | (10.0) | (15.0) | (20.0) | (25.0) | (25.0) | (25.0) | (30.0) | (35.0) | (35.0) | (35.0) | (255.0) |
| Hedge costs / other cost of guarantees | (12.3) | (2.0) | (2.0) | (2.0) | (2.0) | (2.0) | (2.0) | (2.0) | (2.0) | (2.0) | (2.0) | (20.0) |
| Investment of premiums | (453.4) | (226.9) | (273.3) | (240.6) | (225.7) | (209.0) | (161.5) | (56.7) | 152.9 | 361.4 | 879.3 | - |
| Investment of required capital | (141.7) | (50.0) | (100.0) | (100.0) | (100.0) | - | 50.0 | 25.0 | 75.0 | 100.0 | 100.0 | - |
| Investment income | 405.1 | 20.2 | 37.2 | 52.3 | 66.5 | 79.8 | 92.1 | 101.6 | 104.8 | 95.4 | 73.5 | 723.3 |
| Investment income on required capital | 85.0 | 3.0 | 9.0 | 15.0 | 21.0 | 21.0 | 21.0 | 18.0 | 16.5 | 12.0 | 6.0 | 142.5 |
| Profit sharing | (195.6) | (11.8) | (19.5) | (26.2) | (32.5) | (38.2) | (43.5) | (47.5) | (48.6) | (43.9) | (33.6) | (345.3) |
| Total cash flows from operations | 47.4 | (41.2) | (80.9) | (70.7) | (60.5) | 40.1 | 91.0 | 64.6 | 116.3 | 137.1 | 133.8 | 329.4 |
| Capital transfers from / to covered business | 141.7 | 50.0 | 100.0 | 100.0 | 100.0 | - | (50.0) | (25.0) | (75.0) | (100.0) | (100.0) | - |
| Profit transfers from covered business | (189.1) | (8.8) | (19.1) | (29.3) | (39.5) | (40.1) | (41.0) | (39.6) | (41.3) | (37.1) | (33.8) | (329.4) |
| Total capital transactions | (47.4) | 41.2 | 80.9 | 70.7 | 60.5 | (40.1) | (91.0) | (64.6) | (116.3) | (137.1) | (133.8) | (329.4) |

An additional feature of Table 6-9 is that it demonstrates the usefulness of information about operational cash flows from life business if they are presented in the right format. The main reason for this is that the use of funds that flow into covered business (premiums less benefits less expenses and required capital) in excess of free profit margins is largely determined by regulation and internal risk management (future commitments should be covered by investments that have a high probability of generating the required cash flows at the required times). Some of the funds may be invested in the life business itself (operating assets such as IT, debtors, etc.), but Table 6-9 provides a fair, high level representation. If operating noise caused by the cut-off of periods is eliminated, the adjusted cash flow information may even be more relevant than the traditional profit and loss account, especially if the latter is "besmirched" by (one-sided) movements in fair values. As indicated in section 5.4, adjusted cash flow information may give a robust starting point for financial REPorting.

Next, I wish to use the example to show the movements in the "traditional" accounting system and in the stock of cash flows/stock of margins as a consequence of:

- Experience that differs from the projections.
- Changes in operating assumptions.
- Changes in economic assumptions

Table 6-10 shows the information on the opening positions after recording the transactions at the beginning of the year in the triple entry bookkeeping format that has been shown in Table 6-1. Note that the approach used is a mix of temporal triple entry accounting and differential triple entry accounting. It recognises that the earning force will be different in each future accounting period and it records expected future earnings (as in temporal triple entry accounting), not only for the next accounting period, but also over the lifetime of the in-force policies.

**Table 6-10: Opening balance from triple entry bookkeeping for life insurance**

| Future | | Wealth | | Capital | |
|---|---|---|---|---|---|
| Embedded value | 97.4 | Investments | 386.3 | Capital stock | 50.0 |
| Stock of margins: | | Policyholders' liabilities | ( 336.3) | | |
| mortality | ( 70.2) | | | | |
| fees | ( 127.5) | | | | |
| investment spread | ( 38.4) | | | | |
| DAC amortization | 144.1 | | | | |
| COS in margins | 44.5 | | | | |
| | 50.0 | | 50.0 | | 50.0 |

*Variances from projections*

Table 6-11 shows the journal entries to be made. I use the triple entry approach where debit stands for changes in wealth (balance sheet) elements, credit for (accumulated) earnings elements and trebit for the earning force of in-force business, i.e. the embedded value.

In the example, all real cash flows are equal to the expected cash flows that are included in the stocks, except for the mortality benefits, which amount to 98 compared with the corresponding element in the stock of cash flow of 100. In other words, the book value of the stock used is 100 and the realisation value is 98.

Table 6-11 summarises the total movements between the opening position and the closing position, and highlights the movements relating to the mortality benefits.

**Table 6-11: Journal entries of benefits paid**

| | Debit | Credit | Trebit |
|---|---|---|---|
| Investments | -98.6 | | |
| Change policyholders' liabilities | 109.4 | | |
| Investment income | | 23.2 | |
| Technical interest | | -18.9 | |
| Result on interest | | | 4.3 |
| Benefits paid | | -98.0 | |
| Expected benefits | | 100.0 | |
| Experience result mortality | | | 2.0 |
| Mortality margins | | 2.0 | 2.0 |
| Expenses | | -10.0 | |
| Expected expenses | | 10.0 | |
| Expense margins | | 5.0 | 5.0 |
| Hedging costs | | -2.0 | |
| Cost of solvency in liabilities | | 2.0 | 2.0 |
| Expected hedging costs | | 2.0 | |
| Amortization DAC | | -4.5 | -4.5 |
| | 10.8 | 10.8 | 10.8 |

The movement in the investments reflects the real cash transactions (benefits paid, expenses paid, investment income received). The change in the policyholders' liabilities reflects the use of the stocks of cash flows and the release of margins. The use of the stock of earnings force (stock of margins) is reflected in the trebit column. This increases the wealth realised to date and decreases the wealth to be realised in the future.

Table 6–12 shows the closing balance information presented in the roll forward schedule in Table 6-8 in the triple entry bookkeeping format. This schedule presents the historical development in the stock of capital (the stock has increased by a profit of 10.8), the present wealth (60.8) and the composition of the present wealth and the present wealth increased by the stock of future net earnings or stock of margins (109.1).

**Table 6-12: Closing balance in triple entry bookkeeping format**

| | Future | | Wealth | | Capital |
|---|---|---|---|---|---|
| Embedded value | 109.1 | Investments | 287.7 | Capital stock | 50.0 |
| Stock of margins: | | Policyholders' liabilities | (226.9) | | |
| mortality | (68.2) | | | Investment income | 23.2 |
| fees | (122.5) | | | Benefits | (98.0) |
| investment spread | (37.1) | | | Profit sharing | (11.8) |
| DAC amortization | 139.7 | | | Expenses | (10.0) |
| COS in margins | 39.8 | | | Hedging costs | (2.0) |
| | | | | Change PH liabilities | 109.4 |
| | | | | | 10.8 |
| | 60.8 | | 60.8 | | 60.8 |

The information that is kept in the stock accounting system enables direct summarising of the changes in the embedded value during the period. This is shown in Table 6-13.

**Table 6-13: Changes in embedded value**

| | PVFP - CaC | Capital | EV |
|---|---|---|---|
| Opening balance | 47.4 | 50.0 | 97.4 |
| Unwinding discount rate | 4.7 | 5.0 | 9.7 |
| Expected margins | ( 8.3) | 8.3 | |
| Amortization DAC | 4.5 | ( 4.5) | |
| | 0.9 | 8.8 | 9.7 |
| Experience result | | 2.0 | 2.0 |
| | 48.3 | 60.8 | 109.1 |

Table 6-13 shows the changes in the stock of margins (i.e. Present Value of Future Profits less Cost of Allocated Capital), the capital and, hence, the embedded value.

*Changes in operating assumptions*

Now assume that the developments in mortality give rise to the expectation that the 2% experience gain is sustainable. This would decrease the stock of future cash out flows by 68.2 and increase the stock of future margins by the same amount. The journal entry is presented in Table 6-14[64].

**Table 6-14: Journal entry assumption change**

| | Debit | Credit | Trebit |
|---|---|---|---|
| Stock of future cash outflows | | | ( 68.2) |
| Cost of solvency embedded in margins | | | 32.5 |
| Net stock of margins | | | 35.7 |

The changes in assumptions (in this case favourable) have no effect on the current stock of capital, because the extra margins are "kept in stock" until realised in the foreseen transactions.

**Table 6-15: Adjusted closing balance in triple entry format**

| | Future | | Wealth | | Capital |
|---|---|---|---|---|---|
| Embedded value | 144.8 | Investments | 287.7 | Capital stock | 50.0 |
| Stock of margins: | | Policyholders' liabilities | ( 226.9) | | |
| mortality | 136.4 | | | Investment income | 23.2 |
| fees | 122.5 | | | Benefits | ( 98.0) |
| investment spread | 37.1 | | | Profit sharing | ( 11.8) |
| DAC amortization | ( 139.7) | | | Expenses | ( 10.0) |
| COS in margins | ( 72.3) | | | Hedging costs | ( 2.0) |
| | | | | Change PH liabilities | 109.4 |
| | | | | | 10.8 |
| | 60.8 | | 60.8 | | 60.8 |

64 In order to keep the example simple, the effects of lower mortality on premium income have been ignored.

The present stock of wealth is unaffected; the change is recorded in the stock of future earnings only. Consequently, the journal entries are only in the trebit column. The decrease in the stock of cash outflows due to lower projected death benefits creates an addition to the cost of solvency embedded in margins. This is the discount that a third party would require if he purchased those additional margins. The closing balance after this journal entry is presented in Table 6-15.

The roll forward schedule of the embedded value as presented in Table 6-13 can now be extended with one line.

**Table 6-16: Embedded value development including change in operational assumptions**

| | PVFP - CaC | Capital | EV |
|---|---|---|---|
| Opening balance | 47.4 | 50.0 | 97.4 |
| Unwinding discount rate | 4.7 | 5.0 | 9.7 |
| Expected margins | ( 8.3) | 8.3 | |
| Amortization DAC | 4.5 | ( 4.5) | |
| | 0.9 | 8.8 | 9.7 |
| Experience result | | 2.0 | 2.0 |
| Change in operating assumptions | 35.7 | | 35.7 |
| | 84.0 | 60.8 | 144.8 |

Note that the only “judgmental touch point” of this schedule is the review of assumptions. All other elements relate to the recording of events that tell how well the targets and expectations reflected in the standard cost price have been met. Maintaining a permanent record of the stock of cash flows “at standard cost” records the analysis of differences between standard and realised cash flow elements instead of preparing retrogressive estimations as is often the case in the present situation.

*Change in economic assumptions*

Economic assumptions relate to parameters that are beyond the control of the enterprise, such as market interest/investment income, inflation, cost of equity, etc. The enterprise cannot influence these parameters, but can decide upon the degree of its exposure to them.

Before looking at the effect of expected changes in future investment income, let us have a brief look at the sensitivity to such changes. In the example, the net stock of cash flows at the end of year 1 amounts to -226.9. This amount has been received in cash. It could be invested in a zero bond with a redemption value of 383.3, which would imply an annualised yield of 6% (the same as the assumption used for determining the premium rate).

Table 6-17 splits the stock of cash flows into:

- Secured cash flows. These are the cash flows that the enterprise is committed to pay in the future, but for which it has secured the availability of such cash flows from the proceeds from investments.
- Committed cash flows. These are the cash flows that the enterprise is (conditionally) committed to, but that have not been secured. The enterprise has committed itself to paying guaranteed benefits and to maintaining the book of business if and for as long as the policyholder pays premium.

- Projected cash flows. Investment incomes on future investments and on equity investments represent the expected values, but no one is committed to pay them to the enterprise. On the other hand, the enterprise has no commitment to pay a profit share to the policyholder if the investment income projection is not met fully or only partly. This column includes the projected future margins.

**Table 6-17: Further analysis of stock of cash flows**

| | Secured | Committed | Projected | Total |
|---|---|---|---|---|
| **Stock of cash inflows** | | | | |
| Premiums receivable | | 3,257.7 | | 3,257.7 |
| Investment income | 156.4 | | 686.1 | 842.6 |
| | 156.4 | 3,257.7 | 686.1 | 4,100.3 |
| **Stock of cash outflows** | | | | |
| Guaranteed benefits | 383.3 | 3,026.7 | | 3,410.0 |
| Profit sharing | | | 333.5 | 333.5 |
| Maintenance expenses | | 245.0 | | 245.0 |
| Guarantee and hedge cost | | 18.0 | | 18.0 |
| | (383.3) | (3,289.7) | (333.5) | (4,006.5) |
| **Stock of equity servicing** | | | | |
| Expected return on equity | | | 139.5 | 139.5 |
| Cost of solvency | | | 93.0 | 93.0 |
| | - | - | (232.5) | (232.5) |
| Cost of solvency in margins | | | (39.8) | (39.8) |
| Liability adequacy level | (226.9) | (32.0) | 80.3 | (178.6) |
| | | | | |
| **Stock of margins** | | | | |
| Mortality | | | 68.2 | 68.2 |
| Expenses | | | 122.5 | 122.5 |
| Investments | | | 37.1 | 37.1 |
| | - | - | 227.8 | 227.8 |
| Needed for acquisition costs | | | (139.7) | (139.7) |
| Cost of solvency in margins | | | (39.8) | (39.8) |
| Net stock of margins | - | - | 48.3 | 48.3 |
| | (226.9) | (32.0) | 32.0 | (226.9) |

Adding this dimension to the stock of cash flows gives insight into the sensitivity of the in-force business (together with the investments allocated) to changes in the operational assumptions and enables assessment of whether observed changes in economic assumptions have the effect that was assumed in previous sensitivity analysis.

If, for example, the projected investment income increased to 8%, the secured cash flows would show no movement, because the projected cash outflows fully match the projected cash inflows. The projected investment income would increase. Such increase is for 90% for the benefit of policyholders; the shareholders benefit by 10% of the additional investment income. The corresponding increase in the stock of margins amounts to 18.2 and the cost of solvency related to this increase margin is 7.3. Because the expected return on equity increases, the cost of the solvency element that represents the minimum buffer in the policyholders' liabilities decreases by 46.5 and the future margins increase by this amount. The net stock of future margins increases by 57.6.

So if balance sheet lines were considered cash flow in progress in accordance with the Schmalenbach definitions, there would be no need to restate the secured part of the future cash flows or the financial instruments that secure them. If a company carries investment instruments at market value as standard setters require, the only possibility is to restate the liabilities to the extent that only the net effect of asset related assumption changes are reflected in equity and results (see also section 5.4).

Were the future investment income to drop to 1%, the secured cash flows would still not show movement, but the total (secured and projected) investment income would be insufficient to meet the guarantees. The stock of future net cash outflows would increase to 381.5. Given the book value of the liabilities of 226.9, the shortfall would be 154.6 and should be added to the book value of the stock of cash flows in order to make them sufficient to meet all commitments. In such a situation, the enterprise could sell the investment instruments at a market value of approximate 350 and realise a book gain of 123. However, under normal circumstances, strategic (or regulatory) restrictions would require that the proceeds be reinvested in similar fixed interest instruments. Apart from an arbitrage result (if any), the full amount should be reinvested in order to maintain the backing of the secured cash flows and given the market rate at the time of swapping) the shortfall should be further increased by the same amount of 123. In other words, purchase and sale transactions of investment instruments cannot generate results in the circuit of investments and stock of cash flows as a whole. Investment instruments are not available for sale; at best, they are available for swapping within the strategic and regulatory boundaries of asset liability management.

Suppose that not all cash flows from year 1 were invested in a fixed interest instrument, but that 100 was invested in shares. In that case, the amount of secured cash flows would be limited to 126.9 and the net position of investments and technical reserves would be more sensitive to changes in economic circumstances. If, for example, the value of the shares were to drop to 70, the projected and committed cash flows would not move in the same direction, perhaps with the exception of the profit share, which might give a limited compensation. In this situation, cash flows are more volatile and more economic capital is required (see chapter 4), which leads to a higher cost of solvency.

### 6.4 Summary and conclusions

In the previous section, triple entry accounting has been applied to the permanent recording of changes in embedded value. As explained in section 6.2, triple entry accounting can be applied as:

- Temporal triple entry accounting. In this case, the third dimension is the budget result for the next accounting period. Target future wealth less budget makes present wealth. Accumulated past income and transactions with owners also makes present wealth (the first dimension) and the balance of all assets and liabilities as well (the second dimension).
- Differential triple entry accounting. The third dimension here is the earning force, i.e. the future earnings per period that will be generated until the next friction moment.

When accounting for embedded value, we know that the earning force will differ by accounting period. For example, we know that the mortality force increases with the age of the policyholders and that the income force from funds invested increases as funds accumulate. On the other hand, the periods in which future earnings on in-force business will be earned, exceed the next accounting period. Consequently, temporal triple entry accounting cannot be applied without modification.

Combining the features of temporal and differential triple entry accounting, we derived stock accounting for embedded value, a *perpetual value recording method*, an approach where the value is updated by (type of) transaction and where the "judgmental touch points" are concentrated and visibly connected to experience. With such an approach, all segregation of functions, the mandatory balancing in the triple entry bookkeeping system and other control mechanisms underpin the credibility and the robustness of the value presented.

A normal stock of finished goods or goods in progress has two dimensions, i.e. quantity and unit value, and can be expressed as:

- Present = past: the value equals the normative value of the normative quantities of inputs.
- Present = future: the value equals the estimated future realisable value less the estimated value of the future inputs less the embedded margins (the latter subject to a minimum of zero).

Both approaches lead to the same value at the present.

For life insurance policies, the future developments evolve over many future years, sometimes decades. Hence, the main focus is on the equality *present = future*, and the dimensions of the future cash flows should be more extensively considered in the stock accounting system. The dimensions to be considered are:

- Quantity (number of policies, similar to stocks of goods).
- Product category (in order to enable analysis of reasonably homogeneous groups).
- Nature of expected cash flows (premium, investment income, benefits, expenses, etc.).
- Timing of the expected cash flows by accounting period (in order to make friction in this timing visible).
- Quality of the expected cash flows:
  - Secured (in this case, future commitments have been "hedged", e.g. by fixed interest securities, producing the same cash flows as committed to).

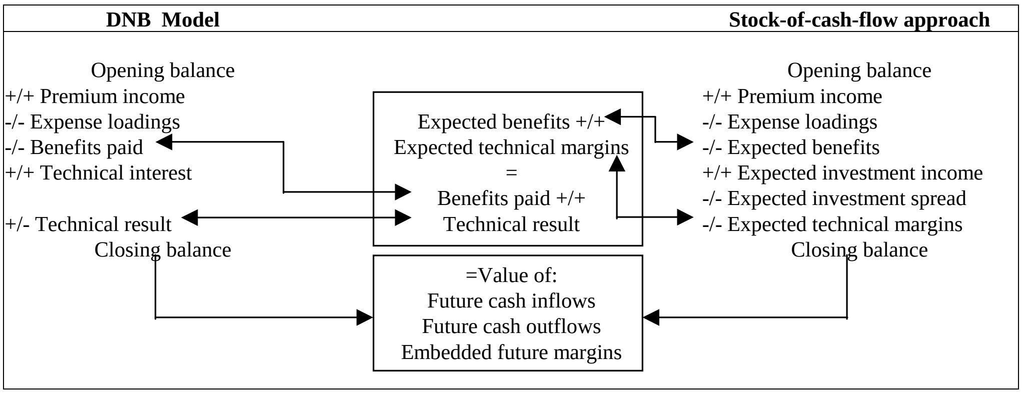
– Committed (the enterprise is committed to provide a certain minimum benefit or to manage a book of insurance business, but has not the same entitlements against these commitments).
– Projected (the enterprise has best-estimated cash inflows, but has no entitlement to them, or cash outflows, but has only legal or constructive obligations if the conditions framing the estimate become reality).

These dimensions make a stock accounting system for a book of life business more complicated than a product stock accounting system, but current technology should be able to solve this problem. An illustration: Suppose, there are 100 product groups, 6 types of cash flow, 3 qualifications of cash flow, 30 years of timing, and 20 years of origination. This means 1,020,000 fields to store and update, which is no problem using present-day technology.

Section 6.4 shows that the stock-of-cash-flows approach leads to a book value of policyholders liabilities in accordance with the stage-of-completion approach, thereby treating policyholders' liabilities as a tangible liability, in a consistent manner with tangible assets. The equality *Present = Future*, or *Present = (Future cash flows + Unrecognised margins)*, makes reserve inadequacy immediately visible and shows directly the present value of future profits and the cost of allocated capital.

In Table 5-3, the roll forward of policyholders' liabilities according to the requirement of the Netherlands insurance supervisor is shown. Figure 6-10 compares this with the stock-of-cash-flow approach[65].

**Figure 6-10: Stock-of-cash-flow approach in relation to supervisory reporting requirements**




The two roll forward schedules are the same under all circumstances. The stock-of-cash-flow/stock-of-margins approach supports a permanently recorded analysis of experience versus assumptions. But again, this approach only works if assumed future cash flows and margins are supported by a sound integral standard cost price for each product.

65 Experience results are omitted from the schedule for the sake of simplicity.

Now there is one final hurdle to take. Not all cash flows, even if they are classified as secured, committed or projected, can be estimated with the same degree of precision. The example in section 4.1 shows that there is a probability distribution of possible outcomes of the individual classes of cash flows and that there is often non-zero covariance between them. The shape of such a probability distribution is relevant for determining the degree of precision of the cash flow projections, which is directly related to the required economic capital for an x% certainty that the enterprise can meet its commitments.

Developing an accounting method that not only updates the stock of future cash flows per documented event, but also the probability distribution around those future cash flows, would really complete the third (future-oriented) dimension in accounting.

**Appendix 6-I: CFO Forum embedded-value reporting principles translated into systems and controls**

| Principles | Required in information system and controls |
|---|---|
| **Principle 1: Embedded Value (EV) is a measure of the consolidated value of shareholders' interests in the *covered business*.** | |
| **Principle 2: The business covered by the Embedded Value Method (EVM) should be clearly identified and disclosed.** | Information system:<br>• All individual transactions, balances, income, expenses, cash flows, numbers of contracts separately for each class of covered business.<br>• Reconciliation of financial statements equity, cash flow and P&L figures regarding covered business segments.<br>• Reconciliation of expected financial statements' profits and expected statutory profit from in-force business.<br>• Comparison and analysis of differences between expected and realised in-force profits on both bases. |
| **Principle 3: EV is the *present value* of shareholders' interests in the earnings distributable from assets allocated to the *covered business* after sufficient allowance for the aggregate risks in the *covered business*. The EV consists of the following components:**<br>■ *free surplus* allocated to the *covered business*<br>■ *required capital*, less the cost of holding *required capital*<br>■ *present value* of future shareholder cash flows from in-force *covered business* (PVIF).<br>**The value of future new business is excluded from the EV.** | Standard cost price per product and standardised "stock of cash flows"/"stock of margins", including contracted and assumed future premiums from renewals.<br>Capital allocation model per segment of covered business. |
| **Principle 4: The *free surplus* is the market value of any capital and surplus allocated to, but not required to support, the in-force *covered business* at the valuation date.** | |
| **Principle 5: *Required capital* should include any amount of assets attributed to the *covered business* over and above that required to back liabilities for *covered business* whose distribution to shareholders is restricted. The EV should allow for the cost of holding the *required capital*.** | Balance sheet of covered business by segment or life fund. |
| **Principle 6: The value of future cash flows from in-force *covered business* is the *present value* of future shareholder cash flows projected to emerge from the assets backing liabilities of the in-force *covered business* ("PVIF"). This value is reduced by the value of *financial options and guarantees* as defined in Principle 7.** | Options and guarantees to be estimated explicitly, as a separate component of the standard cost.<br>Stochastic analysis of the expected value and the lower bound of cash flows. |

| Principles | Required in information system and controls |
|---|---|
| **Principle 7: Allowance must be made in the EV for the potential impact on future shareholder cash flows of all *financial options and guarantees* within the in-force *covered business*. This allowance must include the *time value of financial options and guarantees* based on *stochastic techniques* consistent with the methodology and assumptions used in the underlying embedded value.** | |
| **Principle 8: New business is defined as that arising from the sale of new contracts during the reporting period. The value of new business includes the value of expected *renewals* on those new contracts and expected future contractual alterations to those new contracts.<br>The EV should only reflect in--force business, which excludes future new business.** | Standard-cost price including cost of options and guarantees and cost of capital.<br>Activity Based Costing (ABC).<br>Analysis of distribution expenses: efficiency results and occupational results.<br>Record present value of future premiums as a "stock of cash flows" and explain variances. |
| **Principle 9: The assessment of appropriate assumptions for future experience should have regard to past, current and expected future experience and to any other relevant data. Changes in future experience should be allowed for in the value of in-force when sufficient evidence exists and the changes are reasonably certain. The assumptions should be *actively reviewed*.** | ABC.<br>Experience variance, reconciling with the primary reporting and the statutory basis underlying the PVPF.<br>Analysis of experience variance:<br>• Policyholder behaviour and other external factors (credibility indicator for underwriting/selection policy).<br>• Company's policies. Analysis of cost per policy. Relationship to budgets and non-financial KPIs. Impact analysis of company's actions (e.g. actions to enhance persistency, to increase renewals, to cut expenses per unit). |
| **Principle 10: Economic assumptions must be internally consistent and should be consistent with observable, reliable market data. No smoothing of market or account balance values, unrealised gains or investment return is permitted.** | Eliminate effects of movements in fair values of assets.<br>Record volatility due to experienced changes in economic assumptions and analyse the difference from the reported sensitivity. |
| **Principle 11: For *participating business* the method must make assumptions about future bonus rates and the determination of profit allocation between policyholders and shareholders. These assumptions should be made on a basis consistent with the projection assumptions, established company practice and local market practice.** | Eliminate effects of movements in fair values of backing assets. |
| **Principle 12: Embedded value results should be disclosed at consolidated group level using a business classification consistent with the primary statements.** | |

# 7 Bayesian statistics and its potential for financial recording and reporting

After the hurdle of recording, explaining and valuing economic events has been taken, the challenge of systematically recording the precision of value estimates remains to be met. One of the main conclusions of chapter 3 was that value and volatility form key information requirements for large groups of users of financial reports. This view has been elaborated for life insurance enterprises in chapter 4. Embedded value has been identified as a large part of the total value of an insurance enterprise: embedded value plus the value attached to the ability to acquire new contracts (the structure value) forms the total fundamental value of a life insurance enterprise. Explaining the sensitivity of embedded value estimates to assumptions is an important element in the European Embedded Value Principles. Explaining the sensitivity of financial reporting estimates to assumptions is an area that has been addressed to some extent by the IASB in a number of IFRS (e.g. in IFRS 4). This chapter investigates whether it is possible to define an accounting framework that supports and further enhances the credibility of the measurement of sensitivity/volatility and the disclosures on it.

The desire to record and present (expected) values and variance is not new. In the 20$^{th}$ century, Morgenstern (1950, page 30-32) described a balance sheet as a set of individual elements, some of which (such as cash) are 100% accurate and others have degrees of precision and reliability that can vary between high (such as trade receivables) and low (such as goodwill). In real life, these elements are arithmetically summed to an equity amount that suggests an accuracy that does not exist. The confusion is compounded by the fact that the individual elements of the balance sheet may or may not have already been formally or informally adjusted for risk and imprecision (by applying a cost or lower scheme or non-recognition). Sprouse (see Anthony 2004, p. 51) speaks in a similar context of a sheet of balances rather than a balance sheet.

In the second edition of his book (1963, pages 76 to 79), Morgenstern suggests a probabilistic structure of the asset side of the balance sheet. Each item would be reported in five columns, i.e.:

- Description of the item (cash, inventory, trade receivables, etc.).
- Carrying value (this is the basis for arriving at the book value of the equity).
- Marginal probability (this is the probability that the present value of the future cash flows to be realised from the underlying asset is at least the carrying value).
- Mathematically Expected Value.
- Standard error.

In order to present this information, it would be necessary to know the probability distribution of future cash flows underlying an asset (or cash-generating unit). Such a distribution can be obtained by a descriptive mathematical model or by simulation as shown in section 4.1. The mathematically expected value is not always available for individual assets. Often, only the direct realisable value is available for an individual asset; indirect realisable value is mostly generated by the complex of the enterprise (or a smaller cash generating unit) and assumes future cash outflows in order to unlock this value (in other words, it assumes business continuity).
Furthermore, there is the issue of aggregation to the book value of the equity. Probabilities and standard errors do not simply add up. The example in chapter 4 shows this.

Finally, there is the choice of the model parameters. The process of generation, analysis and selection of parameters should be sufficiently robust and transparent in order to use it for external financial reporting purposes.

Needless to say, the issues raised above require support from information technology that was not available at the time Morgenstern published his ideas. His remark (1963, page 78).

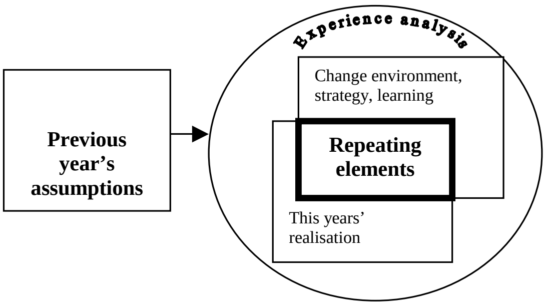
It is, of course, unlikely that balance sheets will be drawn up in the indicated manner; this is a matter for the future. But it is clear that present balance sheets already contain an element of expectation. Indeed, some accounting theorists emphasise this point, though without introducing a probabilistic approach which is indispensable, since there cannot be an expectation without a probability attached to it. This would be meaningless.

More than forty years have passed since this statement was made and one can wonder whether the future that Morgenstern refers to has begun. No doubt, information technology (both the capacity to store data and the processing capacity to manipulate them) has improved dramatically and is still improving. Nevertheless, quantitative information on volatility of future cash flows and precision of estimates is only reluctantly being welcomed into financial reporting in the form of sensitivity analysis or (sometimes) value at risk reporting. A pioneering idea for insurance enterprises is the Embedded Value at Risk™ concept, which has been developed by the American Council of Life Insurers and Ernst & Young. Embedded Value at Risk has been defined as:

The difference between the mean embedded value and the chosen percentile embedded value for each risk element.

Such a metric indicates the volatility of embedded value estimates, but also enables the measurement of the economic capital that is required to secure the business that is covered in the embedded value estimate (see figure 3.1-2).

**Figure 7-1: Experience and choice of parameters**




Embedded Value at Risk measures the imprecision in the embedded value estimate for each risk element (mortality, morbidity, investment income, etc.) separately and for all elements together, thus dealing with the covariance between the various elements.

The question I wish to address in this chapter is to what extent information about the precision of estimates and their x% lower precision bounds can be generated and updated within the accounting routine of recording events in a way so that they are sufficiently robust for external reporting.

Relating to this question, two elements are relevant:

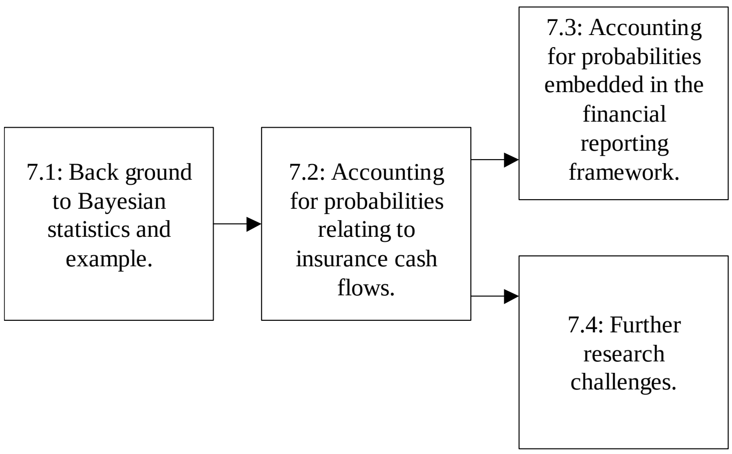
- Generation and updating of parameters;
- The model to be used.

With respect to the choice of the parameters, Figure 7-1 is important. Considerable effort in chapters 3, 4, 5 and 6 has been put into explaining the importance of accurately recording and explaining historical events for value estimates that are based on estimated future cash flows. The financial REPorting concept has been designed because recording historical events in the same format and using same the principles that are used for projection and a proper analysis adds learning and hence credibility to assumptions and parameters used for future projections. We desire the future, but we possess the past. Using our possession in a smart way brings us closer to our desire. The *perpetual value recording method* explained in chapter 6 will not make us astrologists, but it will assist us in reliably recording all experienced changes in value during a financial reporting period. This provides a set of facts rather than an estimate of past events.

The remainder of this chapter focuses largely on models. Needless to say, it does not provide *the* model for accounting for risk, but merely an example on how the concept could work. The next two sections are a demonstration and, most of all, a challenge to the financial mathematics discipline. This challenge is to provide tools that:

- Effectively describe the probability distribution of various types of cash flows and the total of net cash flows relating to an insurance contract, so that the distribution can play a role in estimating the standard cost price (including cost of the required economic capital).
- Update such a probability distribution in a transparent way on the basis of transactions, experience, management decisions (such as the hedging of open positions) and changes in the environment, thus creating a type of "probability distribution ledger".

The road map to this chapter is as follows:




Section 7.1 gives a brief introduction to Bayesian statistics and its similarity with bookkeeping in the sense that quantified information can be used to update a probability distribution whenever events (or transactions) indicate the need for such an update. In this way, it is possible to keep a historical record of events that gave rise to changes in the probability distribution. This is demonstrated with a model that was originally designed for statistical auditing purposes, i.e. the Felix & Grimlund model. The background to statistical auditing and to the model is discussed briefly .

Section 7.2 demonstrates, using the Felix & Grimlund model, how updates of the probability distribution of life insurance cash flows that are based on observed events can be made in order to create a *perpetual risk recording* method for life assurance. With this approach, value and risk/volatility are both permanently updated ("booked") from transactions and events. The facts and events that lead to updates are discussed at a high level.

Section 7.3 places the *perpetual risk recording* method in the comprehensive framework of *Financial REPorting*, *perpetual value recording* and *perpetual risk recording*. It demonstrates the relevance of the recording and analysis of historical events, the connection with the update of value and volatility, and the connection between value and volatility via the (cost of) economic capital.

Section 7.4 summarises the research challenges that are ahead of us in order to make the *perpetual risk recording* method really work in practice.

## 7.1 Bayesian statistics and the Felix & Grimlund model

In Section 2.2.1, the law of large numbers has been explained. It tells us that in a very large experiment the frequency with which a certain attribute is possessed by the elements in the experiment converges to the probability that the attribute is possessed by any individual element. Using this law, the outcome of experiments from known, closed probability distributions (such as flipping coins, rolling dice, etc.), gives us adequate predictions. However, in real life we roll many dices together and those dices have an unknown number of surfaces that may change over time so that our past observations are not always representative for the future.

Thomas Bayes (1763, page 1) formulated our day-to-day problem of estimating future events from only limited historical observations available, as follows:

*Given:* the number of times in which an unknown event has happened and failed.
*Required:* the chance that the probability of its happening in a single trial lies somewhere between any two degrees of probability that can be named.

The appendix to Bayes’ essay, written by Charles Price, includes an example of a lottery in which the probability of winning a prize is unknown and has to be derived from observations. Suppose one has observed 10 misses and one prize (a frequency of 1/11), what is the chance that the probability of winning a prize lies between 1/12 and 1/10? Bayes’ rule (Bayes, 1763, page 14) gives 0.07699, which can also be obtained by calculating the binomial probability. With the observation of 100 misses and 10 prizes, the probability increases to 0.2390. This is basically the way, Bayes’ theorem records learning from observations.

Price (Bayes, 1763, p. 19) mentions in his appendix another illuminating example, also quoted by Folpmers (2002, p. 127).

Let us imagine to ourselves the case of a person just brought forth into this world and left to collect from his observations the order and course of events and what powers and causes take place in it. The sun would, probably, be the first object that would engage his attention; but after losing it the first night he would be entirely ignorant whether he should ever see it again. He would therefore be in the condition of a person making a first experiment about an event entirely unknown to him. But let him see a second appearance or one *return* of the sun, and an expectation would be raised in him of a second return, and he might know that there was an odds of 3 to 1 for some probability of this. This odds would increase, as before represented, with the number of returns to which he was witness. But no finite number of returns would be sufficient to produce absolute or physical certainty. For let it be supposed that he has seen it return at regular and stated intervals a million of times. The conclusions this would warrant would be such as follow: There would be the odds of the millionth power of 2, to one, that it was likely that it would return again at the end of the usual interval. There would be a probability of 0.5352, that the odds for this was not *greater* than 1,600,000 to 1; and a probability of 0.5105, that it was not *less* than 1,400,000 to 1.

At least as illustrative is the relationship that Price describes between the cause of a certain event and its probability.

By parity of reason, it follows universally, with respect to every element about which a great number of experiments has been made, that the causes of its happening bear the same proportion to the causes of its failing, with the number of happenings to the number of failures; and that, if an event whose causes are supposed to be known happens oftener or seldomer to be known, happens oftener or seldomer than is agreeable to this conclusion, there will be reason to believe that there are some unknown causes which disturb the operations of the known ones.

Take for example the tables of mortality frequencies described in section 4.1. These frequencies are commonly used for estimating mortality *probabilities* when determining premium rates or technical reserves of life insurance enterprises. However, in the course of time, there is a change in the causes that drive death frequencies by age class. The people that buy life insurance now did not go through the hardship of the Second World War, while people in recent mortality statistics did, or have benefited from improvements in medical science. Or perhaps, buying life insurance is itself proof of belonging to a class of persons in a country that is more vital and healthier than the average population of that country.

The man in the example of Bayes and Price could after four days' observations on earth read a book and analyse why the sun rises every day at a predictable time and why it is probable that it will continue to do so for a while. He would probably give more weight to this analysis than to a million observations. In other words, analysing causes of events and changes therein may be used in estimates of the probabilities of future events before the frequency of these events has been observed. For example, if a new medicine has been introduced that may increase average human life by 2 years, it is not necessary to wait for new observations of mortality frequencies to estimate new mortality probabilities. The new information can be used directly, *provided that the new information can be properly quantified and can be given proper weight.* And in the latter lies the challenge.

Bayesian statistics have been discussed extensively within the accounting profession in relation to managing the risk of not discovering a material error in an audit. The next sections are dedicated to this issue[66].

### *7.1.1 Financial statements and risk*

Financial statements present the financial position of a company at a certain moment and the performance for a certain period. They are materially misstated if an error or omission exists which would have led to another decision by the user (would not have sold his shares, not have granted the credit, not have placed the order, not have selected the company as employer, etc.) had he known about it.

The basics of financial statements have been described in chapter 3.

Figure 7-2 shows how an individual account balance develops within a set of financial statements. This figure demonstrates that financial statement accounts basically originate from (business) processes. Part of the information in financial statements is based on estimates that may have different levels of accuracy. Notes to the financial statements should clearly outline the accounting policies and the basis for estimations. Where an unexpected degree of uncertainty (or inherent variability) exists, this should be explained in the notes to the financial statements.

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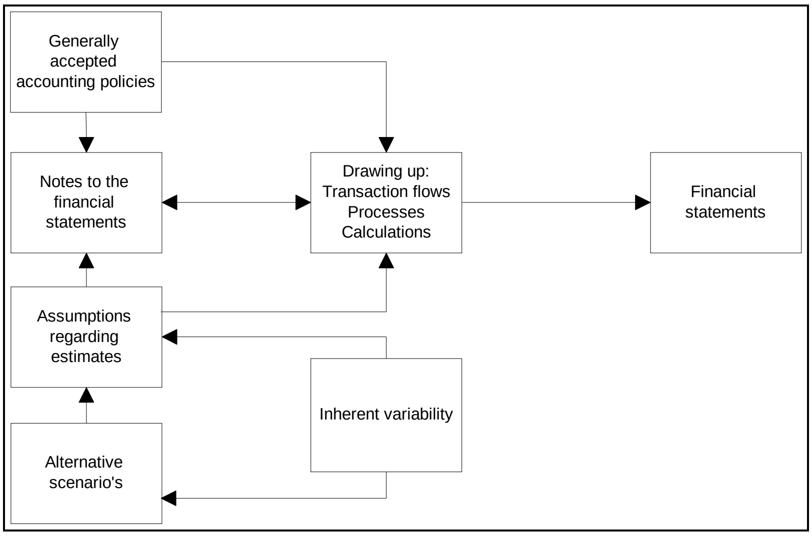
66 Sections 7.1.1 and 7.1.2 have been derived from an unpublished paper by Folpmers and De Jager (2000): Quantifying the risk of missing a material error in financial statements; a long-existing problem rewritten.

**Figure 7-2: Drawing up an account balance**




Standard setters (see for example the IAS framework) acknowledge that not all account balances can be established with the same accuracy and that in some cases estimates have to be made. Examples of estimates are lifetime of fixed assets, adjustments for uncollectible receivables, provisions, etc.

A material difference between a final outcome and an accounting estimate used in a set of financial statements is not considered an error in these financial statements. Failure to use all the relevant information available at the date of the financial statements is; so is failure to include the proper explanatory notes.

**Figure 7-3: Types of possible errors in financial statements**

| Source | Error in FS | Affects: | |
|---|---|---|---|
| | | Qualitative information | Quantitative information |
| • Improper classification | Yes | | • |
| • Incorrect timing | Yes | | • |
| • Elements do not exist | Yes | | • |
| • Improper valuation | Yes | | • |
| • Incomplete recording | Yes | | • |
| • Difference estimate/outcome | No | | |
| • Improper disclosure about degree of uncertainty | Yes | • | |
| • Not using all relevant sources of information in accounting estimates | Yes | | • |
| • Improper notes on accounting policies and basis for estimates | Yes | • | |
| • Allowance for risk[67] | No | | |
| • Deliberate overstatement of prudence cushions | Yes | | • |

67 To the extent permitted by the financial reporting principles.

A particular issue with respect to estimates in account balances is prudence. This concept and the relationship to uncertainty regarding future cash flows have been discussed in chapter 4.

Figure 7-3 summarises the possible types of (material) errors and omissions in financial statements
Comprehensive risk analysis models that are used by audit firms (or that are still in the research laboratories) focus primarily on the risk of a material error or omission[68] in the financial statements that affects the quantitative information.

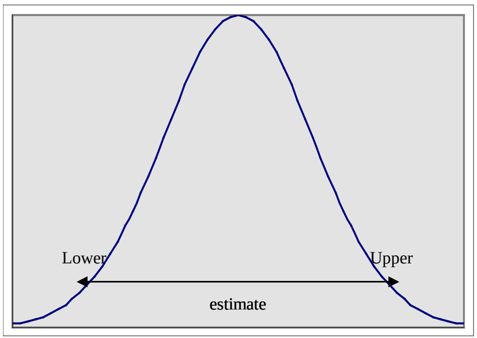
### *7.1.2 Statistics and auditing*

Here is a classical example of a statistical audit technique. In a not-so-long-ago era, inventory records were not related to the general ledger and there was no *perpetual inventory recording method* (see chapter 6). Goods were debited to the accounts at their purchase price when purchased, and credited at their sales price when sold. Gross margin was assessed periodically, based on a physical stocktaking.

A possible audit technique was as follows:
- Select a sufficiently large random sample from the inventory records.
- Physically count the stock of the selected articles.
- Estimate the total inventory amount and assess the precision of this estimate.
- Assess gross margin by adjusting the book amount of inventory according to the financial accounting to the estimate.

Figure 7-4 shows the evaluation of such an audit of an account balance. The audit is deemed adequate if the distance between the estimate and the upper bound (or the lower bound) is within the materiality level, given an acceptably low level of risk that these bounds are exceeded. This risk is controlled by the standard deviation of sample averages multiplied by a certain factor. This factor is governed by the (standard) normal distribution, provided that all the conditions of the Central Limit Theorem (CLT)[69] are met. Given the nature of this type of population and the size of this type of sample, this can be considered plausible.
When companies began to record their inventory value and gross margin on a permanent basis, the audit technique described above was not efficient anymore, since a controlled reality always outperforms an auditor's statistical model. A more efficient approach was, to focus not on the

**Figure 7-4: Evaluating audit results regarding an account balance**

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68 A material error or omission is defined as an error or omission of such significance that a user of the financial statements would have taken a different decision if he had been aware of this error or omission at the time.

69 The CLT states, informally: 'For "large enough" $n$, $\bar{x} \rightarrow N(\mu, \sigma^2 / n)$.' The rate at which the distribution approaches a normal distribution depends on the shape of the parent population. See section 2.2.1.

*values* of the articles selected but on the *differences* between book value and audited value. The distribution of such differences is fundamentally different from the distribution of the values. It is skewer and contains a substantial number of zeros. Referring to the CLT and saying that the sample averages are normally distributed is not necessarily true for the differences. When the number of differences unequal to zero is small, it has even been demonstrated to be untrue.

As accounting systems and data processes improve, finding differences in the course of an audit becomes a rare event. Consequently, an estimate of the total of such differences becomes more difficult. Needless to say, extending the audit until sufficient differences have been found to make a proper estimate would be an unacceptable approach: the audited enterprise would be punished with extra audit work because its records do not contain sufficient errors to easily satisfy the auditor's estimation models. Consequently, the audit profession has focused on the data processes rather than the records, for the purpose of arriving at an *assumption* about the level of errors rather than an outright estimate of the error level.

In the last decades, data processes have become more and more integrated in the workflow within the business processes. A well-known example is a point-of-sale system, where the activity of settling a sales transaction leads to an update of the sales statistics, the inventory records and the general ledger, without further interference. In such a situation, audit evidence about the assumption of the level of errors in the accounting records should be generated from business processes rather than stand-alone data processes (which often do not exist anymore in the classical form).

E-commerce is leading to cross-organisational business processes (e.g. placing purchase orders and accepting sales orders via the web). The consequence is that part of the audit evidence is not generated from processes or records within the organisation of an enterprise but from the data-generating processes. Ultimately, the accuracy of data is governed by their source rather than by their destination.

The impact of the tendencies described above is that the auditor's conclusion regarding an account balance is the result of:

- a large number of different findings and impressions
- from the organisation of the audited enterprise and its environment,
- giving different degrees of assurance,
- which are sometimes quantitative and many times qualitative,
- for which assigning a quantitative weight is often a challenge.

### ***7.1.3 The Felix & Grimlund model***

W.R. Felix and R.A. Grimlund designed their model originally in 1977. The technical details are explained in Appendix 7-I. It is meant to convert experience and knowledge into a probability distribution of potential error amounts in accounting populations. The model is a combined attribute variable model. It describes the error rate and the size of the error separately and converts these into a combined error amount, and assesses the probability of that error amount occurring. The input for the model can consist of the results of one or more consecutive samples, but can also consist of other types of information, as long as the user is prepared to quantify his evidence, knowledge and experience, by answering the following questions:

- How significant is the evidence gathered (to be expressed as a "sample equivalent")?
- What error proportion does the evidence indicate?
- What value might the elements in error have on average?
- What volatility has the value estimate?
- What is the strength of the evidence regarding the value?
- What is the strength of the evidence regarding the volatility?

The main challenge for this model is the calibration of non-sampling information. This is largely subjective and rules have to be developed in order to give the quantification of non-sampling information sufficient credibility.

Until recently, not only the calibration, but also the arithmetic solution was an issue. After years of silence around the model, Steele (1992, page 112) gave an elaborate description of the potential of the model for auditing.

An important step in making the model operational has been set by Folpmers (2002) who provided an efficient (Matlab™) procedure that easily converts sample and quantified non-sample information into a probability distribution of possible error amounts. I developed the same procedure in Visual Basic™ (see Appendix 7-I), which is easier to connect to a wide variety of standard applications, and thus more convenient in experiments by non-mathematicians.

In order to demonstrate the model, I use the same example as Steele (1992) and Folpmers (2002). The example assumes an accounting population (e.g. inventories) that consists of 5,000 elements. Table 7-1 summarises the data used. The experiment starts with prior information about the frequency and size of potential errors. This prior information may originate from prior years' findings, knowledge about controls over financial reporting, analytical reviews, etc. The prior information has a total weight of 300, expressed as a sample equivalent. In other words, an equivalent evidence value of a sample size of 300 elements has been attached to the prior information.

**Table 7-1: Felix & Grimlund, Steele, Folpmers example**

| | Prior | Sample 1 | Posterior 1 | Sample 2 | Posterior 2 |
|---|---|---|---|---|---|
| Weight elements in error | 2 | 3 | 5 | 2 | 7 |
| Weight correct elements | 298 | 97 | 395 | 98 | 493 |
| Total evidence weight | 300 | 100 | 400 | 100 | 500 |
| Average error frequency | 0.67% | 3.00% | 1.25% | 2.00% | 1.40% |
| Average error per unit | 20 | 59.9 | 30.88 | (0.26) | 26.09 |
| Weight for average error per unit | 8 | 3 | 11 | 2 | 13 |
| Weight for variance error per unit | 6 | 3 | 9 | 2 | 11 |
| Variance error per unit | 1,371.7 | 2,899.7 | 2,267.0 | 19.9 | 2,007.6 |
| Variance error amount: Var($\pi$) | 2,314.7 | | 3,179.7 | | 2,642.5 |

The average error per unit indicates the severity and the direction of the error, given that it occurs. The variance of the error per unit indicates the variance of this average. For the two samples, the variance of the error per unit is measured by the variance of the sample elements found in error, as can be seen from Table 7-2.

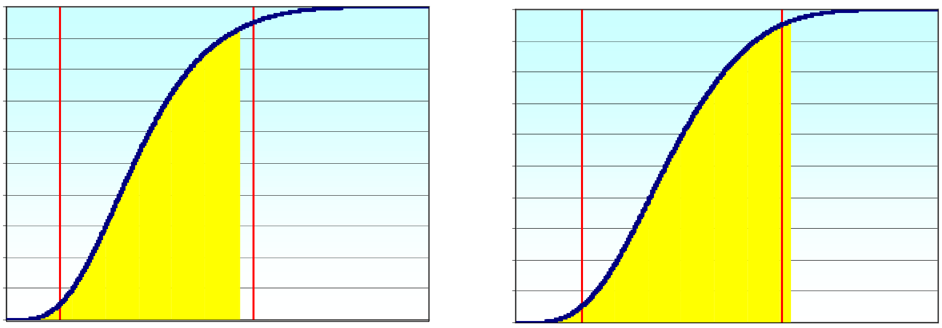
**Table 7-2: Sample results**

| | Sample 1 | Sample 2 |
|---|---|---|
| Sample size | 100 | 100 |
| *Errors:* | | |
| Item 1 | 13.51- | 4.20 |
| Item 2 | 79.17 | 4.72- |
| Item 3 | 114.11 | |
| Average | 59.92 | 0.26- |
| Variance | 2,899.69 | 19.89 |

The weight of the average error per unit and the weight of the variance per unit are indicators for the quality of the evidence about these two parameters. These weights play a role in the calculation of the variance of the error amount var($\pi$). Note that for the two samples the weight for the average error per unit or for the standard deviation of the error per unit is equal to the number of elements in error. This can be expected, because the observed errors here are the source of the information about direction, severity and volatility. In the prior information, the weights (8 and 6) are heavier than the prior assumption of error occurrence (2). Obviously, an analytical review or other sources of evidence provided additional information about potential errors. The variance of the error amount is calculated as shown in Appendix 7-I, as are the updated parameters for the posterior distribution.

Figure 7-5 shows the distributions for posterior 1 (left) and posterior 2 (right). The x-axis represents the possible error amounts and the y-axis the probability. The curve represents the cumulative density function for the total error amount in the population/account balance. The two straight lines represent the confidence bounds (based on 95% reliability in the example) and the filled (shaded) area represents materiality (3,500 in the example). The figures are easy to interpret with respect to a possible material error (the filled area would then be outside the straight lines) and the sufficiency of the audit evidence (the evidence is sufficient if the filled area overlaps the straight lines, which is not the case for the first sample, as shown in the left part of the figure, but is the case in the right part, for the second sample of 100 elements).

**Figure 7-5: Posterior 1 and posterior 2**



The model was originally designed for sampling purposes in relation to the audit of financial statements. Folpmers (2002) has drawn attention to its potential use in quality control within business processes (which has a strong relationship to managing operational risks and to control over financial reporting, hence, indirectly with financial statements).

In section 7.2, a high-level landmark study is performed into whether the model (or similar Bayesian models) would be useful in recording the uncertainty and imprecision of future cash flow estimates observation-by-observation.

## 7.2 An explorative application for life insurance

In this section, I use an approach where cash flow estimates and volatility indicators are directly recorded in a Bayesian model (The Felix & Grimlund model) in order to estimate the precision interval around the projected cash flows. This is close to bookkeeping. Similar to the recording and valuing of financially relevant transactions in the ledger, the consequences of transactions, observations, experienced variances, budget and control procedures, changes in the environment, etc. are systematically recorded in the Bayesian model in order to generate a "fresh" probability distribution of future cash flows each time. This form of "accounting for risk" is demonstrated in Figure 7-9.

**Figure 7-6: Composition probability insurance cost (IAIS)**

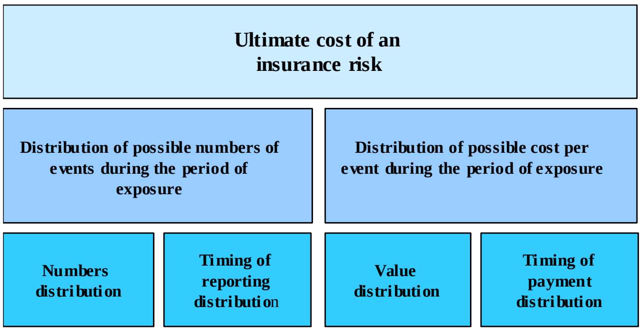



Figure 7-6 has been derived from the discussion paper on quantifying and assessing insurance liabilities (2003) by the International Association of Insurance Supervisors (IAIS).

The figure assumes that the distribution of the potential ultimate cost of insurance has three dimensions, i.e. frequency, value per unit and timing. The Felix & Grimlund model describes two of the three dimensions. It contains a beta distribution that governs the frequency of a certain event and a normal distribution that governs the value given that this event has happened. Most (life) insurance cash flows have a frequency dimension (claim frequency, mortality, etc.) that is binomially distributed (and the beta distribution is conjugate to a binomial distribution) and a value dimension that can often be reasonably described by a normal distribution. The timing is to a large extent determined by the mortality frequencies per unit.

In order to demonstrate the use of the model, I make use of the example discussed in sections 4.1 and 4.2. Figure 4-6 shows the frequency distribution of the total results from the 1,000 simulation runs, which is the most representative information about the probability distribution of future cash flows. However, the curve given in this figure consists of two parts with completely different properties (see Appendix I to chapter 4):

- A part where the guarantee is out of the money.
- A part where the guarantee is in the money.

These two parts would need a separate model description and should be recorded separately[70].

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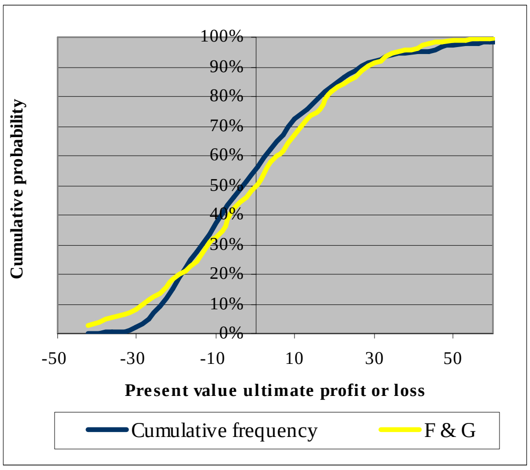
70 The European CFO Forum discussed this issue extensively when developing the European Embedded Value Methodology. They decided that options and guarantees need a separate evaluation in the embedded value estimate because of their asymmetry (cost for the enterprise in unfavourable situations, profit for the policyholder in favourable situations). For traditional deterministic cash flow projections, the cost of this asymmetric proposition would not be taken into consideration as long as the option or guarantee is out of the money.

However, the variant where the guarantee to the policyholder has been synthetically hedged shows a far more symmetric distribution of outcomes and may be resembled by a single model.

Figure 7-7 shows the frequency distribution of the cash flows according to the example used in chapter 4, compared with a comparable probability distribution according to the Felix & Grimlund model. The following parameters were set for the F & G model to produce the curve shown:

**Figure 7-7: Example frequency to F & G probability**




| | |
|---|---|
| Weight number of benefits | 8,734 |
| Weight number of deaths | 1,266 |
| Total evidence weight | 10,000 |
| Average benefit fraction | 87.34% |
| Average net cash flow per benefit | 0 |
| Weight for the average | 8,734 |
| Weight for the variance | 8,734 |
| Variance cash flow per unit | 498,418,353 |
| Variance cash flow value | 498,589,591 |

The total evidence weight resembles the initial number of policyholders and the weight of the number of benefits is evidenced by the mortality table (in Table 7-1, this parameter indicates the number of errors).

The average cash flow per benefit is initially zero, because the premium income (in Table 7-1 this parameter indicates the average error per unit) in the example (excluding cost of guarantee and solvency) is equal to the expected value of benefits and expenses[71]. The variance of the cash flow value was found from the simulations as the variance of the aggregate cash flows from mortality and expense results. The weights for the average and variance per unit are initially set to the expected number of benefits. If one considered the "quality of the evidence on expected cash flows" to be worse, one could adjust this by decreasing the prior weights.

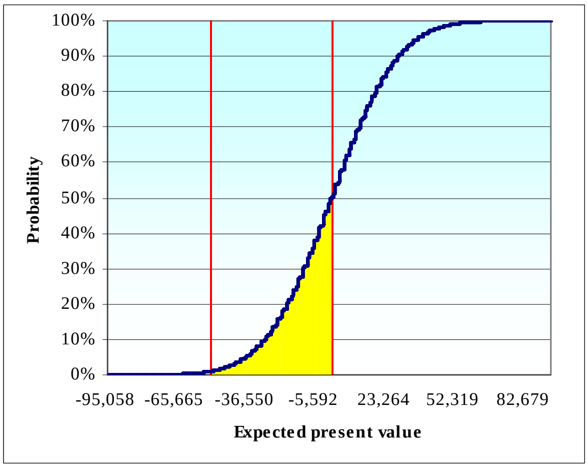
Although there is not a perfect fit between the two curves, there is sufficient resemblance to consider the use of the Felix & Grimlund model (or a similar prior distribution model) to account for the imprecision of future cash flow estimates in situations where the upward potential and the downward risk for the insurance enterprise are not too asymmetrical. (In propositions with naked options and guarantees, a split of the distribution for the part where the options and guarantees are out of the money and situations where they are in the money should be considered). Note that the "real" distribution (which is also based on assumptions about probability distributions) has been generated by simulation on one model point. Update of this distribution, when necessary, takes place by simulation again. A simulation run, even for an example as simple as the one presented, takes some time and does not necessarily analyse the difference from the previous simulation. This difference may be due to the "granular capital" attached to units of insurance products sold

71 The simulation results give a small value per unit, which can be considered a model variance. These account for a part of the difference between the two curves.

or extinguished during the reporting period, experience during the reporting period and/or changes in the circumstances.

The Felix & Grimlund model, once resemblance to the cash flows of the underlying insurance contracts has been established, is used for each "stock item" of cash flow as defined in chapter 5. The model can be updated "in a flash" and is quite flexible. As can be seen in Figure 7-8, the output is easy to interpret. The curve represents the probability distribution of all possible net present values of future cash flows. The left straight line is positioned at the (in this case 99%) lower bound and the right straight line at the zero point. (Below this point, the enterprise has to meet its commitments from the economic capital.) Given a 99% assurance that the enterprise will be able to meet its commitments, the need for economic capital can be read using the left straight line, the amount being of minus 48,992. If I were not comfortable about the prior estimates of average per unit or variance per unit, I could attribute a lower weight. For example, the implication of attributing a weight of 50 to the average and 20 to the variance would be that the curve would extend further to the left and the economic capital requirement would increase to 52,147.

**Figure 7-8: Output F & G model**



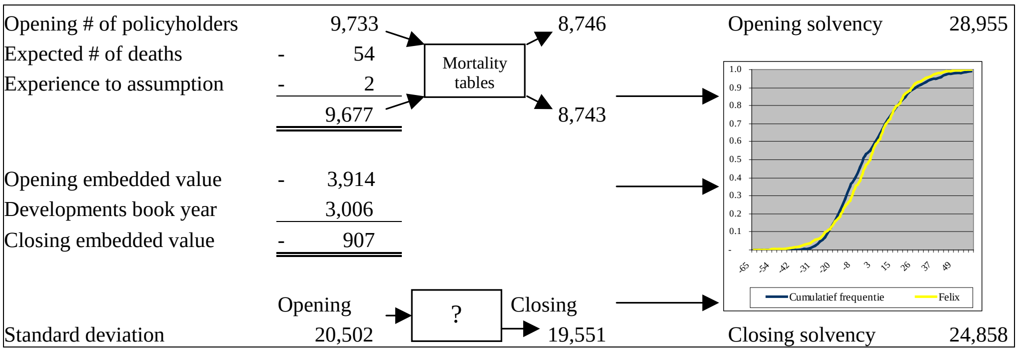

In order to investigate the usefulness of the F & G model for accounting for the probability distribution during the lifetime of the policies, I have simulated the future cash flows starting at year 2, year 3, year 4, etc., and compared the simulation results with the F & G model. Each time, the "real experience" from the preceding year is treated as "history" and taken as a starting point for subsequent years. Hence, for the simulation starting in year 4, the "history" of the years 1 to 3 is taken as a starting point. The parameters used in the F &G model are:

- The number of policyholders still alive at the beginning of the simulation.
- The ex-ante proportion of policyholders expected to be alive on maturity (based on the mortality table).
- The embedded value (or the equity plus the stock of margins)[72].
- The variance. Because no other information is available, the variance from the simulation rounds has been used as input for the F & G model.

[72] For practical reasons, allocated capital is disregarded in the example. Consequently, there are no costs of allocated capital. At inception, the embedded value is zero, because there are no margins. At the end of each year, a profit or a loss may have occurred and the investment fund may have overperformed or underperformed. This gives sufficient information to project the expected future expense result (underperformance means an expected future loss on expenses, overperformance an expected future profit) and the investment income on surpluses or deficits that have accumulated to date. Hence, the embedded value can be estimated autonomously.

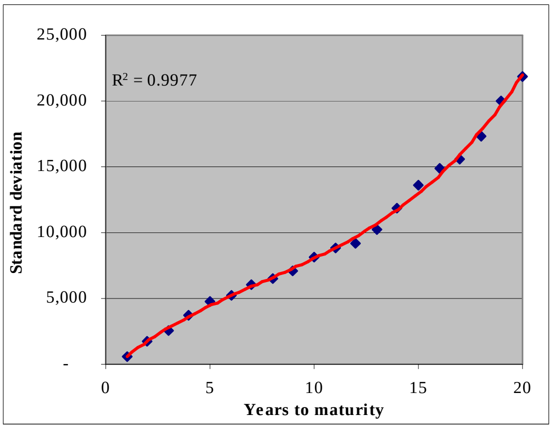
Appendix 7-II shows the comparison between the simulation results and the F & G model for years 1, 4 and 7, and for years 13, 16 and 19. The graphs show that the F & G model remains a fair resemblance of the product specific simulation results and thus remains an acceptable tool to account for risk in the given example. It also shows that the variance decreases as the policies reach maturity. In Figure 7-9, the relationship between the developments in the input variables and the solvency requirement according to the F & G model is shown for the simulation in year 10.

**Figure 7-9: Example of annual update of F & G parameters**




The changes during the book year are entered in the F & G model to generate an updated probability distribution and to re-estimate the required solvency at a (in the example) 99% confidence level. The F & G model does not generate the revised parameters, however. This is done in the production systems. Compare it to the traditional accounting system. The quantities and values to be recorded in the accounting system are counted and valued within production systems, the same as with the F & G model as a supplement to the stock of cash flows/stock of margin system described in chapter 6. The model records the probability distribution and changes in the probability distribution as a consequence of observed events. This creates a reference trail between the events and the changes in the probability distribution or in the economic capital. The model does not count and value the observed events.

**Figure 7-10: Standard deviation and time**




The development in the number of policyholders can be observed from the experience during the financial year.
The development of the embedded value is the movement in the equity (in the

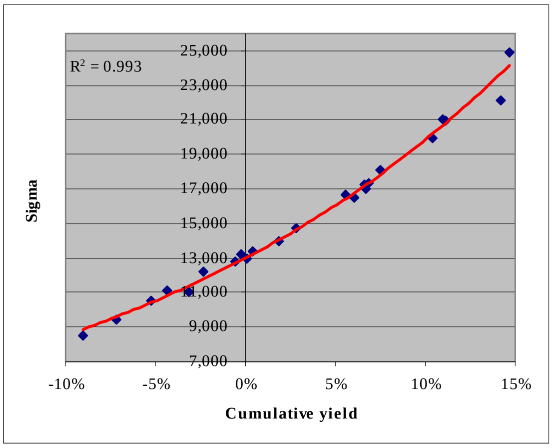
example equal to the result for the book year) and the change in the present value of future profits (the stock of margins). In the example, the latter is only the change in the expected future expense results, based on the experienced development in the funds.

Although the variance is more difficult to assess from the experience during the financial year, it is fair to suspect that it is a function of the volatility in the returns on the investment fund and the potential variance in the number of survivors on the maturity date. Section 4.4 describes the relationship between volatility in the investment return and time to maturity. For the type of insurance described in the example, it is reasonable to assume that volatility decreases as time to maturity elapses.
The same assumption seems reasonable for the variance in the expected number of survivors on maturity, with each year providing additional information on this. Figure 7-10 corroborates this assumption: there is a high correlation between the number of years to maturity and the standard deviations found in the simulations from each year of commencement[73].

Furthermore, the relationship between fund value and standard deviation has been investigated by analysing 23 simulation runs with inception year 5. The relationship to the fund value and cumulative yield has been investigated. Cumulative yield and standard deviation gave the highest correlation, as presented in Figure 7-11.

So although we do not have a number for the variance to be used as input into the F & G model, we do know what drives the development in it. Further research in financial mathematics should lead to a mechanism for translating all experience during an accounting period into parameters that update the probability distribution of future cash flows. When this is found, the reliability of financial statement estimates, the variability of future cash flows and thus the measure for economic capital can be entered in a "risk ledger" where every effect of transactions and changes in economic and non-economic parameters can be recorded. Such a "risk ledger" enhances the insight of an enterprise into its risk drivers and provides a robust accounting platform for reporting on risk and required economic capital. Section 7.4 elaborates on the research challenges.

**Figure 7-11: Standard deviation and cumulative yield**

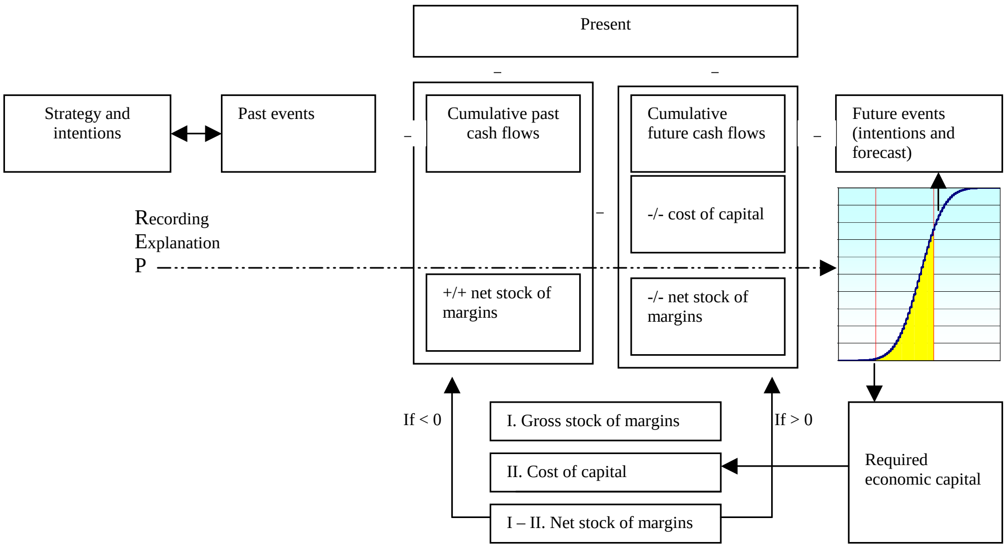



73 In order to avoid any influence from other variables, the investment yield in each year of experience has been kept close to zero. In this way, the value of the fund unit has been eliminated as a factor influencing the standard deviation.

## 7.3 Accounting for risk in a comprehensive accounting and reporting framework

The framework in Figure 7-12 summarises the thoughts that have been developed above i.e. on *Financial REPorting*, *perpetual value recording* and *perpetual risk recording*.

**Figure 7-12: Value and risk in financial reporting**




It shows the consistency between the past, present and future that is compelled by triple entry accounting: cumulative past events equal present; present equals estimated future events. The concept can be used for wealth or (embedded) value as a whole and for individual balance sheet items, which can basically be regarded as "cash flow in progress".

If past accumulated cash outflows exceed past accumulated cash inflows and/or future cash inflows exceed future cash outflows, the item under review is an asset (plant, machinery, inventory, etc.).

If past accumulated cash inflows exceed past accumulated cash outflows and/or future cash outflows exceed future cash inflows, the item under review is a liability (e.g. life insurance liabilities). There is basically no justification for treating this liability differently from the assets mentioned, just because it is on the other side of the balance sheet.

The framework presented in Figure 7-12 can be explained by some simple examples.

a Past net cash outflows amount to 100, future net cash inflows amount to 120, cost of capital has been established at 10. The amount to be evaluated at present represents an asset. Historical cost is evaluated in the left part of the framework and amounts to 100. The future value is evaluated in the right part of the framework and amounts to 120 – 10 – (20 – 10) = 100. The right part of the framework equals the left part, as required.

b Same example as 1, except that the future net cash inflows amount to 108. In this case, the net stock of margins is negative i.e. 8 - 10 = -2. This means that the left part of the framework is evaluated as 100 + (-2) = 98. The right part is evaluated as 108 – 10 = 98, which also meets the requirement of equality. In this case, the framework mandates an impairment of the asset.

c  Same example as 2, except that the future net cash inflows amount to 90. The net stock of margins amounts in this case to -10 - 10 = -20. The left part of the framework is evaluated as 100 + (-20) = 80 and the right part as 90 - 10 = 80, which demonstrates the required equality in this case, too.

d  Past net cash inflows amount to -120, future net cash outflows amount to -100 and the cost of capital amounts to 10. The net stock of margins amounts to 20 – 10 = 10. The right part of the framework is evaluated as -100 – 10 – 10 = -120 i.e. a liability of 120. The required equalities are met.

e  Same example as 4, except that future net cash outflows amount to -112. The net stock of margins amounts to 8 - 10 = -2. The left part of the framework is evaluated as -120 + (-2) = -122. The right part is evaluated as -112 - 10 = -122. The framework mandates a reserve adequacy adjustment.

f  Same as example 5, except that future net cash outflows amount to -130. The net stock of margins amount to -10 - 10 = -20. The left part of the framework is evaluated as -120 + (-20) = -140. The right part is evaluated as -130 – 10 = -140, i.e. a liability of 140.

The framework maintains the three-dimensional equality Past = Present = Future under all circumstances. It is also interesting to note that in examples 2, 3, 5 and 6, the asset under review is adjusted for impairment or the liability under review is adjusted for adequacy. The discounted value of all future cash flows using the same discount rate as used in the cost of capital calculation leads to the same book value after impairment or adequacy adjustment. The examples given in section 6.3 demonstrate this.

But there is more in Figure 7-12. The framework not only compels the keeping of a permanent record of the stock of future cash flows and margins (which enables the recording of experience variances from all perspectives rather than retrospectively estimating them), but also requires evaluation of the sensitivity of cash flow estimates in such a way that a net lower bound can be constructed, which gives direct input into the conceptual cost of economic capital.

Finally, the framework mandates that a record be kept of what is learnt about future developments from the observation, recording and explanation of historical events.

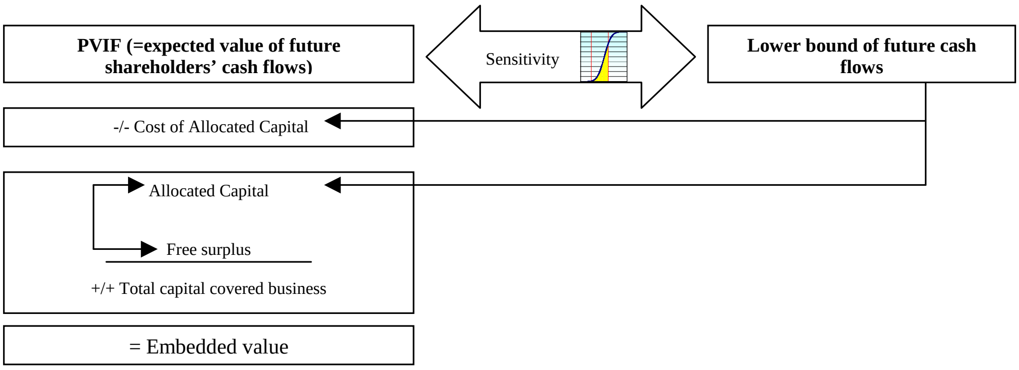
A bookkeeping system that supports movements in assets and liabilities, movements in stocks of future cash flows and margins and movements in the probability distributions of future cash flows and margins is a tool that enables control to be kept over embedded value reporting by life insurance enterprises.

In the framework, embedded value shall be equal to the present value of the stock of gross margins less the cost of capital plus required economic capital (increased by free surplus if any). It is also equal to the present value of the stock of net margins plus the required economic capital. And it is also equal to the present value of the stock of cash flows (including projected investment income on required capital). The framework provides a complete set of checks and balances, and a reference trail from transactions, events and observations to balances, and from transactions, events and observations to posterior probability information. Moreover, it concentrates the judgmental elements in a few areas:

- Developing standard cost prices, eventually driven by the enterprise's strategy.
- Giving weight to events and observations to update the prior distribution that underpins the expected value and lower bound of future cash flows.

Figure 7-13 shows embedded value reporting in the context of the value and volatility framework shown in Figure 7-12.

**Figure 7-13: Embedded value in value and volatility framework**




The framework also assists in making further improvements in embedded value financial reporting and in dealing with concerns that users of financial statements have at present. The analysts at Smith Barney reviewed the European Embedded Value methodology in relation to their equity research of European Insurance enterprises[74] and raised the following issues:

- The method reveals little about underlying cash flow development. The stock accounting system of cash flows and margins described in chapter 6 gives the basis for additional disclosures about expected timing of expected cash flows.
- It reveals little about the company's solvency position. The framework includes a (Felix & Grimlund or other suitable) function to evaluate sensitivity in a way that required economic capital can be derived from the lower bound of the net cash flow estimates.
- A thorough sensitivity analysis is needed to reveal potential sources of risk. The risk that a certain level of negative net cash flows is exceeded can be directly read from the (Felix & Grimlund or other suitable) function included in the framework. More important is that the reference trail of all changes between the previous period's (prior) function and this period's (posterior) function is recorded in detail, can be compared with observed sensitivities and can be efficiently summarised to a disclosure about sensitivities.

Table 7-3 uses a fictitious example to show what embedded value reporting in a value and volatility framework might look like. The example is based on the embedded value result and other movements in embedded value shown in Table 5-12. The relationship between embedded value results and "traditional accounting results" according to Figure 6-5 and the effects of volatility explained above have been added.

74 Smith Barney: Equity research Europe Insurance, 5 July 2004.

**Table 7-3: Example embedded value in value and volatility framework**

| | PVIF (Expected value of future cash flows) [1] | Lower bound of future cash flows [2] | Allocated capital [3]* | Cost of Allocated Capital [4]** | Free surplus [5] | Embedded value [6]*** |
|---|---|---|---|---|---|---|
| Unwinding of discount rate | 2,600 | | 500 | 350 | | 3,450 |
| Model profit | ( 4,300) | 2,050 | 4,300 | | | |
| Experience results | 150 | | ( 150) | | | |
| Change operating assumptions | 900 | 100 | | | | 900 |
| *Value of new business:* | | | | | | |
| Present value future profits of new business | 4,450 | ( 5,750) | | | | 4,450 |
| Cost allocated capital | | | | ( 400) | | ( 400) |
| Distribution costs | | | ( 2,250) | | | ( 2,250) |
| | 4,450 | ( 5,750) | ( 2,250) | ( 400) | - | 1,800 |
| EV operating profit | 3,800 | ( 3,600) | 2,400 | ( 50) | - | 6,150 |
| Current year investment experience | 1,400 | | 2,300 | | 450 | 4,150 |
| Change future investment assumptions | ( 1,050) | ( 2,050) | | ( 50) | | ( 1,100) |
| Foreign currency results | ( 1,700) | | | | | ( 1,700) |
| Embedded value result | 2,450 | ( 5,650) | 4,700 | ( 100) | 450 | 7,500 |
| Opening value | 37,250 | ( 16,100) | 16,100 | ( 5,850) | 2,550 | 50,050 |
| Embedded value result | 2,450 | | 4,700 | ( 100) | 450 | 7,500 |
| Change in allocated capital | | ( 5,650) | 950 | | ( 950) | |
| | 39,700 | ( 21,750) | 21,750 | ( 5,950) | 2,050 | 57,550 |

* The opening value of the allocated capital is equal to minus the lower bound of future cash flows. The movement of the lower bound of future cash flows depends upon the movement in the risk exposures, while the movement in allocated capital depends upon actual comprehensive income. The closing balance of the allocated capital is set equal to minus the closing lower bound by a transfer from / to free surplus.

** The cost of allocated capital is a function of the allocated capital and depends on the size of the allocated capital, the period it is needed and the difference between the hurdle rate and the expected investment yield.

*** The embedded value = [1] + [3] + [4] + [5]

The PVIF (Present Value of In-force business) is based on the expected value of future cash flows. The nature of the movements has been explained in section 5.3. The second column presents the present value of the x% lower bound of future cash flows, estimated as described in this chapter. In most circumstances, this will be a negative amount, which indicates the amount of economic capital that is required to ensure that the insurance enterprise can meet its commitments in x% of all possible scenarios. The change in the lower bound of future cash flows during the period is mainly due to the passing of time and the change in the fair value of investments (represented by the current year's investment experience), but also by the increase in total exposure as a result of new business. The allocated capital is the mirror of the present value of the lower bound of cash flows. The result shown in column [3] is the "traditional accounting profit[75]". The line items in this profit and loss account are similar to the reported source of earnings shown in Table 5-6. The unwinding of the discount rate in this column reflects the expected investment income on allocated capital. Together with the unwinding of the discount rate of the PVIF and the amount that becomes available from the cost of capital, it forms the unwinding of the discount rate on the total embedded value.

75 But using an accounting model where acquisition costs are not deferred, because the cash flows relating to new business do not take into account the amortisation of acquisition costs. Deferral of acquisition costs serves to match expenses with (future revenues). In the figure above, all future revenues have already been captured in the PVIF.

The allocated capital is kept equal to the absolute value of the present value of the lower bound of cash flows by transferring an amount to or from free equity. The cost of capital is a function of allocated capital (hence of the lower bound of future cash flows), discount rate and assumed investment yield.

A schedule as shown in the example above includes all three elements of the financial reporting triplet of Figure 1-1. Recorded historical events are compared to earlier estimates, which increases the relevance of the former and the credibility of the latter and provides input for future estimates. The reliability of the estimated future cash flows is presented as the precision interval, i.e. the difference between the present value of expected cash flows and the present value of lower bound cash flows. The lower bound is directly translated into a capital requirement, which drives the cost of capital. A higher risk profile of the business leads to a higher gap between expected value and the lower bound. Hence, a higher risk given a certain level of expected cash flows leads to a lower embedded value. In this way, economic capital is not only a common metric for all risks of the enterprise (see Doff, 2005, p. 583), but is also a metric for reliability in financial reporting. The example above shows the value estimate, the reliability of the value estimate and the historical developments against earlier estimates and thus closes the financial reporting triplet.

In recent times, market consistent valuation techniques become more and more developed. These valuation techniques are based on risk and arbitrage-free pricing. They assume that each set of uncertain future cash flows can be traded against a risk-free set of cash flows (or such a situation can be created synthetically). If this were true for all cash flows, it would not be necessary to look at the lower bound of cash flows, because adverse developments could be hedged away. The relevant factor for the embedded value would no longer be cost of solvency, but the cost of the hedges.

If instruments or synthetic hedging strategies are only partly available to convert uncertain future cash flows into risk-free cash flows (which will be the case in most circumstances), the cost of such instruments will cause a decrease in PVIF, while the lower bound of future cash flows will come closer to the expected values. The latter phenomenon will decrease the cost of capital. If this “gain” exceeds the hedging costs, the hedging strategy is efficient.
Market-consistent valuation assumes the use of risk-free and arbitrage-free discount rates instead of discount rates with a risk surcharge. But to avoid any misunderstanding, this would require finding risk-free equivalents to the estimated future cash flows. Section 4.3 sufficiently corroborates the view that the PVIF based on real cash flows and that based on risk-free equivalents will be equal, provided that the correct techniques are used.

## 7.4 Research challenges

As indicated in the introduction to this chapter, my aim has not been to attempt to give a general solution for translating experience, transactions and events into a volatility measure. The previous sections are a demonstration of how accounting for risk or the *perpetual risk recording* method could work using a Bayesian model that can be updated for each experience, transaction or event. The example used is relatively simple, but even for this example it is a challenge to find the right parameters. The development in the variance certainly needs more research.

In my opinion, this research should start with the standard cost price of an insurance product. Traditionally, this consists of the (expected) value elements. It has been concluded that it is necessary to obtain insight in the volatility elements, too. This enables the "granular capital" attached to each product unit to be estimated and the risk drivers to be assessed. The question for further research would be how the standard cost price (value characteristics and volatility characteristics) should be documented in order to make the *perpetual value recording* and *perpetual risk recording* methods work.

In the example, the main risk drivers are mortality and yield on investments. In practice, there are many complicating factors. Premiums may be single premiums and recurring premiums; the latter adds volatility to the cash inflow from policyholders. Policyholders' behaviour (on lapses, surrenders or paying-up of policies, on premium payments, in exercising options such as fund switching, increase of insured amount etc.) is relevant in "real life".

The investment yield and the guarantee were modelled reasonably simple in the example. In practice, options by the enterprise (such as discretion on profit participation, the ability to smooth surpluses over generations of policyholders) should be taken into account and they should all be part of the product characteristics that eventually lead to (an update of) the probability distribution of future cash flows and thus to (an update of) the "granular capital" attached to each unit of product.

Apart from knowledge about the probability distribution of future cash flows for one product unit or for a book of homogeneous products, enterprises will wish to have insight into such a distribution for business units, subsidiaries and eventually for the enterprise or group as a whole. This means that there is an aggregation and consolidation issue that definitely needs to be investigated further. One of the issues is the Bayesian update mechanism of the variance in models such as the F & G model. Appendix 7-I describes this update, with reference to Steele (1992, p. 145). Steele states that this update is only valid in situations where the covariance between the prior values and the update information is zero. In aggregation and consolidation situations, this is not necessarily true, because in some situations (e.g. when combining a book of term insurances, which is profitable when mortality is less than expected, with a book of annuities, which is a burden when mortality is less than expected), there is a non-zero covariance. This issue is also ripe for further research.

### 7.5 Conclusions

A significant part of the judgment needed to make future estimates of value has condensed into the distribution function that describes the possible outcomes of future cash flows and thus drives volatility, which drives the required economic capital and the cost of capital, the latter being an element that decreases the value. In this chapter, I have used the Felix & Grimlund model to illustrate this thought, not because it has been proven that it describes cash flows from insurance contracts under all circumstances, but because it has the following promising properties:

- It has a quantity/frequency dimension of a certain event (death, survival, accident, etc.) and a value dimension given the event.
- It can be updated many times and using various information sources, as long as it is accepted that this information is translated to the parameters described in section 7.2.
- The information fed to the model may change the mean (expected value of cash flows), variance and the shape of the curve. The resulting posterior probability distribution always reflects the most recent information available and a reference trail of the historical causes of movements in the position and shape of the probability distribution is kept.

To repeat, the Felix & Grimlund model or a suitable model with similar characteristics does not make us prophets. But embedded in the framework given in Figure 7-12, with all the checks and balances of three-dimensional accounting, the segregation of functions of the underlying transaction flows and the mandatory link to strategy and intentions, it provides information about estimates and volatility that is consistently based on all the information that the enterprise systematically recorded during the reporting period.

I believe that information produced by the framework under review can be efficiently tested for accuracy, completeness and consistency because of the reference trail to both historical development and the history of changes in estimated future development. I also believe that the information produced is easy to understand by accounting staff and (financial) management.

The main research challenges have been outlined in section 7.4. They relate to model development in relation to the translation of events, transactions and experiences into model parameters and to the developments required by the far more complex real world. They also relate to aggregation and consolidation issues.

The challenge for the discipline of financial mathematics is to further develop the Felix & Grimlund model into a model that describes prior information and allows the “booking” of new observations in a flexible way.

The challenge to both accounting and financial mathematics will be to find procedures to calibrate such models in order to allow the objective and unambiguous translation of events and observations into model parameters. This would allow the update of prior information on future cash flows from routine accounting processes.

**Appendix 7-I: Felix & Grimlund model**

The Felix & Grimlund model was originally developed for risk analysis and for designing and evaluating statistical samples in auditing. This appendix describes the model, explains how it can be implemented using Visual Basic™ and indicates how it can be used in the audit process for the continuous updating of conclusions about (parts of) accounts. The model accepts the results from subsequently selected statistical samples, but also from other steps in the audit process, as long as the auditor would be prepared to quantify his impressions about:

- The strength of the evidence about good experiences (where audited values equal book values) and the bad evidence (where audited values are not equal to book values).
- The potential magnitude of the bad evidence.
- The imprecision of the estimated potential magnitude of the bad evidence.
- The strength of the evidence about the potential magnitude.
- The strength of the evidence about the imprecision.

The model is described in chapter 6 of Steele (1992, page 111) and chapter 8 of Folpmers (2002, page 183). It is a mixture of three distributions:

- A distribution of possible error frequencies in a population. This is modelled by a $\beta$ distribution. Bad evidence is indicated with parameter a = k'; good evidence with parameter b = n'-k'.
- A distribution of the error size of non-zero errors. This is modelled by a normal distribution. $\mu$ is the indicator of the expected magnitude of the bad evidence, $\sigma$ of its imprecision. A factor $k_n$ is an indicator of the quality of the evidence about the magnitude of bad evidence. This factor is relevant when the prior information is updated with the data of a sample or other sources of information. The higher $k_n$ is, the more weight the prior information has when updated. A factor *v* fills the same role for the quality of the evidence on the imprecision.
- A distribution for the standard deviation given a certain variance of sample means and the weight given to them. This is modelled by a Gamma-2 distribution.

Table 7-4 summarises the parameters, expected values and variances of these distributions.

**Table 7-4: Distributional summary**

| Parameter | p | h=1/$\sigma$ | $\mu$ conditional on h |
|---|---|---|---|
| Distribution | Beta | Gamma | Normal |
| Parameters | *n',k'* | $\frac{1}{2}u', \frac{1}{2}u'v'$ | $m', hk_n^{'}$ |
| Expected value | *p=k'/n'* | *h'=1/v'* | *m'* |
| Variance | *p'(1-p')/(n'+1)* | $2h'^{2}/u'$ | $hk_n^{'}$ |

Table 7-5 explains all parameters in the F & G model and gives their meaning when they refer to information from a statistical sample and when they originate from other (quantitative or quantified qualitative) sources of information.

**Table 7-5: All model parameters**

| Symbol/Formula | Meaning if sample | Meaning if other information |
|---|---|---|
| k’ | Prior weight to elements in error | Prior weight to elements with a certain attribute |
| n’-k’ | Prior weight to correct elements | Prior weight to elements without that attribute |
| m’ | Prior average value of elements in error | Average financial consequence of the attribute |
| $k'_n$ | Weight given to m’ | |
| u’ | Prior variance of m’ | |
| v’ | Weight given to u’ | |
| n | Sample size | Weight of additional information |
| k | Errors in sample | Weight of additional error information |
| a’’=a+k | Update of prior weight errors | Update of prior weight elements with attribute |
| b’’=a+n-k | Update of prior weight correct elements | Update of prior weight elements without attribute |
| $x_i$ | Size of observed error amount in element i | |
| m | $\frac{1}{k}\sum x_i$ | Subjective estimate of severity |
| u | $\frac{1}{k-1}\sum (x_i - m)^2$ | Subjective estimate of imprecision in severity |
| $k''_n$ | $= k'_n + k$ | |
| m’’ | $= \frac{k'_n m' + km}{k''_n}$ | |
| v’’ | If $k'_n > 0$: $= v' + k$ If $k'_n = 0$: $= v' + k - 1$* | |
| u’’ | $= \frac{[v'u' + k'_n m'^2] + [uv + km^2] - k''_n m''^2}{v''}$ ** | |
| π | Size of an error arising from an error generating process that is governed by the distributions described above | |
| var(π) | $= \frac{v''}{(v''-2)} \cdot \frac{(1 + k''_n)}{k''_n} u''$ ** | |

Next, a more formal description of the Felix & Grimlund model is given[76], using the same notation as Steele (1992).

The error distribution is described as a mixture of two distributions. First there are the zero elements, present in the mixture with probability 1-*p*. The other component in the mixture, capturing the non-zero elements, have a weight p in the mixture.

Prior distribution of *p* is a beta distribution:

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* One degree of freedom is always lost when calculating a variance. This is recorded in the first stage where the weight of the mean receives a value.

** Steele (1992, page 145) refers to Raiffa and Schlaiffer and to Hey for the derivation of this update of the variance for a $\gamma$ distribution

76 With thanks to Harrie Hendriks and Martien van Zuijlen of Nijmegen University who were a great help in providing the building blocks for this section.

$$p \sim f_\beta\left(p \mid k', n'\right) = \frac{1}{B\left(k', n'-k'\right)} p^{k'-1}(1-p)^{n'-k'-1}$$

The interpretation could be that the prior estimate of *p* is *p'*=*k'*/*n'* with variance of *p'*(1-*p'*)/(*n'*+1). This prior estimate may come from a statistical sample with size *n'*+1 or from another type of information that has been translated into a "sample equivalent".

Now, suppose additional information arises in the form of a sample of *n* elements with *k* errors. This leads to the following posterior:

$$f_\beta\left(p \mid k'' = k' + k, n'' = n' + n\right)$$

Multiplying this by the number of records in a population *X*, we can define the number of errors in the population as:

$$r = p.X$$

The non-zero elements (in the context of statistical sampling we call them errors) are postulated to have normal distribution with unknown mean $\mu$ and unknown variance $\sigma^2$. The judgmental uncertainty for these parameters is modelled as follows:

The prior distribution of $h = 1/\sigma^2$ belongs to the so-called Gamma-2 family:

$$h \sim f_{\gamma 2}(h \mid u', v') = \frac{\left(\frac{1}{2}u'v'\right)^{\frac{1}{2}v'}}{\Gamma\left(\frac{1}{2}v'\right)} h^{\frac{1}{2}v'-1} e^{-\frac{1}{2}u'v'h}$$

The expected value is $1/u'$ and the variance is $2/(u'^2 v')$.

The conditional distribution of $\mu$ given *h* is normal:

$$m \mid h \sim f_N(\mu \mid m', hk_n')$$

This represents a normal distribution with mean *m'* and $h_\mu = hk_n' = \frac{1}{\sigma^2_\mu}$. A sample size of *n* with $k \geq 1$ errors leads to the statistics:

$$m = \frac{1}{k}\sum x_i$$

and

$$u = \frac{1}{k-1}\sum (x_i - m)^2 \text{ (u = 0 if k = 1)}$$

$$v = k - 1$$

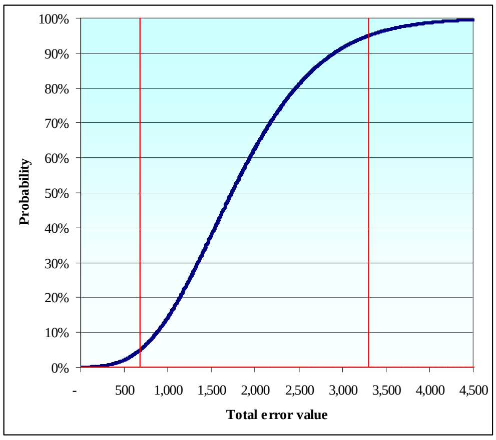
Here, the values of $x$ for $i = 1$ ….., $k$ are the observed error amounts (note: in the case of $k = 0$, there is nothing to update for the error size distribution). The posterior normal-gamma-2 density is given by:

$$f_{N\gamma 2}(\mu, h \mid m'', k_n'', u'', v'') = f_N(\mu \mid m'', hk_n'')\, f_{\gamma 2}(h \mid u''v'')$$

The calculation of the posterior parameters $m''$,$k_n''$, $u''$ and $v''$ from the prior parameters and the additional information has been explained in Table 7-5.

The total error in the population $\pi_T$ is approximately normally distributed (Steele, 1992, page 146)***:

**Figure 7-14: F & G distribution**




$$f(\pi_T \mid r) = f_N\left\{\pi_T \mid rE(\pi), \frac{1}{r\,\mathrm{var}(\pi)}\right\}$$

The combination of the β distribution and the normal distribution would show a 3-dimensional picture if plotted. The probability of a certain value of π is represented by the volume of a "pillar" within this picture, the total volume being 1.

In order to be able to make calculations with the model, I took the following approach. First, I divided the area of the beta distribution into 75 intervals. For the average of each interval, I calculated the probability according to the beta distribution.

Next, I divided the area of the standard normal distribution into 85 intervals. Again, I calculated probability for the average of each interval.

Finally, I crossed each interval of the β distribution with the 85 intervals of the normal distribution (taking into account the r.m'' and r.var(π) value of the relating interval) and multiplied the probabilities of the two distributions. This gives 6,375 small "pillars", representing the unconditional probability of each π. This approach has been tested with the example described by Folpmers (2002, page 187). Folpmers solved the cumulative density function using Matlab, which gave about the same result as the graph in Figure 7-14. The vertical lines represent the 95% upper and lower bounds. Folpmers' solution gives a 95% upper bound of 3,300; my

*** When u'' and v'' are updated as described in Table 7-5, the result is the generalised Student distribution with mean m'' and variance var(π). If there are r errors with a value $\pi_1 - \pi_r$, each having a Student distribution, the aggregate is approximately normally distributed (Steele, 1992, page 146).

calculation gives 3,302. My conclusion is that my approach is sufficiently accurate for the purpose for which it is used.

When considering the Felix & Grimlund model for the life insurance situation, the "error rate" should be interpreted as the proportion of policyholders that will receive a benefit or claim, and the average error size should be interpreted as the average amount given that a claim or benefit is granted. The proportion of claims can be well described by a beta distribution and the average error size in many cases by a normal distribution[77]. Hence, the Felix & Grimlund model should be well positioned to describe a probability distribution of total disbursements, total technical results or the present value of technical results. However, the update of the parameters cannot take place according to the procedure described in this appendix. One of the requirements to use this procedure is that subsequent sources of information (in the original situation statistical samples) are independent from each other. Insurance experience results during subsequent financial periods are not mutually independent. Consequently, the updates of the parameters due to experience should take place in a different way. Once those parameters are updated by different (business) processes[78], section 7.3 corroborates that the F & G model can give a fair representation of (accounts fairly for) the "real" probability distribution of the future cash flows from a book of life insurance during its lifetime and under different circumstances. However, more research is required to evidence that this is the case under all circumstances. The issue of updating parameters is described below more in more detail.

At each time *t*, we have a number of survivors $N_t$. In the example, which involves pure endowment policies, we are mainly interested in $N_T$, and $N_T$ given $N_t$. $N_t$ is binomially distributed with parameters ( $N_t$,$p_{tT}$), where $p_{tT}$ is the conditional probability of surviving if still alive at time *t*. This can be extracted from mortality tables (see appendix 4-I), unless it is plausible that these probabilities evolve over time according to some trend and/or random process.

Furthermore, there are investments with a value $S_t$, and we are interested in $S_T$. Conditional on $S_t$, we have $\ln(S_T)$ distributed with $\text{Normal}(\ln(S_t) + (r_{tT} - \sigma_{tT}^2/2)(T-t), \sigma_{tT}^2(T-t))$.

If the variables $p_{tT}$, $r_{tT}$, $\sigma_{tT}^2$ are considered known and the update from period to period can be captured, this completely describes the uncertainties in the end result. In other words, the Bayesian procedure for estimating $N_T$ and $S_T$ consists of plugging $N_t$ and $S_t$ into the above given known objects.

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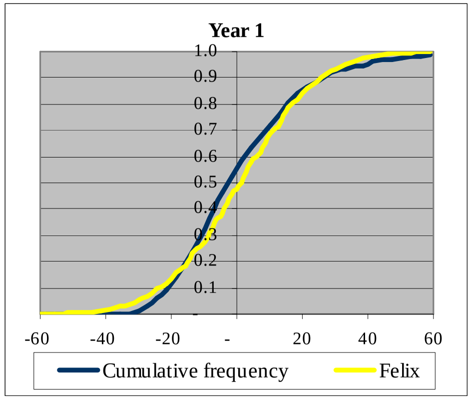
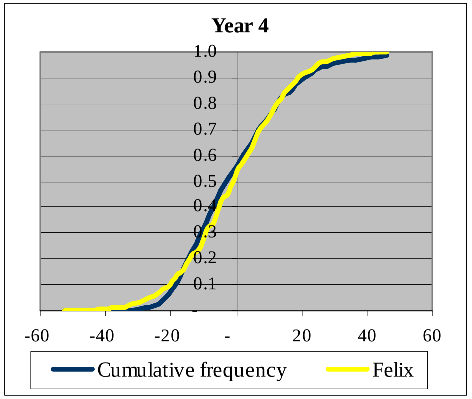
77 This is not the case in situations where rare, catastrophic events affect the average claim size. In the example used, this is not the case.

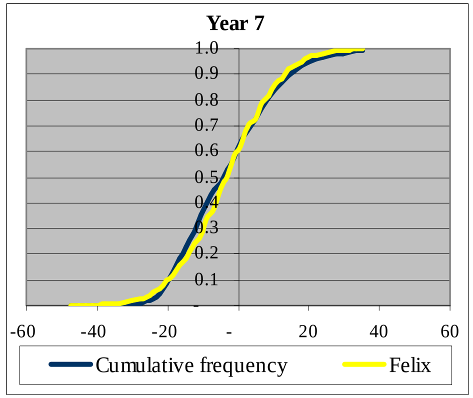
78 Business processes produce quantitative information and qualitative information that has to be translated into updates of model parameters. The calibration of the latter may be the greatest challenge and is not different from the "original" Felix & Grimlund proposition, where the description of the update process is based on statistical samples that are independent of each other. If the model were used in a real audit, where the audit evidence is gathered from a number of sequential procedures that may produce qualitative information, quantitative information for which the projection needs professional judgment and some sampling information, one would face the same issues as encountered in the insurance proposition.

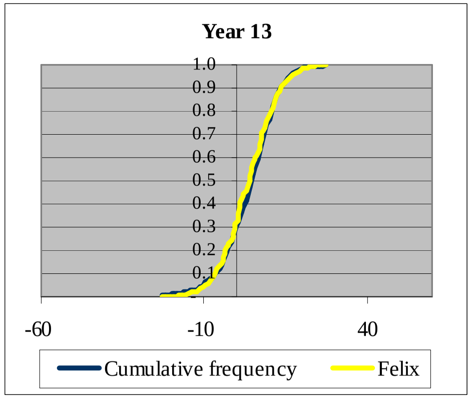
If we are uncertain about the development in $p_{tT}$, $r_{tT}$ and $\sigma_{tT}^2$, but assume that they originate from certain stochastic processes that contain unknown process parameters α, β, γ, …, and that past observations of $N_t$ and $S_t$ and other variables allow to reduce the uncertainty about these process parameters, then a Bayesian approach might be suitable for determining posterior distributions for these process parameters and thus for updating the variability in the outcome of the life insurance business.

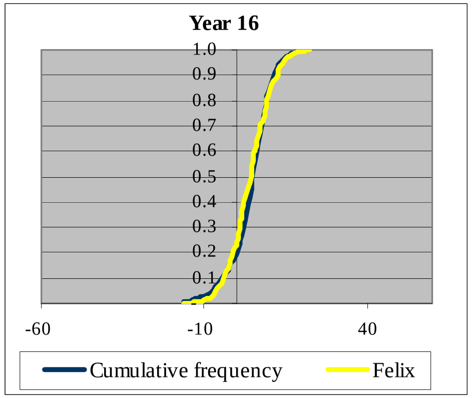
## Appendix 7-II: Development in probability distributions

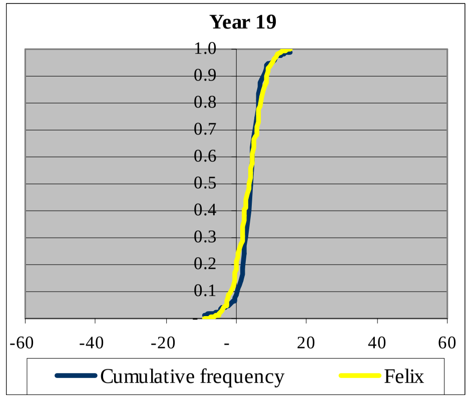


# 8 Summary, general applicability and conclusions

The main purpose of this chapter is to analyse the extent to which the questions presented in chapter 1 have been answered in the previous chapters.

In section 8.1, the main issues and conclusions from the previous chapters are summarised. The accounting engineering concepts relating to question 7 and 8 are developed in chapters 6 and 7, and the examples and cases mainly deal with the life insurance industry. The need and the potential for using the same concepts in other industries are briefly addressed in section 8.2. In section 8.3, the findings with respect to each individual question are presented. These are generalised to provide a conclusion to the central theme of this study. Section 8.4 is the epilogue.

## 8.1 Summary of history, financial reporting concepts and accounting engineering

The historical analysis of chapter 2 starts around 8000 BC, a time when there was no formal script, no money and no abstract counting. In that era, physical objects such as corn, oil, cattle, etc. were recorded in the form of clay objects. In the centuries thereafter, they were "summarised" in clay balls (envelopes) with the imprint of the content on the exterior. Obviously, this kind of recording resulted from the need to record the physical reality (existence) of certain goods and the social reality (ownership) of such goods that could be under custody/stewardship of someone other than the owner (often a temple).

Ventures for joint account and risk lead to the need for historical records of receipts and disbursements that eventually led to the lifetime profit (*totalgewinn)* of such a venture. The introduction of Arab ciphers into Western Europe during the late middle ages was a great step forward in the ability to make calculations in the business environment.

Double entry bookkeeping, developed in Western Europe during the Renaissance and formally described by Luca Pacioli, enhanced the control over the records of enterprises and made the duality of economic transactions (output from one process is input to the other, sale of goods means a decrease in inventories and an increase in cash) visible.

The development of ventures/entities for an indefinite period rather than one voyage, crop, etc. and the segregation between capital and management basically introduced two issues.

- The accountability of management to owners, to answer the question "what happened to the capital supplied by the owners", or "does the management comply with the terms of the (formal or informal) agency contract". Accountability triggered the need for balance sheets from time to time as a representation of "cash flow in progress". Ways to deal with accounts receivable and accounts payable, as well as with inventories (Grammateus) were developed centuries ago. Assets such as ships, buildings, fortresses were disregarded in balance sheets for a long time and the investments were recorded as costs. The example of the VOC demonstrates that this type of prudence may actually be imprudent, because the related assets are out of sight and managers are no longer accountable for them. Recognition of tangible assets (in the industrial revolution) and later of intangible assets was introduced from a situational need rather than as implementation of a concept.
- The value of the enterprise. Ventures for an indefinite time unavoidably lead to the need for certain owners to divest and convert their share in the enterprise into cash. Such value of the enterprise is neither recorded by the balance sheets as prepared in ancient days, nor by the balance sheets prepared today. Financial statements, together with management disclosures and analysis, are at most an informal representation of "strategy in progress". Probably unintended, Pacioli's ball game and the discussions about this game in the sixteenth and seventeenth century demonstrate why: the exit value of a venture (or game) depends on the estimated future developments of the venture (or game) rather than the history.

With the acceptance of the fact that the future plays a role in assessing value, uncertainty and the degree of aversion against such uncertainty becomes relevant. In the example used in section 2.3, uncertainty is eliminated by a perfect foresight assumption. Under this condition, the value of the enterprise is fully represented by the present value of future cash flows (the fundamental value).

Cash flows represent the benefit that the owner will eventually receive, so the present value is what the owner should receive were he to transfer his enterprise to another party now.

Mattessich's model for conditional-normative accounting theory (CoNAT), explained in section 2.6, provides a good point of departure that value can also be properly represented by expected future cash flow under conditions of uncertainty. As a positive conceptual representation, CoNAT starts with the representation of a principal that requires his agent to "maximise his wealth". This could very well be the positive representation of the position of neo-classical economists. However, maximising the wealth of a specific principal may conflict with other objectives (e.g. relating to people and planet), especially if short-term wealth is involved. I therefore revised CoNAT into a Revised Conditional Normative Accounting Theory in which the implicit existence of a four-party agreement between principal, public authorities, financial market and agent is assumed. Maximising (fundamental) value means maximising the discounted aggregate of all future cash flows (most of them relating to the long-term, see Figure 6-3) and it is not unreasonable to believe that all conflicts with other objectives are solved in the maximisation process under the constraints of this four-party agreement. Without an effective four-party agreement, enterprises may not receive the correct impulse from stakeholders for maximising value. This problem cannot be solved within the enterprise, and certainly not within its financial reporting.

In chapter 3, the presupposition of perfect foresight was abandoned by including some simple uncertainty conditions in the example used in chapter 2. This revealed an important phenomenon, i.e. volatility in estimated future cash flows. The historical overview in chapter 2 had already revealed the long-existing sense that this variability has a price, because a decision-maker is not indifferent between a certain value and the probability-weighted average of an array of possible values. Uncertainty about future cash flows also implies a risk that actual net cash flows are negative, so commitments (towards creditors or other contract parties) can no longer be met. This uncertainty can be controlled by economic capital (i.e. capital that remains at risk as a security to creditors and other contract parties).

Apart from investors in the share capital of an enterprise, creditors and other contract parties, implicitly or explicitly, also charge a price for the risk that their contractual rights will not be fully met. This price increases with the risk, which is a function of the volatility in future cash flows and the available capital that serves as a buffer for adverse cash flow scenarios. Hence, value and volatility form key information to most users of financial statements (no matter whether they are owners, creditors or other contract parties).

In situations where the probability distribution of future cash flows could be determined, the required economic capital can be read directly from the lower tail of such a distribution. A situation such as this would resolve two important issues that many researchers in the field of financial reporting have addressed:

- The first relates to the requirements for capital maintenance in relation to general or specific price fluctuations. If required economic capital can be measured unambiguously, price fluctuations are no longer a specific issue; only the maintenance of sufficient economic capital in relation to the business volume and the business risk is relevant. If specific price fluctuations or inflation affects economic capital, this will be revealed by an analysis of future expected cash flows and their volatilities, but neither of them needs specific attention.

- The second is the issue of recognition of certain assets and liabilities (e.g. provisions). Recognition of assets and liabilities is connected to a reasonable degree of certainty of their social reality and the ability to measure their value sufficiently accurate. If the degree of accuracy and certainty can be measured and the lower bound of the future net cash flows is translated into an economic capital requirement, recognition or non-recognition does not make any difference to distributable cash flow. The recognition of assets simply translates into a higher equity requirement. Consequently, the question of recognition can be rephrased as: “For which assets (including business development and self-created goodwill) should the management of an enterprise be held accountable for in the future?” In this respect, assets and liabilities in a balance sheet can be treated in the way they are really meant to be, i.e. as stocks of cash flow in progress.

Volatility and value require future estimates. Profits and losses measured as the difference between two consecutive values are only the difference between two consecutive expectations and have no meaning in relation to what the enterprise has realised in relation to its objectives. Historically, this has lead to substitution (Schmalenbach) of relevant but inaccurate principles by less relevant but more accurate ones. Eventually, this resulted in Hoogendoorn’s clashing concepts in financial statements, which ended up in balance sheets that do not represent value, profit and loss accounts that do not show performance, and too many subjective elements in certain accounts to make financial statements still fully suitable for stewardship purposes. Value and performance relevance is informally provided by the combination with footnote disclosures (within financial statements) and management discussions and analysis (apart from financial statements), but the reporting of “hard” historical events and “soft” estimates are blurred and can hardly be separately identified. The financial REPorting concept is designed to separately identify the recording of historical events on a basis of (modified) cash flows, the explanation of affairs and the progress in meeting the enterprise’s objectives, and the projections and estimates, including the volatility related to such estimates and the relationship to the economic capital required.

Future estimates on their own provide no robust basis for financial reporting and historical events on their own often lack relevance. But the connection between the two, the explanation of how accurate previous period’s estimates were, the assessment of the degree to which historical events might repeat in the future, and the impact of the enterprise’s strategy and changes in the environment add relevance to the history and robustness to the future picture. Financial REPorting is a handshake between the past and the future.

In chapter 4 and 5, the financial REPorting concept has been further investigated for life insurance enterprises. Chapter 4 again uses a “semi-reality” example that resembles some important “real life” processes, but is sufficiently simplified for understanding the underlying stochastic processes. The example shows that estimated future developments relating to a long period play a role in both pricing and reviewing developments from period to period.

In the example, a minimum benefit on maturity is granted to the policyholder, whilst all accumulated investment income in excess of that guarantee is for his benefit. The generation of 1,000 random scenarios reveals two important phenomena.

- Since all favourable outcomes are for the policyholder and all unfavourable outcomes are for the enterprise, the average result for the enterprise is negative. The average negative result equals the price for a put option and represents an expense for the enterprise.
- The guarantee results in a high volatility, unless a hedging strategy is applied.

Creating a confidence level for meeting commitments under uncertainty about future cash flows raises the need for solvency. And solvency has a cost, which is related to the choice between investing in a risk-free instrument and putting money "at risk" to meet insurance commitments. The cost of solvency is to be borne by the policyholder, in other words, the policyholder has to pay an extra margin to give the supplier of solvency a perspective of a sufficiently high yield on his investment.

If assuming fully transparent markets, the margin included in an insurance product would be equal to the cost of solvency (see section 4.5), because that is what the insurance product should yield to the supplier of solvency in excess of the yield on the assets the solvency capital is invested in. The higher the risk, the higher the capital should be to ensure an appropriate confidence level. The higher the required solvency, the higher the cost of solvency and the higher the required margin will be. This is an elegant way of describing the relationship between risk and minimum prudence levels in pricing and reserve adequacy tests.

In reality, financial markets are not transparent, and policyholders do not have access to the capital markets to the extent insurance enterprises have. Using solvency, investments and large numbers as raw material, insurance enterprises manufacture products and may earn a trading margin (in excess of the cost of solvency, which has just been identified as cost of raw material). Under most present financial reporting practices, this margin is recognised over the lifetime of the policy. In fact, the profit margins are recognised when the services (standing at risk, administering the policy, handling claims, etc.) are rendered. It is what most industries do (compare with the stage of completion method used by contractors and service providers) and it can be justified from a theoretical point of view. As realisation is an important indicator of business performance and the credibility of performance measurement, it deserves a place in financial reporting.

Chapter 5 addresses the essentials of contemporary financial reporting for life insurance enterprises. Three important financial reporting issues deserve to be highlighted.

- When performing a reserve adequacy test, the amortised sales value of insurance contracts is tested against expected costs. Since solvency is raw material, the cost of solvency should be included in these expected costs. Most present standards do not permit this, since cost of solvency is to be paid to the shareholder. However, as has been discussed extensively in chapter 4, the cost of solvency is the natural minimum prudence margin. Below this level, the book value of equity less goodwill may exceed fair value, which would permit an "enterprise-wide impairment" to be unrecorded.
- Recorded equity and results may be distorted if insurance liabilities are carried at the higher of amortised sales value and expected costs, and assets that must be designated as available for sale, while during the lifetime of the policy they are actually only available for swap, are marked to market. The "old Dutch" approach (all fixed interest instruments at amortised cost and amortisation of realised results over the remaining lifetime) is not permitted under IFRS

or US GAAP, so the only way to eliminate this anomaly in recording historical events, is to adjust the discount rate used in insurance liabilities.

- Insurance contracts with discretionary participation features in fact reflect a joint venture with policyholders. An extra buffer is created by levying a high premium relative to guaranteed benefits in order to invest a higher proportion in shares and real estate, which in most cases give a superior yield in the long run, but show a high volatility from year to year. These extra margins and the investment margins are "kept at risk" to the extent necessary to maintain a sufficiently high certainty level of meeting the guaranteed benefits. In many cases, this results in a smoothed release to policyholders' rights and (if applicable) to shareholders' funds. In financial reporting, both the accumulation of value within the "joint venture" and the vesting of value for the benefit of policyholders and shareholders are relevant.

Embedded value is defined as the shareholders' equity, increased by the shareholders' share in the present value of all future net margins from in-force business (i.e. the present value of future profits) less cost of capital. Embedded value is not the total fundamental value of the enterprise (the appraisal value), the difference being the value of the potential to acquire future new business (the structure value).

Embedded value is based on future estimates. However, the roll forward shows elements of recording (real cash flows from mortality benefits, expenses, and investment income), explaining (experience to assumption analysis) and projection (reassessment of assumptions). These can and should be addressed separately in a financial report. Identification of covered business (in embedded value) in the segmented information of a financial report helps the reader to understand the connection between recorded historical events (e.g. shareholders' cash flows) and estimates. Footnote disclosures should be designed to explain performance, credibility (of past estimates) and volatility, and should clearly link this explanation to revision of sets of assumptions and parameters. The elaboration of the financial REPorting concept for life insurance enterprises in section 5.4 provides schedules on cash flow, operating profit, experience–to-assumption analysis and development in value. Basically, most of the information provided in these schedules is made available by present financial reporting (if we include embedded value disclosures), but without the clear distinction between facts, explanation and estimates.

Chapter 6 is about the accounting engineering that is necessary to give the financial REPorting concept sufficient robustness. It starts with the business strategy and planning process that outline which targets to achieve and how. This is the best starting point for estimating future cash flows: the best way to predict the future is to shape it. Traditional bookkeeping systems record documented financial events in two dimensions, i.e. past (which historical transactions underlie present wealth) and present (of which components does present wealth consist). Where future cash flow estimates are essential to financial reporting, one would wish that documented financial events that drive future cash flows would also be recorded in the third (future) dimension. Ijiri's triple entry bookkeeping is a system that provides such recording. Ijiri's method has been further developed into the *perpetual value recording* method. Under this concept, a stock of cash flows and a stock of future margins are recorded. Each event (such as new policies, premium receipts, benefit payments, lapses and surrenders) triggers an entry in the traditional ledger and in the stock accounting system. By applying this concept, the changes in the stock of cash flows and stock of margins can be directly read from the financial system rather than being constructed from a retrograde analysis. Where necessary, the changes can be reviewed down to the single event that triggered the change. Business strategy and the relating budgets and projections trigger reassessments of the stock of cash flows and stock of margins. Recorded events compare real cash flows (according to the traditional ledger) to target cash flows and margin release according to the stock accounting system. Unlike differential triple entry bookkeeping, the *perpetual value recording* method allows us to take friction into account by considering the lifetime of existing contracts and arrangements when projecting cash flows. By categorising all sources of cash flows as Secured, Committed and Projected, the stock accounting system provides a source for evaluating the sensitivity of future cash flows to changes in circumstances.

And finally, chapter 7 is about the sensitivity of future cash flows to changes in circumstances. The examples used in chapters 3 and 4 show that sensitivity can be measured by the frequency distribution of outcomes from a simulation of a large number of possible scenarios. This gives an expected value in the form of the average outcome, which is of limited importance. However, as stated above, the x% lower tail of the distribution is more interesting, because it can be directly connected to the required economic capital.

At the end of a financial reporting period, the actual developments are known. In fact, this reality can be seen as a “sample” from all possible scenarios. Conditional on the outcome of this “sample”, the simulation could be re-performed at the end of the financial reporting period, but it would be more robust and more transparent if an update of the existing distribution were to be made visible from the developments during the reporting period. This would provide a reference trail of changes in the volatility of future cash flow estimates and would build up a history of which events contribute to the increase and decrease of risk.

From this perspective, an explanation of the Felix & Grimlund model has been given. Originally, this model was designed to support auditors in evaluating the evidence gathered from the various activities in the audit process, to assess whether the financial statements under audit might or might not contain material errors and/or to decide on the nature and extent of additional audit procedures in order to come to a sufficiently precise conclusion, given an acceptable level of residual risk. The input for the Felix & Grimlund model is formed by the results based on statistical samples and other audit evidence that the auditor is prepared to translate into a “sample equivalent”.

I used the Felix & Grimlund model for assessing the lower bound of cash flows in the situation described by the example used in chapter 4. Comparing the Felix & Grimlund model with the real simulation results, gave a deceptively good fit under all the circumstances tested. In addition, the factors that determine the principal input parameters (number of policyholders alive, estimated present value of future profits, variance, etc.) could be reasonably well identified. Unlike simulation, the Felix & Grimlund model has the ability to process each risk-relevant event and to provide an updated probability distribution (and thereby the lower bound of cash flows) at any required moment. It provides a type of risk ledger that shows the risk implication and implication for economic capital for each event added to or deleted from the set of identified events, as well as each risk reassessment and each risk response measure.

I used the words “deceptively good” because my analysis is of an explorative nature only and does not provide the proof that the Felix & Grimlund model has a universal use for accounting for risk by life insurance enterprises. Much joint research by financial mathematicians and accounting experts will be necessary to develop a working accounting system for recording risks.

However, the demonstration provides a strong indication that Bayesian models have the potential for developing continuous risk recording systems that support the integration of Enterprise Risk Models, economic capital models (which capture all enterprise risk under a common denominator) and external reporting on risks and reliability of estimates.

**Figure 8-1: Other studies to the Felix & Grimlund model**

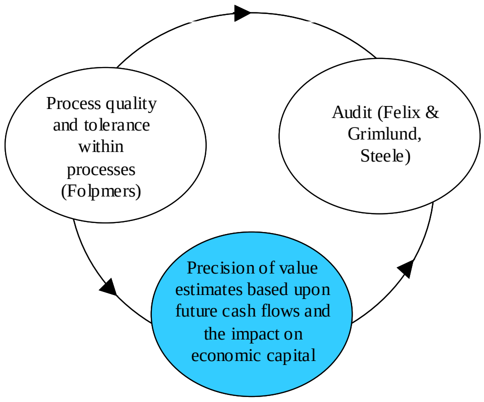



Figure 8-1 shows the relationship between this study and earlier studies that made use of the Felix & Grimlund model. Folpmers (2002) explained the model in relation to the measurement of quality of business processes. Business process quality contributes not only to the required reasonable assurance of the enterprise achieving its targets, but also to reliable financial reporting.

Steele (1992) revisited the model for its original use, i.e. the audit of financial statements. Much audit evidence is gathered from internal controls within processes, so process quality is relevant to the audit. Presenting the precision in estimates and disclosing on risk make financial statements more transparent, but also make the reasonable assurance provided by auditors easier to understand. Not only the presented estimate is audited, but also the degree of imprecision and uncertainty.

## 8.2 Insurance only or a broader application?

After the general introduction to the financial REPorting concept in chapter 3, the concept, together with the related accounting engineering concepts, has been further elaborated for life insurance enterprises. Life insurance is an industry with a reasonably long tradition of estimating future cash flows over long periods. The nature of the activities simply requires this.

Compare life insurance to trading in fresh fruit and vegetables for example. Here, the cycle from cash-to-cash is only a few days. Extensive projections of future cash flows have limited relevance, because the reality is known within a couple of days. Furthermore, a (life) insurance enterprise has no cash constraints on performing payments to the owner, because the enterprise receives cash (premiums) before it pays (claims). Other types of enterprise first perform payments (purchases, capital investments) before they generate revenues (sales), their credit limits forming a "natural limitation" on payments to the owner or other investors. For insurance enterprises, such a limitation is formed by regulated solvency requirements or by economic capital measurements, which makes it necessary to evaluate the volatility of future cash flows.

Financial REPorting has been developed from the idea that value and volatility reflect the key information for all stakeholders/users of financial statements, because value and volatility represent for all stakeholders the degree to which the enterprise is able to perform (pay interest and redemption, continue employment and pay salaries, honour lease terms, fulfil reasonable expectations on dividends, etc.) with respect to them.

No doubt, recording and presenting historical cash flows according to a fixed format (that is consistent with previous expectations) and providing an explanation of the developments in relation to previous periods and previous expectations is useful for all types of enterprises. But should the projection part lead to a measurement and presentation of the full fundamental value of the enterprise? In my opinion, conceptually nothing would be against this, provided that all of the following conditions are met:

- The degree of reliability can be measured and is disclosed.
- The degree of reliability/volatility is consistently translated into an economic capital requirement that prevents excessive distributions of capital.
- The entire constellation of R, E and P is sufficiently transparent to enable the user to adjust the P to his own degree of belief and risk appetite.

Nevertheless, many would find full fundamental value in the primary financial statements "a bridge too far", as long as generic conventions for estimating and disclosing value and volatility for all types of enterprises do not exist. However, providing (fundamental) value information in financial statements might not only be for the sake of the value presented, but might also contain an element of stewardship. Stakeholders provide resources to the enterprise for fulfilment of its strategy. It is no more than fair that the stakeholders are informed from time to time about the stage of achievement of this strategy, i.e. the cash flow that has been created in relation to the planned cash flow and the current projections in relation to the original projections.

The insurance example concerning embedded value encompasses the value of the contracts that have been "taken into stock". The enterprise paid for the stock (either in the form of acquisition costs for individual contracts or in the form of Value of Business Acquired for blocks of contracts) and it is no more than reasonable to inform the stakeholders about the movements in (the value of) this stock. Similar arguments are applicable if, for example, an enterprise pays for goodwill. This can also be regarded as a stock of (excess) cash flows. In this situation, too, it is no more than reasonable that the stakeholders are informed about the part of the stock that has been "used" during the reporting period and the stock that is present at the end of the reporting period.

Other types of enterprise have developed their standards for reporting on the movements in inventories. The *perpetual inventory recording* method provides a robust recording platform for providing the user of financial statements with reliable information on inventory.

The *perpetual value recording* method concept is meant to do the same for more complex "stocks of cash flows", which (in addition to embedded value of insurance contracts) are often embodied in assets that have a long lifetime and for which no other option exists than using them in the operations of the business. Such assets are certain enterprise-specific tangible fixed assets, certain intangible assets and goodwill.

The *perpetual risk recording* method is meant to continuously record events with a risk impact and translate their likelihood and impact into a lower bound of cash flows. Such a lower bound can be directly linked to the amount of resources that is needed to provide a robust probability that an enterprise can meet its commitments.

Both *perpetual value recording* and *perpetual risk recording* come closer and closer nowadays to the reality of management, recording and reporting, and this applies not only to the regulated environment of insurance enterprises. I will illustrate this by two recent developments relating to value and risk management:

- The proposed statement on fair value measurements issued by the US Federal Accounting Standards Board in 2004.
- "Enterprise Risk Management – Integrated Framework", issued by the Committee of Sponsoring Organisations of the Treadway Commission (COSO), also in 2004.

I will explain these developments also by using a simple example.

*Fair value measurement*

The exposure draft on fair value measurements mentioned above describes a fair value hierarchy that starts with a fair value estimate using quoted prices for identical assets or liabilities in active reference markets whenever that information is available (the first preferred option) and ends with estimates with significant entity inputs (in the absence of available market inputs). For the latter, present-value techniques are typically an obvious choice (see also section 3.7.4). These are discussed in a separate appendix (Appendix A) to the exposure draft. Important items to consider are future cash flow estimates, possible variation in the amount and/or timing of these cash flows and the price for bearing the uncertainty. The price for bearing risk should replicate the market's behaviour towards assets and liabilities with uncertain cash flows. Basically, there are two ways of including the price of risk into fair value measurements that are based on discounted cash flow techniques; these have been discussed extensively in chapter 3 and 4.

The first is to reduce the cash flows to their risk-free equivalent and subsequently discount these equivalents using the risk-free rates. The second is to discount the "real world cash flows" by a rate that includes a surcharge for risk. Section 4.3 explains that both methods lead to the same answer provided that the models used are properly calibrated. Considerations for choosing between the two methods are:

- For which method is the best market evidence available (risk-free equivalent cash flow measures or market surcharge for risk)?
- Is there a benefit in comparing expected cash flows with realisation in order to validate assumptions (this comparison is only useful with real world expected cash flows)?

Outside the world of financial institutions, discounted cash flow techniques are relevant for financial reporting with respect to goodwill, intangible assets and tangible assets without a direct realisable value (see chapter 3) if impairment is to be tested. The example below explains how the *perpetual value recording* method may support the process of such impairment testing and the disclosures to be given on it.

Consider a balance sheet item (no matter whether it is goodwill, an intangible asset or a tangible asset of the type described above) that is expected to generate an annual cash flow of 500 during 5 years. Now suppose also that the volatility of this cash flow is known (and can be demonstrated to the capital market) in a way that the 99.5% lower bound of the annual cash flow is 300. In other words, there is a probability of only 0.5% that in a certain year the cash flow is lower than 300. The interest rate for AA debt is 5%; the market rate for equity instruments is 10%.

The series of cash flow lower bounds provides a borrowing base for an AA loan and can be discounted at 5%, resulting in an amount of 1,299. For the excess above the lower bound, economic capital should be allocated in order to provide a high (99.5%) probability that the enterprise can meet its commitments. Consequently, the excess has to be discounted at 10%, resulting in an amount of 758. Hence, the total fundamental value for which the item can be acquired in a transaction between knowledgeable and willing parties is 2,057.

**Table 8-1: Stock of cash flows at inception**

| | 1 | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|---|
| Project proceeds | 500 | 500 | 500 | 500 | 500 | 2,500 |
| Interest expenses | ( 65) | ( 53) | ( 41) | ( 28) | ( 14) | ( 201) |
| Cost of allocated equity | ( 76) | ( 63) | ( 50) | ( 35) | ( 18) | ( 242) |
| Total stock of cash flows | 359 | 383 | 409 | 437 | 468 | 2,057 |

Table 8-1 shows the total purchased stock of cash flows at inception. As in chapter 6, interest expenses, as well as the cost of allocated equity (the valuation method assumes that these amounts become available to the shareholder), are treated as stocks of cash outflows. Each cash flow item relating to each financial year can be recorded as a stock item and the use or change in value can be monitored item by item.

Now, suppose that during year 1 an additional capital investment of 100 is made that is expected to extend the lifetime of the item and generate a cash flow of 700 in year 6.

**Table 8-2: Stock of cash flows end of year 1**

| | 2 | 3 | 4 | 5 | 6 | Total |
|---|---|---|---|---|---|---|
| Project proceeds | 500 | 500 | 500 | 500 | 700 | 2,700 |
| Interest expenses | ( 53) | ( 41) | ( 28) | ( 14) | - | ( 136) |
| Cost of allocated equity | ( 73) | ( 61) | ( 47) | ( 31) | ( 15) | ( 227) |
| Equity costs embedded in margins | ( 27) | ( 30) | ( 33) | ( 36) | ( 40) | ( 166) |
| Total stock of cash flows | 346 | 368 | 392 | 418 | 645 | 2,170 |
| Stock of margins | | | | | ( 539) | ( 539) |
| Equity costs embedded in margins | 27 | 30 | 33 | 36 | 40 | 166 |
| | 373 | 398 | 425 | 454 | 146 | 1,798 |

The lower bound of this additional cash flow in the example is assumed to be zero, so there is no additional borrowing base. The additional investment of 100 should be fully financed with equity. Table 8-2 shows the stock value at the end of year 1. The additional disbursement creates a margin in year 6. This is treated as negative stock in order to arrive at the historical cost of the item. (Note: In chapter 6, the margins were positive stock in relation to the liabilities). As in the example in chapter 6, all stock items are real expected cash flows, except for the cost of solvency that is embedded in the margins, which is not a real cash outflow, but would be the discount on the cash inflow that would be created if the margins were sold to a third party. In order to ensure that the total stock of cash flows equals a mark-to-model (fundamental) fair value and the total stock of cash flows net of stock of margins equals amortised cost, the equity costs embedded in the margins has been credited to the stock of cash flows and debited to the stock of margins. Impairment (such as the loss adequacy issue of the example in chapter 6) takes place when the net stock of margins becomes negative.

**Table 8-3: Movements in the stock of cash flows during year 1**

| | Opening stock | Use | Newly "purchased" | Closing stock |
|---|---|---|---|---|
| Project cash flows | 2,500 | ( 500) | 700 | 2,700 |
| Interest expenses | ( 201) | 65 | | ( 136) |
| Compensation allocated equity | ( 242) | 76 | ( 61) | ( 227) |
| Equity cost embedded in margins | | | ( 166) | ( 166) |
| Total stock of cash flows | 2,057 | ( 359) | 473 | 2,170 |
| Stock of margins | | | ( 539) | ( 539) |
| Equity costs embedded in margins | | | 166 | 166 |
| Book value assets | 2,057 | ( 359) | 100 | 1,798 |

Table 8-3 shows the movement schedule that a stock accounting system for future cash flows can provide. The "use" of the stock is presented at its book value. Needless to say, the real cash flows during year 1 form the basis for the profit and loss account. The difference between experience and cash flow stock should be analysed and explained to validate the value of future cash flow stock items. Table 8-3 shows both the fair value, being the total stock of cash flows, and the historical cost basis.

Unavoidably, the above reveals a flaw in present-day financial reporting rules that has already been discussed in chapter 3. If the item under review were a tangible fixed asset, the historical cost of all investments and a systematic depreciation would be taken into account. Assuming that the use of cash flow stock items (which in the example leads to annuity-based depreciation) is an elegant method for systematic depreciation, with the book value being 1,798. The fair value would only be applicable if it were lower than the historical cost-based value[79]. The same would apply to an intangible asset that is depreciated in a systematic way.

If the item were goodwill, the balance sheet value at the end of year 1 would be 2,057. Goodwill is not amortised. The investment of 100 during the year in the structure of the cash-generating unit is self-created goodwill and does not qualify for recognition. The balance sheet value is tested for impairment against the fair value of 2,170, which includes the margin embedded in the newly achieved future cash flows.

In other words, in the first situation (tangible assets) the expenditure during year 1 is included in the book value, but the margin is not, while in the second situation (goodwill) used stock of cash flows are gradually replaced by future margins, but the expenditure that creates these margins is rejected.

This difference in treatment can be understood from the viewpoint that goodwill has historically been seen as a residual between the purchase price of an enterprise and the fair value of all identifiable assets, instead of as a stock of cash flows, and that standard setters have always been concerned about the subjectivity of recognising self-created goodwill. But if there is a robust stock accounting system for future cash flows and achieved future margins, there is no reason to treat balance sheet items that are different in nature, but identical regarding reliability of measurement, in a different way.

*Enterprise Risk Management*

In 1992, the Committee of Sponsoring Organisations of the Treadway Commission (COSO) issued their document "Internal Control – Integrated Framework" for the purpose of improving enterprises' (and other entities') internal control systems. This framework has often formed the basis for rules on corporate governance and internal control.

The framework basically consists of five components of internal control:

- Internal environment.
- Risk assessment.
- Control activities.
- Information and communication.
- Monitoring.

These components intersect with the dimensions, operations and financial reporting. In 2004, COSO issued their integrated framework on Enterprise Risk Management, shown in Figure 8-2. The definition of ERM given by COSO is as follows:

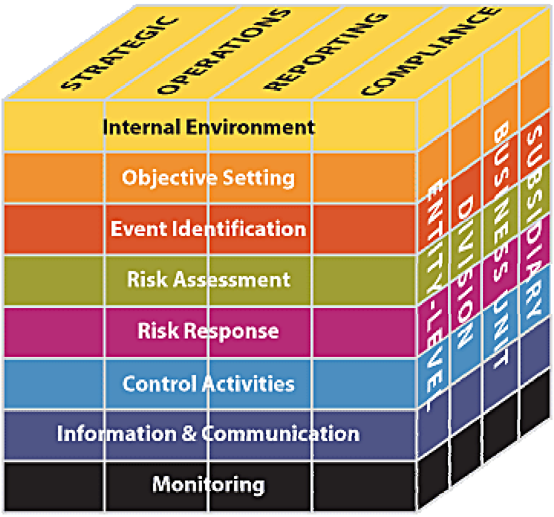
Enterprise Risk Management is a process effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.

79 IFRS permits an alternative treatment if property, plant and equipment are regularly revalued.

I would add to this that a key element in providing this reasonable assurance is the allocation of sufficient resources (including economic capital) to create expected assurance of achieving the targets and a high assurance of fulfilling commitments, even in stressed scenarios (which brings us to the concepts set out in chapter 7).

An important change from the previous framework is that the strategic dimension has been integrated. This is consistent with the conclusion in chapter 6 that creating and recording value starts with strategy. In this respect, COSO's presupposition is that an entity exists to provide value to its stakeholders. For shareholders in a for-profit entity, this value can be captured by estimated future cash flows. This simplification is justified in the Revised Conditional Normative Accounting Theory explained in section 2.6. The four-party agreement constructed there ensures that long-term cash flows can be optimised without doing harm to the interests of other stakeholders.

**Figure 8-2: Framework for Enterprise Risk Management**




Source: Enterprise Risk Management – Integrated Framework (COSO) p. 7

Special attention is paid to the phenomenon of risk appetite, that is, the amount of risk on a broad level that an entity is willing to accept in pursuit of value. Risk appetite is attached to strategy risk tolerance, which in turn is attached to operational goals. Risk tolerance is the acceptable level of variation relative to the achievement of a specific objective. Operational targets are often measured in terms of (financial or non-financial) key performance indicators. Risk tolerance measures are supposed to be measured in the same units as the performance indicators. An example mentioned in the COSO document: the target is 98% on-time delivery; the tolerance interval is 97% – 100%. Setting a risk tolerance for each performance indicator enables management to explicitly address the relative importance of each indicator and provides assurance to management that it remains within its risk appetite.

Another important change is that the risk assessment in the previous framework is extended by event identification and risk response. Event identification focuses on the identification of factors that can have either a positive or a negative impact on successfully implementing strategy and achieving objectives. Events are initially identified without assessing their impact and likelihood, in order to prevent relevant events from being overlooked. Identifying and maintaining records of events is a complex matter, because there are many, they are diverse and it is virtually impossible to ensure completeness.

Figure 8-3 summarises the event categories encountered within the ERP Framework. Once they have been identified, their likelihood and impact is assessed in order to determine relevance and to prioritise them. Risk response may involve:

- Avoidance: e.g. exiting a product line, selling a division, etc.
- Reduction: e.g. by control measures.
- Sharing: e.g. insurance, hedging transaction.
- Acceptance (i.e. no action).

The last option means, in effect, that sufficient resources (capital) should be set aside to deal with the potential negative impact on cash flow. In this respect, it is worthwhile to mention that improvement of deployment of capital as a part of the risk assessment framework is explicitly mentioned by COSO. It is thus embodied in the framework for operating an entity. It reduces to the question: Given my strategy, do I have sufficient resources to provide a high probability of meeting the commitments that follow from the strategy.

**Figure 8-3: Summary of COSO Events Categories**

| External factors | Internal factors |
|---|---|
| **Economic** (capital availability, credit, market, competition, etc.) | **Infrastructure** (capability of assets, access to capital, etc.) |
| **Natural environment** (waste, energy, etc.) | **Personnel** (health and safety, fraud, etc.) |
| **Political** (legislation, regulation, governmental changes, etc.) | **Process** (capacity, suppliers, dependencies) |
| **Social** (demographics, terrorism, privacy, etc.) | **Technology** (data integrity, system availability, maintenance) |
| **Technological** (power interruptions, emerging technology, etc.) | |

The ERM framework requires an analysis of all risks and mentions the deployment of capital as a part of the risk framework, it does not require translating the analysed risks into economic capital. However, for financial service institutions such as banks and insurance enterprises, such translation is imminent due to emerging solvency regulations. With ERM, a step has been taken in this direction for other types of enterprise. Using a *perpetual risk recording* method as explained in chapter 7 may improve the robustness of the event identification, risk analysis and risk response process outlined in the ERM framework. For financial reporting, it would mean that all risks could be summarised as the volatility of future cash flows. Morgenstern's ideas could then finally be implemented and a trade-off between relevance and reliability in financial reporting would no longer be necessary, as reliability and volatility (and the related consequences for economic capital) would be a reporting subject in itself.

## 8.3 Conclusions

When dealing with the central theme of this study, i.e. the financial information that helps to understand the variability in financial statement measurements and future cash flow projections and the conclusion on the financial position of an enterprise in relation to this variability, eight questions have been formulated in chapter 1.

*Historical development*
Four questions relate to the historical development of the relationship between agent and principal and the need for financial information that resulted from this relationship. The table below repeats these questions and summarises the major findings from the previous chapters in relation thereto.

| | Question | Findings |
|---|---|---|
| 1 | What need for information is created by entrusting values to another party and how did the recording and providing of information develop? | From the early days on, systems have been developed to keep track of the historical developments that are relevant to entrusted funds or assets, such as cattle, crop, etc. Such systems have developed from recording descriptive information to information that was brought to a common financial denominator that enabled addition and summarisation.<br>In the 15th century, double entry bookkeeping was developed. This enhanced control over financial reporting of historical events is still the backbone of accounting systems (see section 2.1). |
| 2 | What additional need for information was created by the use of values entrusted by another party to meet a certain objective, or to create value, and how did the recording and providing of the information in question develop? | When the “certain objective” is explicitly agreed between a specified principal and the agent, the developed information systems described in section 2.1 may be sufficient. However, when the objective is generalised to optimise (shareholder) value and principals are anonymous (as is the case with listed companies), additional information on value and the development therein is required. Agents and principals as well as different groups of principals and other stakeholders may have different personal objectives, different degrees of belief, different appreciation for risk and thus a different appreciation of value.<br>In order to resolve these conflicts for financial reporting purposes, the Revised Conditional Normative Accounting Theory has been introduced as a theory to deduce accounting and financial reporting that is relevant to all stakeholders (see section 2.6.4). This leads to a |

| Question | Findings |
|---|---|
| | conceptual representation that accounting should produce information about value, driven by expected future cash flows, which are the consequence of risky choices by the agent. In financial reporting, a direct representation of the value (of the enterprise) has not been formally developed. Moreover, a pragmatic conceptual representation is used, that has developed over time from incidents and additional needs for information. |
| 3 How did thinking about (reportable) value develop in relation to the dimension of risk and uncertainty? | There is reasonable consensus that under perfect foresight, the value of an enterprise is the aggregate of all discounted future cash flows (section 2.3). |
| 4 How did mankind deal with uncertainty in decision-making and how was information about this uncertainty recorded and provided? | Although it was known that uncertainty played a role in business decisions and was thus relevant to value reporting (Pacioli touched on this subject in his Summa), uncertainty has never obtained a formal place in accounting. In financial reporting, disclosures on risk are of the last decade.<br><br>The example of the VOC given in section 2.4 shows that uncertainty was often dealt with by non-recognition of uncertain elements, thereby indicating that this type of prudence may eventually reveal itself as carelessness.<br><br>Section 2.5 shows that even insurance enterprises, whose products are based on risk and uncertainty, hardly reflected this in their financial reporting. |

*Present-day financial reporting*
Two questions related to present-day financial reporting are stated in the table below, together with a summary of findings.

| Question | | Findings |
|---|---|---|
| 5 | What value-relevant and volatility-relevant information does present-day financial reporting have to offer? | Section 3.1 shows the implications if the assumption of perfect foresight is abandoned. It demonstrates that uncertainty leads to the need for a buffer (economic capital) for situations in which developments are worse than expected and that uncertainty has a price (in the form of a risk surcharge). These factors do not play a formal role in current financial reporting. However, for (life) insurance enterprises it is increasingly becoming a reporting issue (see chapters 4 and 5). The combination of providing historical information and explanations in footnotes, management analyses and risk disclosures provides a basis for value-relevant information (see chapters 3 and 5). Specifically for life insurance enterprises, value information (see section 5.3) is being provided more and more. |
| 6 | What effect does the often-made trade-off between relevance and reliability of information have on the demonstration of value and volatility by the enterprise? | Historically, the reaction to uncertainty in financial reporting was to sacrifice relevance for reliability. This approach creates accounting mismatches that lead to volatility in financial reporting, without any economic meaning. It may disturb the historical pattern of key financial indicators and may thus decrease the value relevance of financial statements.<br><br>Accounting mismatches can be avoided if uncertainty becomes a formal reporting element, leading to a minimum level of economic capital that is protected from distribution, and if the already present elements of recording historical events, explanation of those events and projection of future cash flows are formalised in a reporting framework. |

*Accounting engineering*
Finally, two questions related to accounting engineering focused on bringing the recording of value and risk/volatility under the discipline of an accounting system that is fed from the enterprise’s business processes and that has the checks and balances inherent to accounting systems.

| Question | | Findings |
|---|---|---|
| 7 | What systems can be developed to record value in a systematic way? | Triple entry bookkeeping can be used for embedded-value recording by treating it as a stock of future cash flows and future margins. Such a stock accounting system can be connected to the major business and data processes within the enterprise (chapter 6). |
| 8 | What systems can be developed to record risk in a systematic way? | Ideally, such a system should continuously record the changes in the probability distribution of the stock of future cash flows evolving from life insurance policies. The explorative study of chapter 7 shows how such a *perpetual risk recording* system could operate. It shows the connection between recorded risk and uncertainty and economic capital. Hence, it makes economic capital an indicator for the uncertainty of projections that play a role in financial reporting, either in the form of disclosures on value or in the form of accounting estimates.<br><br>Such a risk-accounting system can be connected to the major business and data processes within the enterprise. |

*Final generalisation*
This study demonstrates that future cash flows and their volatility (determining the lower bound of future cash flows) drive value for all types of enterprises. Fair value is determined by expected future cash flows. Even though present-value techniques have the lowest rank in the fair value hierarchy, one should be aware of the fact that quotations in a deep market are also ultimately determined by a degree of belief (B) in a series of expected future cash flows (C) and the utility (U) related to uncertainty (v) and the time value of money (i). Alternatively (from an outsiders' perspective):

$$Value_o = f\{B, C, U(v,i)\}$$

*Perpetual value recording* is a concept that assists in tracking the development in stocks of cash flows and stocks of future margins in complex situations and therefore enhances the credibility of estimates and performance measurements. It is based on Ijiri's triple entry bookkeeping system, which enforces the equality:

*Past = Present = E(Future)*[80]

80 E stands for expected value.

*Perpetual risk recording* is a concept that assists in accounting for the identified events, the analysis of likelihood and impact, and the risk response. It enables the continuous recording of the observed events and the related consequences for risk. In addition, it analyses the influence of "risk-valued" events on the volatility of future cash flows, thereby providing a robust basis for external reporting on risk and volatility. It enforces the visibility of the relationship:

$$Past \rightarrow Present \rightarrow V(Future)$$ [81]

Whenever an enterprise provides information that is relevant for its fundamental value, this information should lead to insight into E(Future) and V(Future). Should an enterprise report its fundamental (management's) value? Again, there is nothing against this, provided that sufficient transparency is obtained through the financial REPorting concept; it is not required, however. The fundamental value presented by the enterprise would differ anyway from the value attached by the user of financial statements because of differences in belief (B) and utility (U) between reader and writer of financial statements. The essential point is that there is neither misrepresentation of nor misunderstanding about cash flows (C) and volatility (v).

The following central theme was stated in chapter 1:

*How can financial reporting help to understand the variability of financial statement measurements and the volatility of future cash flow projections, and how could it help with forming conclusions on the financial position of an enterprise in relation to this variability and volatility.*

The nature of the answer that this study points to can be summarised as follows:

- Support value estimates with accounting techniques that systematically record the impact of all relevant transactions and events on future cash flow estimates and on the volatility in those estimates.
- Present in a systematic way the recorded historical events and provide an explanation about performance, the credibility of former estimates and the volatility that is inherent to the enterprise's exposure.
- Present current estimates and projections in a visible relationship to past records and explanations.
- Present volatility in estimates and projections explicitly in a financial report.
- Present required economic capital as a separate section in financial reports and let it be consistent with the observed volatility in estimates and projections.
- Provide sufficient disclosures to enable the reader to revise estimates and projections in line with his own degree of belief and risk appetite.

And:

- Let financial reporting as much as possible present the stage of completion of the enterprise's strategy.
- Let the principal as user of the financial statements be knowledgeable, so that he sends the correct impulses back to the agent and the financial market.

81 V stands for variance.

The financial reporting triplet shown in Figure 1-1 connects the recording of progress and of historical events to value measurement based on projected future cash flows and economic capital driven by the volatility in future cash flows. Value measurements obtain their credibility from the recording of historical events in relation to earlier projections. Volatility in future cash flows obtains its credibility from observed volatility compared with earlier assessments and solves the problem of trade-off between relevance and reliability, because it provides a measurement for reliability. Historical records obtain their relevance by supporting value projections and volatility assessments. And all is driven by the strategy of the enterprise and the information model that is the most suitable to monitor progress in achieving this strategy.

### 8.4 Epilogue

Believe in your own strategy with all your heart, translate it into currency, measure and report this currency at each stage of completion of your strategy and gather sufficient resources to meet your commitments, even under stressful circumstances. This is the statement made in chapter 1 to explain the three basic elements of financial reporting, i.e. intended and estimated value creation, recording of observed events and progress, and uncertainty, translated into an economic capital requirement.

The translation of strategy into currency, i.e. into expected future cash flows, is underpinned by the Revised Conditional Normative Accounting Theory that has been explained in section 2.6. And ReCONAT is underpinned by the assumed existence of an implicit four-party agreement between public authorities, capital market, principal and agent. Strategy is multi-coloured and may serve many stakeholders. The four-party agreement stimulates that due and balanced care for all stakeholders' interests optimises long-term future cash flows and provides sufficient liquidity to realise the value embedded in those cash flows at any desired moment.

One of the elements in the four-party agreement is the understanding of financial reporting by the principal and the ability to identify the value and volatility drivers from the process. Misunderstanding by the user is as destructive as misrepresentation by the issuer.

Pacioli's Summa is a book on mathematics with a section devoted to bookkeeping. Pacioli made a mistake in the explanation of his ball game: he looked at history for assigning value instead of the future. But it was a productive mistake, because it triggered gamblers and mathematicians to search for a solution. At the end of the eighteenth century, basically all the ingredients for quantifying uncertainty and imprecision and for assessing the impact of utility related to them were available. By that time, bookkeeping and financial reporting had gone their own way, primarily focusing on the evaluation of historical events, but gradually admitting elements of future estimates. The increase in importance of value estimates and risk disclosures in present-day financial reporting makes the use of quantitative techniques unavoidable. In addition, present-day information technology, with its ability to process enormous amounts of data and to handle complex models, provides the engine for using the theories of Bernoulli, Bayes and others in accounting applications.

This study has described an integrated framework for recording and reporting under uncertainty, that has the robustness of traditional double (or triple) entry bookkeeping and the predictive relevance of mathematical models for quantifying risks and imprecision related to estimates. More research by financial mathematicians and financial reporting experts can effectively realise a reunion of the two disciplines that were already jointly treated by that Franciscan monk in 1494.

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## SAMENVATTING

## BERICHT OVER WAARDECREATIE (REPORTABLE CREATION)

### Waarde, prestatie en risicomaat in financiële verslaggeving

Het hedendaagse financiële verslag bevat een veelheid aan informatie die gebaseerd is op toekomstige ontwikkelingen. Een eenvoudig voorbeeld is de waardering van een machine. Een gebruikelijke waardering is kostprijs verminderd met een afschrijving die is gebaseerd op de *verwachte* levensduur. Stel: we hebben een machine met een kostprijs van 1.000, waarvan we verwachten dat hij gedurende 10 jaar prestaties zal leveren. Bij lineaire afschrijving is de waardering 500 aan het einde van jaar 5. We moeten ons echter ook nog de vraag stellen in hoeverre de prestaties van de machine in de resterende 5 jaar voldoende *geprojecteerde* kasstromen genereren om de waardering van 500 te rechtvaardigen. Waneer deze kasstromen bijvoorbeeld aan het einde van jaar 5 een waarde vertegenwoordigen van 700, heeft niemand doorgaans bezwaar tegen de waardering van 500. Maar als de *geprojecteerde* kasstromen aan het einde van jaar 6 onverwacht nog maar een waarde van 200 vertegenwoordigen (de boekwaarde is dan inmiddels 400) en er is geen hogere directe opbrengstwaarde, zullen de meeste mensen een waardevermindering van 200 op zijn plaats vinden. Wat is er dan aan de hand? Een verkeerde voorstelling van zaken door het management, dus een financieel schandaal, zoals we er in de afgelopen jaren vele hebben gekend? Of is er sprake van een natuurlijk verschijnsel omdat we het nu eenmaal hebben over toekomstgerichte informatie en de werkelijkheid materieel hiervan kan afwijken? Of is de mate van onzekerheid over de kasstroomprojecties wellicht onvoldoende naar de gebruiker van het financiële verslag gecommuniceerd? Wanneer aan het einde van jaar 5 niet alleen de waarde van de *geschatte* kasstromen was bepaald, maar ook de betrouwbaarheids-ondergrens van de schatting was bepaald (bijvoorbeeld 150) en gerapporteerd[82], had de gebruiker kunnen weten dat er substantiële risico's waren ten aanzien van de terugverdienbaarheid van de investering. Hij had hierop zijn besluitvorming (bijvoorbeeld tegen welke prijs aandelen te kopen of te verkopen) kunnen afstemmen. Dit brengt ons tot het centrale thema van mijn studie:

*Op welke wijze kan financiële verslaggeving ertoe bijdragen, inzicht te verschaffen in de mate van onzekerheid rond opgenomen schattingen en in de volatiliteit van geprojecteerde kasstromen, en hoe kan de gebruiker inzicht worden gegeven in de financiële positie in relatie tot die onzekerheid en volatiliteit.*

Dit thema wordt behandeld aan de hand van analyse van beschikbare literatuur, gestructureerde modellen die een vereenvoudiging van de werkelijkheid vertegenwoordigen en voorbeelden. Waar dit zinvol is, zijn beperkt enkele empirische observaties opgenomen. Aan het centrale thema liggen acht onderzoeksvragen ten grondslag. Deze zijn in deze samenvatting samen met de conclusies weergegeven onder het hoofd Behandeling onderzoeksvragen.

Ik neem in navolging van Johnson en Kaplan (1991) strategie als uitgangspunt en voeg hieraan de mate waarin een onderneming bereid is, risico's te nemen (COSO, 2004) toe. Strategie is toekomstgericht; de kasstromen die het gevolg zijn van een strategie liggen in de toekomst en zijn

82 Een idee van Oskar Morgenstern (1963).

dus voorspellingen. Maar strategie combineert de ambitie om waarde te scheppen met de vaardigheden die in een organisatie worden opgebouwd en de processen die erop gericht zijn, er een succes van te maken. Het is dus redelijk te stellen, dat strategie het beste uitgangspunt is om toekomstige kasstromen te voorspellen. Of om met Allan Kaye te spreken: “de beste manier om de toekomst te voorspellen is hem zelf te bouwen”. Hierop voortbouwend, kan een driehoeksverhouding worden geconstrueerd tussen de volgende elementen.

a. Vastleggen van historische gebeurtenissen. Dit is van belang voor het afleggen van verantwoording. Hierbij kan worden gedacht aan de besteding van toevertrouwde middelen, maar ook aan de meting van de “strategie in uitvoering”: in hoeverre was de onderneming in staat om zijn plannen te realiseren, zijn beloftes waar te maken. Hoe betrouwbaar waren in het verleden gemaakte schattingen.
b. Waardeschattingen op basis van toekomstige kasstromen. Toekomstige kasstromen worden primair gedreven door het ten uitvoer brengen van de gedefinieerde strategie. Het meten van “strategie in uitvoering” is van belang voor de geloofwaardigheid van schattingen: hoe verhouden deze zich ten opzichte van wat in het verleden is gerealiseerd. Welke aanleiding heeft ervaring gehad om de strategie en de inschatting van niet-beïnvloedbare omgevingsfactoren bij te stellen (en dus de schattingen aan te passen).
c. Benodigde middelen (economisch kapitaal) om de strategie ten uitvoer te brengen. Het algemene principe achter economisch kapitaal kan versimpeld worden uitgelegd. Een onderneming moet zich bij haar (strategische) besluitvorming rekenschap geven van de risico’s die hiermee gemoeid zijn en ervoor zorgen dat zij voldoende middelen verwerft om ook onder negatieve scenario’s aan haar verplichtingen te voldoen. In bovenstaand voorbeeld: aan het einde van jaar 5 bedraagt de resterende investering 500. De schatting van de toekomstige kasstromen bedraagt weliswaar 700, maar de betrouwbaarheidsondergrens van de kasstromen bedraagt 150. Naar de boekwaarde gemeten, moet er dus minimaal 350 aan eigen vermogen aanwezig zijn om ook onder negatieve omstandigheden aan de verplichtingen te kunnen voldoen.

Het onderling verbinden van deze elementen en het koppelen aan de strategie van de onderneming ten behoeve van de financiële verslaggeving, beperkt de vrijheid in het kiezen van de veronderstellingen en grondslagen achter schattingen en verhoogt het inzicht van de gebruiker in de mate van betrouwbaarheid van schattingen en projecties.

Er wordt in deze studie een drietal concepten uitgewerkt:

- Het eerste betreft een nadere structurering van wat reeds in de huidige verslaggevingsregels kan worden teruggevonden:
  – De degelijkheid en objectiviteit van geregistreerde (*Recorded*) historische gebeurtenissen en transacties, gebaseerd op kasstromen, respectievelijk kasstromen die gecorrigeerd zijn voor operationele onvolkomenheden (bijvoorbeeld verstoringen in het patroon van ontvangsten en betalingen).
  – Het toevoegen van relevantie aan deze historische informatie door middel van een uitleg (*explanation*) van trends, afwijkingen ten opzichte van eerdere schattingen, etc., teneinde inzicht te geven in de operationele prestaties, de accuratesse van eerdere voorspellingen (en dus de geloofwaardigheid van de huidige voorspellingen) en de volatiliteit in de kasstromen van de onderneming.
  – *Projecties* (van kasstromen, opbrengsten, kosten) die relevant zijn voor de gebruiker, waarbij verslag wordt gedaan van zowel het waarde element als het onzekerheidselement. Dergelijke projecties kunnen onderdeel zijn van de toelichting,

gebruikt worden bij beslissingen over waardering (bijvoorbeeld waardevermindering van activa) of direct worden gebruikt in schatting van jaarrekeningposten (voorzieningen, levensduur van vaste activa, reële waarde).

Dit concept is "financial REPorting" gedoopt, waarvoor R, E en P de betekenis hebben van Record (registereren), Explain (uitleggen) en Project (projecteren). In feite herbergt dit concept geen elementen die niet al aanwezig zijn in de huidige financiële verslaggeving. Echter de scheiding van informatie die van belang is voor het afleggen van verantwoording (hoe zijn de toevertrouwde middelen besteed, in welke mate zijn eerder geformuleerde doelstellingen bereikt) van toekomstgerichte informatie over waarde en een meer prominente plaats voor gestructureerde informatie over risico's en volatiliteit, verbetert de transparantie en geeft de gebruiker meer mogelijkheid om zijn eigen inschattingen en houding ten opzichte van risico's in zijn beslissingen te doen doorklinken.

- Het tweede concept betreft permanente waarderegistratie. Volgens dit concept worden de mutaties in waardeprojecties van het ene tijdstip naar het andere voor elke individuele gebeurtenis en transactie geadministreerd. Het heeft veel overeenkomsten met de permanente balansmethode zoals we die bij het administreren van voorraden kennen, waarbij elke transactie (inkomen, verkopen, breuk, etc.) op een zodanig consistente manier worden geadministreerd dat op elk moment inzicht bestaat in de samenstelling en de waarde van de aanwezige voorraad. Dit leidt tot een betere beheersing van het logistieke proces, betere controle op de bewaarfunctie en betrouwbaardere verslaggeving. In deze studie heb ik de mogelijkheid onderzocht om waarde intracomptabel te registreren door deze als een voorraad toekomstige kasstromen te beschouwen en alle mutaties in deze voorraad te boeken. Bij deze analyse heb ik gebruik gemaakt van de methode van het driedimensionale boekhouden die is ontwikkeld door Ijiri (1982).
- Schattingen van toekomstige kasstromen gaan altijd met onzekerheid gepaard. De mate van onzekerheid / onnauwkeurigheid is relevant voor de gebruiker, aangezien dit gegeven hem inzicht geeft in het verlies dat hij (als investeerder, crediteur) kan leiden. Om een solide basis voor dit soort informatie in het financiële verslag te creëren, heb ik de mogelijkheid onderzocht om (in aanvulling op de bovengenoemde permanente registratie van de waardedimensie) de ontwikkeling van onnauwkeurigheid / risico naar aanleiding van individuele transacties en gebeurtenissen te registeren. Een dergelijke permanente risicoregistratie is van belang bij de analyse van de oorzaken achter wijzigingen in risico- en nauwkeurigheidsindicatoren en kan een bijdrage leveren aan de verbetering van de informatie over risico en volatiliteit in het financiële verslag. Een dergelijke verbetering kan het (onder omstandigheden waardevernietigende) hiaat verkleinen tussen de perceptie van de gebruiker over risico's en volatiliteit en het beeld dat door de feiten wordt gerechtvaardigd.

De gedetailleerde analyses in deze studie hebben de levensverzekeringsbranche als uitgangspunt. Deze keuze is ingegeven door het feit dat deze bedrijfstak meer dan andere gewend is, om te gaan met ingewikkelde schattingsprocessen die zijn gebaseerd op lange termijn projecties van toekomstige kasstromen. Daarnaast is sprake van een bedrijfstak die onder toezicht staat en uit dien hoofde verplicht is voldoende kapitaal aan te houden om een hoge mate van zekerheid te bieden dat verplichtingen tegenover polishouders kunnen worden nagekomen. Dergelijke toezichtregels worden meer en meer gebaseerd op een evaluatie van alle risico's waarmee de onderneming te maken heeft (ondermeer geïllustreerd door het Solvency II project van de

Europese Unie), zodat aansluiting bestaat met het eerder in deze samenvatting uiteengezette concept van economisch kapitaal.
Levensverzekeringen is gekozen boven andere vormen van verzekeringen omdat het basismodel (leven of dood) eenvoudiger is dan enig ander bedrijfsmodel (waar gebeurtenissen vaak meer dan twee gedaanten kunnen aannemen) en omdat methodes om toekomstige kasstromen te schatten en te evalueren al redelijk ontwikkeld zijn.

**Samenvatting hoofdstuk 2**

Hoofdstuk 2 gaat over de historische ontwikkelingen rondom het ontstaan van boekhouden en financiële verslaggeving, het omgaan met onzekerheid en de verhouding tussen degene die waarde toevertrouwt aan een ander (de principaal) en degene aan wie die waarde wordt toevertrouwd (de agent).

Er zijn aanwijzingen dat er in de prehistorie (ongeveer 8000 jaar voor Christus), ondanks de afwezigheid van schrift, telstelsel en geld al een soort boekhouding werd gevoerd. De te registreren objecten, zoals graan, vaten olie, of vee, werden uitgebeeld door middel van een figuurtje van klei. Elk figuurtje vertegenwoordigde één fysiek object; per type object was er een verschillende vorm. De fysieke objecten (bijvoorbeeld een kudde) werden door de eigenaar (veelal een tempel) aan de zorg toevertrouwd van een bijvoorbeeld herder en de figuurtjes bleven in handen van de eigenaar, die op elk moment zijn eigendomstitel aan de hand hiervan kon staven. Later werd dit systeem verbeterd door de figuurtjes te verzamelen in een klei enveloppe en op de buitenkant hiervan een afdruk van de figuurtjes te maken. Op deze wijze ontstond een verzameloverzicht van alle activa, waarvan de eigendomstitel door de figuurtjes in de enveloppe werd vertegenwoordigd.

Door het ondernemen van activiteiten voor gezamenlijke rekening en risico ontstond gaandeweg de behoefte om historische registraties van ontvangsten en uitgaven aan te leggen op basis waarvan verantwoording aan de zakenpartners kon worden afgelegd. Een winstbepalings-vraagstuk bestond nauwelijks, aangezien de meeste ondernemingen projecten betroffen (één zeereis, de aankoop en verkoop van één partij goederen). Aan het einde van het project werd de opbrengst verdeeld. De introductie van Arabische cijfers in de late middeleeuwen was een belangrijke stap voorwaarts bij het maken van berekeningen en recapitulaties die voor de koopman van belang waren.

De techniek van het dubbel boekhouden is ontwikkeld in Italië gedurende de Renaissance en is in 1494 formeel beschreven door Luca Pacioli in de Particularis de Computis et Scripturis. Dit werk is onderdeel van een wiskundeboek, genaamd Summa de Arithmetica, Geometrica, Proportioni et Proportionalita. Het dubbel boekhouden maakt de dualiteit van financiële transacties zichtbaar (de uitvoer van het ene proces is gelijk aan de invoer van het andere proces, de verkoop van goederen betekent een stijging van de liquide middelen en een daling van de voorraad) en betekende een verbetering van de controle op de juistheid en volledigheid van boekhoudkundige gegevensverzamelingen. In de eeuwen daarna is de techniek van het dubbel boekhouden verder verbeterd; de basis is echter onveranderd gebleven.

In dezelfde Summa van Pacioli wordt een beschrijving gegeven van een balspel. A en B leggen 10 ducaten in. Zij spelen een spel dat per gewonnen ronde 10 punten oplevert. Degene die het eerst 60 punten heeft verzameld, wint de pot. Het spel moet worden afgebroken op het moment dat A 50 punten heeft gewonnen en B 20. De vraag is nu, hoe de pot verdeeld moet worden. Pacioli hanteert een retrospectieve benadering en deelt 50/70 van de pot toe aan A en 20/70 aan B. Dit balspel is in de eeuwen daarna onderwerp van discussie geweest onder gokkers en wiskundigen die (overigens terecht) van mening waren dat niet het verleden bepalend was voor de verdeling maar de kansen met betrekking tot het toekomstige verloop van het spel. Om een verdeling te maken op basis van het geprojecteerde toekomstige verloop van het spel, is een aantal begrippen en vindingen uit de tijd van de Verlichting van belang.

- Op de eerste plaats het begrip "reële gok", geïntroduceerd door Christiaan Huygens. Volgens Huygens is er sprake van een reële gok wanneer de verwachtingswaarde van de opbrengst gelijk is aan de inleg.
- Op de tweede plaats de techniek om een kansverdeling te bepalen. In het geval van Pacioli's balspel is hier de driehoek van Pascal, respectievelijk het binomium van Newton van belang.
- Op de derde plaats is van belang, hoe de kans op een individuele gebeurtenis wordt bepaald (in het voorbeeld: wat is de kans dat A een ronde wint). Van belang zijn hier:
  - De wet van de grote aantallen (Jakob Bernoulli). Op basis van deze wet convergeert de frequentie van een bepaalde gebeurtenis in een groot aantal waarnemingen onder bepaalde condities naar de kans op die gebeurtenis.
  - Het theorema van Bayes, op basis waarvan waarnemingen kunnen worden samengevoegd met reeds beschikbare informatie teneinde op deze manier telkens het inzicht in de kans op een bepaalde gebeurtenis te verbeteren.
- Tenslotte kan worden genoemd de St. Petersburg paradox die, uitgaande van het principe van de reële gok leidt tot een waarde die onder omstandigheden nadert tot oneindig, terwijl een weldenkend mens slechts een beperkt bedrag op die gok zou willen inzetten. Dit heeft onder andere te maken met het feit dat een individu niet zondermeer bereid is, een zeker bedrag in te ruilen voor een gok met een verwachtingswaarde gelijk aan dit zekere bedrag. Die bereidheid hangt ondermeer af van de omvang van de inzet in relatie tot het vermogen van dit individu en de omvang van de mogelijke winst in relatie tot zijn vermogen. In feite heeft de St. Petersburg paradox de nutsfactor bij het nemen van beslissingen onder onzekere omstandigheden zichtbaar gemaakt.

Een zijstapje: het hedendaagse begrip reële waarde betekent de waarde waarvoor een actief kan worden verhandeld of een verplichting kan worden afgewikkeld, tussen terzake goed geïnformeerde, tot een transactie bereid zijnde partijen, die onafhankelijk zijn. Anders gezegd: reële waarde is de prijs van een reële gok, gecorrigeerd voor de (nutsbepaalde) prijs van onzekerheid. Geconcludeerd kan worden dat het gereedschap om een reële waarde fundamenteel, vanuit verwachte toekomstige kasstromen, te benaderen, al in de achttiende eeuw beschikbaar was.

De ontwikkeling van ondernemingen die voor onbepaalde tijd werden opgericht en de steeds verdergaande scheiding van kapitaal en management leidden tot een tweetal attentiepunten.

- De noodzaak voor de ondernemingsleiding om verantwoording af te leggen aan de eigenaren, om de vraag te beantwoorden "hoe zijn de middelen die de eigenaren hebben verschaft, besteed" of "houdt de ondernemingsleiding zich aan de (impliciete of expliciete) overeenkomst met de eigenaren". Omdat ondernemingen steeds meer een continue stroom activiteiten ontplooiden, ontstond de noodzaak van een periodieke balans. Methodes om periodiek de positie van vorderingen en schulden en van voorraden (Grammateus) zijn reeds eeuwen geleden ontwikkeld. Voor vaste activa zoals schepen, gebouwen en forten werd de waardering te onzeker geacht. Aan deze onzekerheid werd, bijvoorbeeld door de Verenigde Oost-Indische Compagnie, uiting gegeven door investeringen in dergelijke activa als kosten te verantwoorden. Het voorbeeld van de VOC geeft aan dat een dergelijke vorm van "voorzichtigheid" onvoorzichtig kan blijken te zijn, omdat de desbetreffende activa uit het zicht van de eigenaren raken en management er geen verantwoording meer over hoeft af te leggen. Het in de balans opnemen van materiële vaste activa (in de industriële revolutie) en later van immateriële vaste activa heeft uiteindelijk plaatsgevonden vanuit een wijziging in de omstandigheden en niet zozeer vanuit een concept.

- De waarde van de onderneming. Belangen in ondernemingen die voor onbepaalde tijd zijn opgericht, wisselen op gezette tijden van eigenaar. De waarde van een dergelijk belang kan doorgaans niet uit de balans worden afgelezen. Ook hedendaagse financiële verslagen, inclusief het verslag van de ondernemingsleiding, geven op zijn best een informele weergave van de "strategie in uitvoering". Pacioli's balspel en de discussies hierover in de zestiende en zeventiende eeuw geven, wellicht onbedoeld, aan waarom de waarde van een onderneming niet uit de (op historische gebeurtenissen gebaseerde) balans kan worden afgelezen. De verkoopwaarde van een belang in een onderneming (of van een spel) is (impliciet of expliciet) een functie de verwachte toekomstige ontwikkelingen van die onderneming.

Wanneer we accepteren dat toekomstige ontwikkelingen een rol spelen bij de waardebepaling, worden onzekerheid en de mate van aversie van belanghebbenden tegen deze onzekerheid van belang voor financiële verslaggeving. Onzekerheid en het belang hiervan in financiële verslaggeving spelen een belangrijke rol in de volgende hoofdstukken. Om echter een eenvoudig en eenduidig waardebegrip als startpunt te hebben, wordt in paragraaf 2.3 een voorbeeld gebruikt waarin onzekerheid is geëlimineerd door een perfect inzicht in de toekomst (*perfect foresight*) te veronderstellen. Onder deze veronderstelling, die de situatie sterk vereenvoudigt, kan de reële waarde van de onderneming worden bepaald als de contante waarde van de toekomstige kasstromen (de fundamentele waarde). Kasstromen vertegenwoordigen het voordeel dat de eigenaren van de onderneming uiteindelijk genieten. Aangezien iedereen hetzelfde (perfecte) inzicht heeft in de toekomstige ontwikkelingen en in de tijdwaarde van geld, vertegenwoordigt de contante waarde van de toekomstige kasstromen op een bepaald moment het bedrag dat de eigenaar moet ontvangen wanneer hij zijn belang op dat moment vervreemdt.

De *Conditional Normative Accounting Theory* (CoNAT), ontwikkeld door Mattessich (1995) en behandeld in paragraaf 2.6, biedt een goed uitgangspunt voor de bewering dat waarde ook zonder de veronderstelling van *perfect foresight* door de toekomstige kasstromen wordt bepaald. Het startpunt van CoNAT is de (op empirisch onderzoek gebaseerde) stelling dat de principaal van de agent (in casu de leiding van de onderneming) verlangt dat deze zijn financiële positie maximaliseert. Echter, de maximalisatie van de financiële positie van een bepaalde principaal kan conflicteren met andere belangen (andere eigenaren, personeel, kanten, milieu), vooral wanneer de onderneming zich concentreert op winstmaximalisatie op korte termijn. Om deze reden heb ik CoNAT aangevuld met de veronderstelling dat er een (ongeschreven) vierpartijenovereenkomst bestaat tussen de principaal, de agent de overheid en de financiële markten. De financiële markten zorgen ervoor voldoende transparant, liquide en efficiënt te zijn. Op deze wijze kunnen fricties tussen korte en lange termijn worden geminimaliseerd. Een belegger met een korte termijn doelstelling kan immers zijn belang vervreemden zonder duurzame waardecreatie in de weg te

zitten. De overheid zorgt voor een zodanig beleid op het gebied van wetgeving en handhaving dat inachtneming van belangen van mensen, milieu, etc. tot een hogere contante waarde van kasstromen leidt dan verwaarlozing ervan. De agent ontwikkelt een strategie die gebaseerd is op maximale waardecreatie (dus op maximalisering van alle te verwachten kasstromen) binnen de beperkingen van de vierpartijenovereenkomst, voert deze uit en rapporteert periodiek over de voortgang. En de principaal committeert zich tot het begrijpen van de rapportage en het geven van de juiste impulsen aan de agent (al dan niet via de financiële markten).
Maximalisatie van (fundamentele) aandeelhouderwaarde betekent het maximaliseren van het gedisconteerde totaal van alle kasstromen. Het merendeel van deze kasstromen heeft betrekking op de lange termijn, dus we hebben het automatisch over duurzaamheid. Bij een goed functionerende vierpartijenovereenkomst, is het niet onredelijk te veronderstellen dat bij dit maximaliseringsproces alle conflicten tussen de verschillende doelstellingen van het ondernemen worden opgelost. De effecten van het imperfect functioneren van de vierpartijenovereenkomst en het suboptimale gedrag van partijen dat hieruit voortvloeit, kan niet binnen een onderneming worden opgelost en al helemaal niet binnen de financiële verslaggeving. Samenvattend kan worden gesteld dat ReCONAT voldoende basis geeft voor het uitgangspunt dat rapportage over (gerealiseerde en geprojecteerde) kasstromen relevant zijn om inzicht in de waarde van een onderneming te verkrijgen. En kasstroom is (anders dan bijvoorbeeld winst) een eenduidig begrip waarvoor geen verschil in interpretatie mogelijk is.

**Samenvatting hoofdstuk 3**

In hoofdstuk 3 is de veronderstelling van *perfect foresight* verlaten door in het voorbeeld dat in hoofdstuk 2 is uitgewerkt, op een vereenvoudigde wijze onzekerheid in te brengen. Deze onzekerheid heeft volatiliteit in de toekomstige kasstromen tot gevolg, die overigens door de vereenvoudiging van het voorbeeld precies kan worden gekwantificeerd. De verhandeling in hoofdstuk 2 over ondermeer de St. Petersburg paradox toont aan dat er al lang het besef bestaat dat deze volatiliteit een prijs heeft omdat een beslisser niet indifferent is tussen een bedrag dat met zekerheid wordt gerealiseerd en een verwachtingswaarde (het kansgewogen gemiddelde van een aantal mogelijke uitkomsten) van gelijke omvang. Bovendien betekent onzekerheid over toekomstige kasstromen veelal dat er een risico bestaat dat de werkelijke netto kasstromen negatief zijn, zodat de verplichtingen jegens crediteuren en andere partijen met wie een overeenkomst bestaat, niet kunnen worden nagekomen. De onzekerheid omtrent het nakomen van verplichtingen kan worden beheerst door het aanhouden van economisch kapitaal, dat is het eigen vermogen dat niet wordt uitgekeerd om een hoge mate van zekerheid te bieden dat de verplichtingen van de onderneming kunnen worden nagekomen.

Behalve de verschaffers van eigen vermogen brengen verschaffers van vreemd vermogen en andere contractpartijen een prijs in rekening voor de kans dat de onderneming haar verplichtingen jegens hen niet nakomt. Deze prijs wordt hoger naarmate het risico hoger wordt (voorbeeld: naarmate de rating van een onderneming lager is, wordt de opslag op het rentepercentage voor vreemd vermogen hoger). Genoemd risico is een functie van de volatiliteit in de toekomstige kasstromen en het beschikbare risicodragende vermogen dat dient als een buffer voor negatieve toekomstige kasstroomscenario's. Daarom vormt niet alleen waarde (de verwachting over toekomstige kasstromen) maar ook volatiliteit belangrijke informatie voor de meeste gebruikers van een financieel verslag (ongeacht of deze gebruiker een aandeelhouder, een crediteur of een andere contractpartij is).

Indien de kansverdeling van toekomstige kasstromen zou kunnen worden bepaald (in het gestileerde voorbeeld is dit het geval), kan het benodigde economisch kapitaal direct worden afgeleid uit de x% ondergrens van deze verdeling. Een dergelijke situatie zou tevens oplossing bieden voor twee belangrijke vraagstukken op het gebied van financiële verslaggeving:

- Het eerste betreft de handhavingsdoelstelling van het eigen vermogen ingeval van algemene of specifieke prijsstijgingen. Wanneer economisch kapitaal op een ondubbelzinnige wijze kan worden vastgesteld, zijn prijsstijgingen geen specifiek probleem meer; slechts de handhaving van eigen vermogen in relatie tot de omvang en het risico van de bedrijfsvoering (afgemeten aan omvang en volatiliteit van toekomstige kasstromen) is dan nog relevant. Indien inflatie of specifieke prijsstijgingen factoren zijn die het economisch kapitaal beïnvloeden, komt dit tot uitdrukking bij de projectie en analyse van de volatiliteit van de toekomstige kasstromen; een specifieke behandeling is niet nodig.
- De tweede betreft het in de balans opnemen van bepaalde activa en passiva. De vraag of activa (bijvoorbeeld immateriële vaste activa of mogelijke vorderingen uit een rechtsgeding) of passiva (bijvoorbeeld voorzieningen) in de balans worden opgenomen, is gekoppeld aan de mate van zekerheid dat er toekomstige kasstromen uit voortvloeien en de mogelijkheid om deze kasstromen betrouwbaar te meten. Wanneer de mate van nauwkeurigheid en betrouwbaarheid van de meting kunnen worden verwerkt in de ondergrens van de schatting der toekomstige netto kasstromen, maakt het opnemen of niet opnemen van activa en passiva geen verschil meer bij de bepaling van de *uitkeerbare* kasstromen. Het in de balans opnemen van activa waarvan de toekomstige voordelen een hoge mate van volatiliteit kennen, vertaalt zich direct in een hogere eis voor het aan te houden vermogen. Als gevolg hiervan kan het vraagstuk van al dan niet opnemen in de balans worden teruggebracht tot de vraag: “Voor welke activa (inclusief zelfgecreëerde goodwill) dient de leiding van een onderneming in de toekomst verantwoording af te leggen op het gebied van bestaan, gebruik en verloop in de waarde. Vanuit deze invalshoek kunnen activa en passiva worden behandeld zoals ze oorspronkelijk bedoeld zijn, te weten “kasstromen in bewerking”.

Het verkrijgen van inzicht in waarde en volatiliteit vereist het maken van projecties. Resultaten die worden gemeten als het verschil tussen twee opeenvolgende waardeschattingen voegen zelfstandig geen informatie toe bij het bepalen van de realisatie van de doelstellingen van de onderneming. Historisch bezien heeft dit probleem geleid tot substitutie (Schmalenbach) van relevante doch onbetrouwbare verslaggevingsprincipes door minder relevante doch betrouwbare principes. Uiteindelijk had dit Hoogendoorn’s botsende beginselen tot gevolg en leidde het tot balansen waaruit de waarde van de onderneming niet kan worden afgemeten, winst- en verliesrekeningen die de prestaties van de onderneming niet weergeven en zoveel subjectieve elementen dat de jaarrekening nog slechts beperkt geschikt is voor het afleggen van verantwoording. Inzicht in waarde en prestatie wordt beperkt en informeel verschaft door de toelichting in de jaarrekening en door het jaarverslag, maar de verslaggeving van harde historische feiten en zachte schattingen lopen door elkaar heen en zijn voor de gebruiker nauwelijks nog te onderscheiden. *Financial REPorting* is ontworpen om de verslaggeving van historische gebeurtenissen op basis van kasstromen (gecorrigeerd voor operationele fricties zoals verstoring van het patroon in betalingen en ontvangsten), de uitleg over de gang van zaken en de mate waarin onderneming eerder gestelde doelen heeft bereikt, en de projecties en schattingen (inclusief de hieraan verbonden volatiliteit en het gevolg hiervan voor het economisch kapitaal), apart zichtbaar te maken.

Projecties van toekomstige kasstromen verschaffen op zichzelf geen solide basis voor financiële verslaggeving en historische gebeurtenissen zijn op zichzelf vaak beperkt relevant voor waardebepaling. Maar de verbinding hiertussen, de uitleg over de mate waarin projecties uit eerdere periodes zijn uitgekomen, de inschatting van de mate waarin historische patronen zich in de toekomst zullen herhalen en de inschatting van de effecten van ondernemingsbesluiten en wijzigingen in de externe omstandigheden, voegen relevantie toe aan de historische beschouwingen en soliditeit aan de toekomstgerichte informatie. *Financial REPorting* is een brug tussen verleden en toekomst.

**Samenvatting hoofdstuk 4**

In hoofdstuk 4 wordt een beknopte uitleg gegeven in de werking van levensverzekeringen. Ook hier wordt een gestileerd voorbeeld gebruikt, dat een sterke vereenvoudiging is van de werkelijkheid. Aan de hand van dit voorbeeld wordt echter ook voor anderen dan actuarissen en financiële wiskundigen duidelijk met welke problematiek levensverzekeringsmaatschapijen (hierna kort aangeduid als maatschappij) te maken hebben bij het schatten van toekomstige kasstromen en het bepalen van de volatiliteit hierin en wat de onderliggende processen zijn.
De werking van de wet van de grote aantallen wordt uitgelegd in het kader van het "fabricageproces" van een maatschappij waarbij individueel onacceptabele risico's worden gesmeed tot een collectief acceptabel risico. Er wordt ook ingegaan of het effect van trends (bijvoorbeeld in de overlevingskansen van verzekerden) die voor de maatschappij niet diversifieerbaar zijn.

In het voorbeeld wordt uitgegaan van een uitkering aan de verzekerde aan het einde van de looptijd van de polis die de hoogste is van een minimum gegarandeerd bedrag en de opgebouwde waarde van de onderliggende beleggingen. Er zijn op basis van een Excel model 1.000 willekeurige scenario's gegenereerd. De eenvoud van het voorbeeld brengt met zich mee dat de meeste onderdelen van de uitkomst ook analytisch kunnen worden bepaald. Bij echte verzekeringsproducten is dit nog zelden het geval. De analytische uitkomsten zijn gebruikt als toets van het simulatiemodel. Het voorbeeld toont twee interessante verschijnselen:

- Aangezien de beleggingswinsten in alle gunstige scenario's voor de polishouder zijn en de beleggingsverliezen van alle ongunstige scenario's voor de maatschappij, is de verwachtingswaarde voor de maatschappij negatief. De gemiddelde contante waarde is gelijk aan de prijs van een put optie en vertegenwoordigt een kostenpost voor de maatschappij. Dit soort kosten van opties en garanties werden in het verleden niet altijd in aanmerking genomen bij het bepalen van de kostprijs van een verzekeringsproduct en zeker niet in de jaarrekening.
- De minimum rendementsgarantie resulteert in een hoge volatiliteit voor de maatschappij, tenzij afdekking van het beleggingsrisico plaatsvindt. Zoals in het vorige punt is aangegeven, zijn de kosten van een dergelijke put optie gelijk aan de contante waarde van de gemiddelde uitkomst van alle mogelijke scenario's. Voor een eenvoudig product zoals in het voorbeeld gebruikt is, geldt dat er een efficiënte markt in derivaten bestaat, waar het risico dat de maatschappij loopt uit hoofde van de garantie, op elk moment volledig kan worden ingedekt. In zo'n geval is het risico voor de maatschappij tot nihil terug te brengen. Alleen de

afdekkingskosten zijn dan nog van belang. In werkelijkheid zijn verzekeringsproducten gecompliceerder en is er niet voor elk risico een passend derivaat te koop. In dat geval is de in het voorbeeld gemaakte veronderstelling realistisch dat er (synthetische) afdekkingsinstrumenten beschikbaar zijn die de risico's slechts gedeeltelijk afdekken.

Het hanteren van een minimale kans, dat gegeven de onzekerheid omtrent toekomstige kasstromen, er een hoge kans (b.v. 99,5%) bestaat dat de verplichtingen kunnen worden nagekomen, maakt de behoefte aan eigen vermogen (solvabiliteit) zichtbaar. Solvabiliteit brengt kosten met zich mee. Dit hang samen met de keuze die een belegger heeft tussen een risicovrij beleggingsinstrument en een beleggingsinstrument (zoals een aandeel in een verzekerings-maatschappij) waarvan het uiteindelijke rendement (positief of negatief) onzeker is. De kosten van solvabiliteit worden in de premie verwerkt. Met andere woorden, de polishouder moet een extra marge betalen om de verschaffer van risicodragend vermogen het zicht op voldoende rendement geeft om bij hem de bereidheid te creëren om de vereiste middelen te verstrekken.

Wanneer alle markten transparant zouden zijn, zouden de winstmarges in de premie van een verzekeringsproduct precies gelijk zijn aan de kosten van solvabiliteit (Girard). Deze marges geven de verschaffer van risicodragend vermogen namelijk precies de risicomarge in het door hem geëiste rendement. Hoe hoger het risico, des te hoger is het vermogen dat noodzakelijk is om het vereiste betrouwbaarheidsniveau te waarborgen (respectievelijk des te hoger de kosten van het afdekkingsinstrument, indien beschikbaar). En hoe hoger het vereiste vermogen, des te hoger de kosten van solvabiliteit en des te hoger de noodzakelijke marge in de premie en in de voorzieningen voor verzekeringsverplichtingen. Dit is een elegante manier om de relatie tussen risico en de te hanteren voorzichtigheidsmarges in premies en bij toereikendheidstoetsen te beschrijven.

In werkelijkheid zijn financiële markten niet volledig transparant. Net als met kruidenierswaren heeft de eindgebruiker slechts toegang tot de "detailhandels" markt waarop bijvoorbeeld verzekeringsproducten worden verkocht. Deze verzekeringsproducten worden door maatschappijen "geproduceerd" met als "grondstoffen" solvabiliteit, beleggingsmogelijkheden en afdekkingsinstrumenten op de "groothandelsmarkt" en als "productiemiddelen" de wet van de grote aantallen en acceptatieregels. Hiermee kunnen maatschappijen een handelsmarge verdienen die de kosten van solvabiliteit (zojuist geïdentificeerd als onderdeel van de integrale kostprijs) te boven gaat. Indien dit onwaar zou zijn, zou een levensverzekeringsmaatschappij niet in staat zijn om met zijn vaardigheden (aandeelhouders) waarde te creëren. In de financiële verslaggevingspraktijken van dit moment wordt een dergelijke marge over de totale looptijd van het desbetreffende verzekeringsproduct in het resultaat genomen. In feite worden de winstmarges als resultaat verantwoord naarmate de diensten (overnemen van het risico van de polishouder, administreren van de polis, schadebehandeling, etc.) worden verleend. Een dergelijke wijze van resultaatverantwoording wordt in de meeste bedrijfstakken gehanteerd die te maken hebben met meerjarige contracten (vergelijk de winstneming naar rato van de verrichte prestaties bij aanneemcontracten). Voor de gebruiker van een financieel verslag is een dergelijke wijze van resultaatverantwoording relevant aangezien deze inzicht geeft in de prestaties van de maatschappij (de werkelijke risicomarges, het werkelijke resultaat op administratieve handelingen) en in de geloofwaardigheid van eerder gerapporteerde schattingen (bijvoorbeeld die opgenomen zijn in de waarde van verkochte polissen).

**Samenvatting hoofdstuk 5**

Dit hoofdstuk behandelt de belangrijkste elementen in de hedendaagse verslaggeving van levensverzekeringsmaatschappijen. Een drietal vraagstukken is bij uitstek van belang:

- Bij de uitvoering van een toereikendheidstoets op de voorziening voor verzekeringsverplichtingen wordt de geamortiseerde verkoopwaarde van lopende contracten vergeleken met de verwachte kosten. Aangezien solvabiliteit een grondstof is bij de "productie" van een verzekeringscontract, dienen de kosten van solvabiliteit in de opstelling van deze verwachte kosten te worden begrepen. Voor zover huidige standaarden op het gebied van verslaggeving dit al regelen, is het niet toegestaan, aangezien de kosten van solvabiliteit aan de aandeelhouder verschuldigd zijn. Zoals echter in hoofdstuk 4 is uiteengezet, vertegenwoordigen de kosten van solvabiliteit het "natuurlijk minimum" van de in de productprijs en in de voorziening voor verzekeringsverplichtingen aan te houden voorzichtigheidsmarge. Onder dit niveau zou de boekwaarde van het eigen vermogen onder aftrek van goodwill boven de reële waarde uit kunnen komen, hetgeen zou betekenen dat een waardevermindering van het complex activa en passiva dat verband houdt met de bestaande verzekeringscontracten, niet verantwoord zou hoeven worden.
- Het beeld van de boekwaarde van het eigen vermogen en het gerapporteerde resultaat kan worden verstoord wanneer verzekeringsverplichtingen worden gewaardeerd tegen de hoogste van de geamortiseerde verkoopwaarde en de verwachte kosten, en activa (die moeten worden aangemerkt als "beschikbaar voor de verkoop" terwijl zij in werkelijkheid slechts "beschikbaar voor de ruil" zijn) op reële waarde moeten worden gewaardeerd. De aanpak die lange tijd in Nederland (en in Canada) werd gehanteerd (alle beleggingsinstrumenten met een vaste rente gedurende een vaste looptijd waarderen tegen geamortiseerde kostprijs en de resultaten bij verkoop verantwoorden over de resterende looptijd van het verkochte instrument), is niet toegestaan onder IFRS of US GAAP. Derhalve is het hanteren van actuele rente bij de waardering van verzekeringsverplichtingen de enige mogelijkheid om deze verstoring in de vastlegging van historische gebeurtenissen op te heffen. Anders dan bij de "Nederlandse aanpak" wordt hierbij de volatiliteit zichtbaar die wordt veroorzaakt door de mismatch tussen de looptijden van activa en verzekeringsverplichtingen. Deze volatiliteit is relevante informatie voor de gebruiker van het financieel verslag.
- Verzekeringscontracten met voorwaardelijke winstrechten waarbij het tijdstip en de omvang van het winstaandeel door de maatschappij kunnen worden bepaald, vertegenwoordigen in feite een joint venture tussen maatschappij en polishouder. Er wordt een extra vermogensbuffer gecreëerd door in verhouding tot de gegarandeerde uitkering een hogere premie in rekening te brengen. Deze buffer stelt de maatschappij in staat om een groter deel van de premie te beleggen in aandelen en onroerende zaken, die op lange termijn een beter rendement geven, maar die van jaar tot jaar een hoge volatiliteit tonen. Deze extra vermogensbuffers worden instandgehouden zolang ze benodigd zijn om een voldoende hoge zekerheid te bieden dat de gegarandeerde uitkeringen kunnen worden betaald. In veel gevallen leidt dit tot een geëgaliseerde toevoeging aan de rechten van polishouders en (indien van toepassing) het eigen vermogen. In het financieel verslag zijn zowel de opbouw van de waarde in de joint venture tussen aandeelhouder en polishouder als de specifieke toekenning van rechten aan polishouders en aandeelhouders van belang.

*Embedded value* kan worden gedefinieerd als het eigen vermogen verhoogd met het deel van de contante waarde van alle toekomstige netto marges in de bestaande verzekeringscontracten dat aan de aandeelhouders toekomt, minus de kosten van de aan te houden solvabiliteit. *Embedded value* vertegenwoordigt niet de totale fundamentele waarde van de maatschappij; het verschil is de waarde die wordt toegerekend aan het potentieel om in de toekomst nieuwe polissen te verkopen.

*Embedded value* is gebaseerd op schattingen van toekomstige kasstromen. Wanneer we echter het mutatie overzicht tussen beginstand en eindstand volgen, zien we elementen van historische feiten (de werkelijke kasstromen uit hoofde van uitkeringen, kosten, beleggingsopbrengsten), verklaringen (de analyse van de werkelijkheid tegenover de aannames uit de vorige periode) en projectie (het vaststellen van de wijzigingen in de veronderstellingen ten aanzien van toekomstige kasstromen). Deze drie elementen kunnen en moeten naar mijn mening apart worden behandeld in het financieel verslag. Identificatie van de verzameling verzekeringscontracten die in de *embedded value* begrepen zijn (*covered business*) in de gesegmenteerde informatie stelt de gebruiker in staat om het verband tussen historische gebeurtenissen (bijvoorbeeld kasstromen) en projecties. Toelichtingen moeten zodanig worden opgezet dat zij inzicht verschaffen in prestatie, afwijkingen van eerdere schattingen (hetgeen iets zegt over de geloofwaardigheid van de huidige schattingen) en volatiliteit. Bovendien moet het verband tussen deze toelichtingen en de revisie van veronderstellingen en parameters zichtbaar worden gemaakt. In hoofdstuk 5 wordt nader inhoud gegeven aan *financial REPorting* in de vorm van schematische overzichten voor kasstroom en operationeel resultaat (*recording*), analyse van werkelijke ontwikkelingen ten opzichte van aannames (*explanation*) en ontwikkeling in waarde (*projection*). In feite is de meeste informatie in deze overzichten al beschikbaar in de huidige financiële verslaggeving (zeker wanneer we hierbij de Europese Embedded Value Principes betrekken), maar zonder een duidelijk onderscheid tussen feiten, uitleg en schattingen en zonder de expliciete structurering van de uitleg naar de onderdelen prestatie, geloofwaardigheid en volatiliteit.

**Samenvatting hoofdstuk 6**

In hoofdstuk 6 wordt ingegaan op boekhoudkundige technieken die het informatiemodel moeten ondersteunen dat vereist is om het *financial REPorting* concept voldoende soliditeit te geven. Het hoofdstuk begint met een uiteenzetting over strategie en het planningsproces waarin wordt bepaald welke doelen te bereiken en op welke manier. Intenties vormen het beste uitgangspunt om toekomstige kasstromen te projecteren. De traditionele (dubbel) boekhoudsystemen leggen historische gebeurtenissen met een financieel gevolg in twee dimensies vast, te weten het verleden (door welke transacties in het verleden is het huidige vermogen opgebouwd) en het heden (uit welke afzonderlijke activa en passiva bestaat het vermogen). Gezien de constatering dat de projectie van toekomstige kasstromen van groot belang zijn voor de gebruiker van het financieel verslag, zou men willen dat gebeurtenissen of transacties die bepalend zijn voor toekomstige kasstromen ook zouden worden geregistreerd en wel in de derde (toekomst) dimensie. Het driedimensionaal boekhouden dat is ontwikkeld door Ijiri (1982) voorziet in deze behoefte. In deze studie is de methode van Ijiri verder ontwikkeld tot een methode van permanente waarderegistratie. Bij deze methode wordt een voorraadadministratie bijgehouden van toekomstige kasstromen en winstmarges. Elke transactie of gebeurtenis (zoals de verkoop van nieuwe polissen, premie ontvangst, betaling van uitkeringen, onnatuurlijk verval, expiratie, etc.) leidt tot een boeking in het traditionele grootboek en in de administratie van de voorraad toekomstige kasstromen. Bij toepassing van deze methode kunnen de mutaties in de voorraad kasstromen en marges direct uit de boekhouding worden afgelezen in plaats van retrograde bepaling. Indien noodzakelijk, kunnen de mutaties worden geanalyseerd tot de individuele transactie of gebeurtenis die aan de mutatie ten grondslag heeft gelegen. Wijzigingen in de strategie en de wijzigingen in de ondernemingsplanning, de budgettering en de kasstroomprojecties vormen gebeurtenissen die leiden tot boekingen in de voorraadadministratie van kasstromen en marges. Bij het registreren van transacties worden de werkelijke kasstromen (volgens het traditionele grootboek) geconfronteerd met de afboeking van de eerder geprojecteerde kasstromen en marges volgens de voorraadadministratie. In tegenstelling tot het *differential triple entry bookkeeping* (waarin een zogenaamd winstmomentum wordt vastgelegd, dat is een periodiek winstbedrag dat in de toekomst zal worden gerealiseerd zolang er geen fricties optreden in de vorm van afloop van contracten, einde levensduur productiemiddelen, etc.), worden bij de methode van permanente waarderegistratie wel fricties in aanmerking genomen, door rekening te houden met de levensduur van bestaande contracten, etc. bij het projecteren van kasstromen. Door alle "voorraadelementen" in de toekomstige kasstromen te registreren in de categorieën *gegarandeerd, verplichting aangegaan* en *geprojecteerd,* biedt de voorraadadministratie de basis om de gevoeligheid van toekomstige kasstromen voor wijzigingen in omstandigheden te evalueren.

**Samenvatting hoofdstuk 7**

De permanente waarderegistratie die in hoofdstuk 6 is uiteengezet, registreert schattingen van toekomstige kasstromen als voorraadelementen, maar nog niet de nauwkeurigheidsmaat van die schattingen. Hoofdstuk 7 gaat in op de gevoeligheid van toekomstige kasstromen voor wijzigingen in de omstandigheden. De voorbeelden die in hoofdstuk 3 en 4 zijn behandeld, tonen dat die gevoeligheid kan worden gemeten door de frequentieverdeling van de uitkomsten uit een groot aantal gesimuleerde scenario's. Uit een dergelijke frequentieverdeling kan een verwachtingswaarde van de toekomstige kasstromen worden afgeleid, die op zichzelf niet zoveel informatie geeft. Er kan echter ook de grens worden afgelezen waaronder de x% meest ongunstige scenario's liggen. Het belang hiervan is tweeledig. Op de eerste plaats kan op deze manier worden bepaald hoeveel weerstandsvermogen noodzakelijk is om in (1-x)% van alle scenario's aan de verplichtingen te kunnen voldoen. Op de tweede plaats kan ermee worden aangegeven hoe nauwkeurig de schatting van de toekomstige kasstromen is.

Aan het einde van een verslaggevingsperiode zijn alle werkelijke ontwikkelingen gedurende die periode bekend. In relatie tot de voorgaande alinea zou je deze realisatie kunnen zien als een "steekproef" uit alle mogelijke scenario's. Uiteraard kan aan het eind van de verslaggevingsperiode de simulatie worden overgedaan op basis van de dan geldende parameters om op die manier een "verse" frequentieverdeling te verkrijgen. De informatie zou echter aan soliditeit en transparantie winnen indien de mutaties op de oorspronkelijke verdeling zouden kunnen worden geregistreerd om op die manier het verband tussen begin en eind van de periode te kunnen analyseren.

Vanuit dit perspectief wordt in hoofdstuk 7 een uitleg van het Felix & Grimlund (F & G) model gegeven. Dit model is oorspronkelijk ontworpen om externe accountants die financiële verantwoordingen controleren, te ondersteunen bij het evalueren van de controle-informatie die is vergaard in de diverse activiteiten van het controleproces. Het gaat er dan om te bepalen welke aanvullende controleprocedures nog moeten worden uitgevoerd om te komen tot een voldoende nauwkeurige conclusie gegeven een acceptabel restrisico, respectievelijk om in te schatten in hoeverre de financiële verantwoording materiële fouten bevat. De input voor het F & G model wordt gevormd door de uitkomsten van een of meer statistische steekproeven en door elke andere vorm van controle-informatie die de accountant in staat en bereid is te vertalen in een “steekproef-equivalent”.

Ik heb bij wijze van experiment het F & G model gebruikt om de ondergrens van toekomstige kasstromen te bepalen voor het in hoofdstuk 4 gebruikte voorbeeld. De uitkomsten van het model waren goed vergelijkbaar met die uit de simulatie onder alle omstandigheden die zijn onderzocht. Bovendien kunnen de factoren die de input van het F & G vormen (aantal polishouders die nog in leven zijn, puntschatting van de contante waarde van de toekomstige winsten, variantie, etc.) redelijk worden benoemd. In tegenstelling tot simulatie kent een model als het F & G model de mogelijkheid om elke transactie of gebeurtenis met risico relevantie te verwerken en een nieuwe kansverdeling (tezamen met een nieuwe betrouwbaarheidsondergrens) te verschaffen. Het biedt een soort risicogrootboek waarin de implicatie voor risico en economisch kapitaal wordt “geboekt” van elke relevante gebeurtenis of transactie, dan wel van elke wijziging in parameters en veronderstellingen en van elke maatregel op het gebied van risicobeheersing.

Bij dit alles moet wel worden bedacht dat er slechts sprake is van een initiële verkenning en niet het bewijs is geleverd dat het F & G model algemeen bruikbaar is voor het voeren van een risicoboekhouding bij levensverzekeraars. Er zal nog veel gemeenschappelijke research nodig zijn van accountants en financiële wiskundigen om tot de ontwikkeling van een algemeen toepasbare methode voor risicoboekhouding te komen. Het voorbeeld geeft echter een sterke aanwijzing dat Bayesiaanse modellen het potentieel hebben voor de ontwikkeling van systemen van permanente risicoregistratie die de integratie ondersteunen van *Enterprise Risk* modellen, economisch kapitaalmodellen (die alle ondernemingsrisico’s onder een gemeenschappelijke noemer vangen), alsmede externe verslaggeving over risico’s en de nauwkeurigheid van projecties en schattingen.

**Behandeling onderzoeksvragen**

In relatie tot het centrale thema van deze studie zijn acht onderzoeksvragen geformuleerd.

Vier vragen hebben betrekking op de historische ontwikkeling van de relatie tussen agent en principaal en de financiële informatiebehoefte die uit deze relatie voortvloeit.

*Vraag 1: Welke informatiebehoefte vloeide voort uit het toevertrouwen van geld of waardevolle bezittingen aan een andere persoon of instelling en hoe heeft het verzamelen, vastleggen en verstrekken van deze informatie zich ontwikkeld?*

Vanaf de prehistorie zijn er methodes ontwikkeld om zicht te houden op de historische ontwikkelingen ten aanzien van toevertrouwde bezittingen. Dergelijke systemen hebben zich ontwikkeld van beschrijvingen van gebeurtenissen en transacties tot informatie die in waarde werd uitgedrukt waardoor rekenkundige bewerking en samentrekking mogelijk werden.

In de vijftiende eeuw ontwikkelde zich de toepassing van het dubbel boekhouden. Dit verbeterde de controle op de juistheid en volledigheid van de vastlegging van historische gebeurtenissen met een financieel gevolg. De methode is nog altijd de ruggengraat van boekhoudsystemen.

*Vraag 2: Welke extra informatiebehoefte ontstond er naar aanleiding van het toevertrouwen van vermogen aan een andere persoon of instelling om daarmee een bepaald doel te bereiken of om waarde te creëren en hoe ontwikkelde de vastlegging en het verschaffen van deze informatie zich?*

Wanneer het “bepaalde doel” expliciet is afgesproken tussen een bepaalde principaal en de agent, zijn de in hoofdstuk 2 beschreven informatiesystemen wellicht nog toereikend. Wanneer echter het doel wordt veralgemeniseerd tot het optimaliseren van (aandeelhouder) waarde en de principalen zijn anonieme partijen (hetgeen het geval is bij beursgenoteerde ondernemingen) is additionele informatie benodigd waaruit de waarde van de onderneming en de ontwikkeling hierin kan worden afgeleid. Agenten en principalen en ook verschillende groepen belanghebbenden kunnen verschillende doelstellingen hebben, een verschillende kijk op toekomstige ontwikkelingen en een verschillende mate van risico aversie. Met andere woorden, hun kijk op waarde kan verschillen. Om doelconflicten te neutraliseren voor de opstelling van het financieel verslag is de *Revised Conditional Normative Accounting Theory* geïntroduceerd als een theorie waaruit een financiële verslaggeving voortvloeit die relevant is voor alle gebruikers. Een en ander leidt tot de stelling dat het genereren en verschaffen van financiële informatie gericht moet zijn op inzicht in waarde, gedreven door geprojecteerde kasstromen, voortvloeiend uit besluitvorming onder onzekerheid door de agent. In financiële verslaggeving is een directe voorstelling van waarde (van de onderneming) nooit ontwikkeld. In plaats daarvan heeft zich door de eeuwen heen een pragmatische voorstelling van de (boek) waarde van het eigen vermogen van ondernemingen ontwikkeld, die van tijd tot tijd werd bijgesteld aan de hand van incidenten en opkomende behoefte aan meer of andere informatie.

*Vraag 3: Op welke wijze heeft de gedachtevorming over waarde zich ontwikkeld in verhouding tot risico en onzekerheid?*

Er bestaat een redelijke consensus dat onder de veronderstelling van *perfect foresight* de waarde van een onderneming gelijk is aan de contante waarde van alle toekomstige kasstromen. Zonder perfect foresight is altijd toevlucht gezocht tot bovengenoemde pragmatische voorstelling. Deze heeft zich in de tijd ontwikkeld op basis van incidenten en ontstane behoeften en er is aanzienlijke ruimte voor misverstanden tussen de opsteller en de gebruiker van informatie.

*Vraag 4: Op welke manier ging de mensheid om met onzekerheid bij het nemen van beslissingen en op welke wijze werd deze onzekerheid vastgelegd en werd erover gerapporteerd?*

Hoewel het altijd bekend is geweest dat onzekerheid een rol speelt bij bedrijfsbeslissingen en derhalve relevant is bij verslaggeving over waarde (gedreven door onzekere toekomstige kasstromen) heeft onzekerheid nooit een formele plaats gekregen bij het administreren. In financiële verslaggeving worden toelichtingen met betrekking tot risico pas sinds de negentiger jaren van de vorige eeuw gegeven.
Het voorbeeld van de Verenigde Oost-Indische Compagnie toont dat onzekerheid in het verleden vaak werd “opgelost” door de posten waarover men onzeker was domweg niet op te nemen. Deze vorm van “voorzichtigheid” is achteraf onvoorzichtig gebleken.

Zelfs verzekeringsmaatschappijen waarvan de producten gebaseerd zijn op risico's en onzekerheden, hebben deze factoren eeuwenlang nauwelijks in hun verslaggeving tot uitdrukking laten komen.

Twee onderzoeksvragen hebben betrekking op hedendaagse financiële verslaggeving.

*Vraag 5: Welke informatie die relevant is voor het inzicht in waarde en volatiliteit kan worden teruggevonden in hedendaagse financiële verslaggeving.*

In hoofdstuk 3 van de studie worden de implicaties getoond van het loslaten van de veronderstelling van *perfect foresight.* Aangetoond wordt dat onzekerheid leidt tot de noodzaak van een financiële buffer (economisch kapitaal) om situaties waarin netto kasstromen zich slechter dan verwacht ontwikkelen, het hoofd te kunnen bieden. Deze onzekerheid heeft een prijs in de vorm van een risico opslag. Een en ander heeft momenteel geen formele plaats in hedendaagse financiële verslaggeving. Voor verzekeraars is risico en de hiermee verbonden solvabiliteitseis van steeds groter belang en wordt geleidelijk ook een onderwerp in het financieel verslag.
De combinatie van het verschaffen van informatie omtrent historische ontwikkelingen en toelichtingen op prestaties, verloop in schattingen (zoals voorzieningen), volatiliteit en risico verschaffen waarderelevante informatie. Specifiek voor levensverzekeraars geldt dat meer en meer directe informatie over waarde (*embedded value*) wordt verschaft.

*Vraag 6: Welk effect heeft de veelgemaakte afweging tussen relevantie en betrouwbaarheid van informatie op het tonen van waarde en volatiliteit?*

Historisch bezien werd er in financiële verslaggeving op onzekerheid gereageerd door relevantie van informatie op te offeren ten gunste van betrouwbaarheid. Deze aanpak heeft fricties tot gevolg die leiden tot volatiliteit die in financiële verslaggeving wordt getoond zonder dat deze enige economische betekenis heeft. In sommige gevallen verstoort deze "valse" volatiliteit het historische patroon van kritieke prestatie indicatoren en wordt op deze wijze de relevantie van financiële informatie verlaagd.
Fricties in financiële verslaggeving kunnen worden voorkomen wanneer onzekerheid formeel een onderwerp wordt waarover wordt gerapporteerd en wanneer de consequentie van deze onzekerheid wordt vertaald in een minimum niveau van economisch kapitaal dat is beschermd tegen uitkering. Dergelijke informatie wordt transparant gemaakt door *financial REPorting* waarin de reeds gebruikelijke vastlegging van historische ontwikkelingen, de uitleg ervan en de hierop gebaseerde projectie van toekomstige kasstromen worden geformaliseerd.

De twee laatste onderzoeksvragen zijn gericht op technieken die het vastleggen van waarde en risico (die beide toekomstgericht zijn) onder de discipline van administratieve systemen (zoals het driedimensionaal boekhouden) brengt, die gevoed worden vanuit de bedrijfsprocessen en die de controles en aansluitingen kennen die al eeuwenlang kenmerkend zijn voor administratieve systemen.

*Vraag 7: Welke systemen kunnen worden ontwikkeld om waarde op een systematische wijze te administreren?*

Driedimensionaal boekhouden kan worden gebruikt voor de administratie van de *embedded value* van levensverzekeraars door deze te beschouwen als een voorraad toekomstige kasstromen en toekomstige marges. Een dergelijke voorraadadministratie kan worden gevoed door de bedrijfsprocessen en de gegevensverwerkende processen binnen de maatschappij.

*Vraag 8: Welke systemen kunnen worden ontwikkeld om risico op een systematische wijze te administreren?*

Idealiter zou een dergelijk systeem à tempo de wijzigingen in de kansverdeling van de voorraad toekomstige kasstromen moeten registeren. De verkennende studie in hoofdstuk 7 toont hoe een dergelijke permanente risicoregistratie zou kunnen werken. Het verband wordt getoond tussen het vastgelegde risico en het benodigd economisch kapitaal. Op deze manier wordt economisch kapitaal een indicator van de mate van nauwkeurigheid en betrouwbaarheid van de (kasstroom) projecties die bij financiële verslaggeving een rol spelen in de vorm van informatie omtrent (*embedded value*) waarde of in de vorm van waardeschattingen van jaarrekeningposten.
Een dergelijk systeem van permanente risicoregistratie kan gekoppeld worden aan de belangrijke bedrijfsprocessen en gegevensverwerkende processen. De beheersingsmaatregelen in deze processen verbeteren de soliditeit van de risico informatie.

**Conclusie**

Deze studie laat zien dat toekomstige kasstromen en de volatiliteit hierin (bepalend voor de betrouwbaarheidsondergrens van toekomstige kasstromen) de drijvers zijn achter de waarde van alle soorten ondernemingen. Voor levensverzekeraars geldt dit bij uitstek vanwege de lange looptijd van de contracten en de hieruit volgende noodzaak om toekomstige kasstromen te beoordelen over een lange looptijd. Ook bij andere soorten ondernemingen kan het belang groot zijn, bijvoorbeeld bij het toetsen van goodwill of activa met een onbepaalde of lange levensduur op duurzame waardeverminderingen.
Reële waarde wordt uiteindelijk bepaald door verwachte toekomstige kasstromen en door het risico dat de desbetreffende verwachting niet uitkomt. Contante waardetechnieken hebben weliswaar de laagste rang in de door regelgevers vastgestelde “reële waarde hiërarchie”; ook noteringen in een efficiënte markt worden uiteindelijk bepaald door het geloof (B) in een serie verwachte toekomstige kasstromen (C) en de mate van appreciatie (U) van de onzekerheid (v) rond die kasstromen en van het beschikbaar stellen van geld (i). In formulevorm (vanuit het perspectief van de buitenstaander):

$$Waarde_0 = f\left\{B, C, U\left(v, i\right)\right\}$$

Permanente waarderegistratie is een concept dat het volgen van de ontwikkeling in de voorraad kasstromen en marges in complexe situaties ondersteunt en op die manier de geloofwaardigheid van projecties en prestatiemeting (bijvoorbeeld waarde nieuw verkochte levensverzekeringen) verbetert. Het concept is gebaseerd op Ijiri’s driedimensionaal boekhouden, dat de volgende gelijkheid afdwingt:

$$Verleden = Heden = E(Toekomst)$$

E staat hier voor verwachtingswaarde.

Permanente risicoregistratie is een concept dat per waargenomen gebeurtenis, transactie, maatregel of hertaxatie de gevolgen voor het risicoprofiel vastlegt. Volgens het concept wordt de invloed van de gebeurtenissen, etc. op de volatiliteit in toekomstige kasstromen geanalyseerd, waardoor een robuuste basis ontstaat voor verslaggeving over risico en volatiliteit. Het dwingt bovendien, de volgende relatie zichtbaar te maken:

$$Verleden \to Heden \to V(Toekomst)$$

V staat hier voor variantie.

Wanneer een onderneming informatie verschaft die relevant is voor de fundamentele waarde, moet deze informatie leiden tot inzicht in E(Toekomst) en V(Toekomst).
Moet een onderneming een schatting door de leiding van zijn fundamentele waarde in het financieel verslag opnemen? Op zich is hier niets op tegen, mits voldoende transparantie wordt geschapen door middel van het *Financial REPorting* concept; er is echter geen noodzaak. De fundamentele waarde volgens de schatting van de ondernemingsleiding zou sowieso hoogstwaarschijnlijk afwijken van de waarde die de gebruiker van het financieel verslag aan de onderneming zou verbinden vanwege verschillen in het geloof (B) dat gehecht wordt aan kasstroomprojecties, en het verschil in nutbeleving (van ondermeer risico) tussen de gebruiker en de verschaffer. Belangrijk is dat er de kasstroomprojecties (C) en de volatiliteit (v) juist worden weergegeven door de verschaffer en juist worden geïnterpreteerd door de gebruiker.

De algemene conclusies ten aanzien van het centrale onderzoeksthema kunnen als volgt worden samengevat.

- Ondersteun waardeschattingen met administratieve methodes waarmee systematisch de invloed van alle relevante transacties en gebeurtenissen op kasstroomprojecties en de volatiliteit in die projecties worden vastgelegd.
- Presenteer op systematische wijze de vastgelegde ontwikkelingen gedurende de verslagperiode en licht de prestaties gedurende de periode, de afwijkingen met schattingen uit voorgaande periodes en de waardebewegingen die gevolg zijn van ingenomen risicoposities, toe.
- Presenteer schattingen en projecties in de huidige periode in zichtbare relatie tot waargenomen ontwikkelingen en de analyse en uitleg hiervan.
- Licht de volatiliteit in schattingen en projecties toe.
- Verschaf inzicht in het vereist economisch kapitaal en zorg dat de basis voor de vaststelling van dit economisch kapitaal consistent is met de waargenomen volatiliteit in schattingen en projecties.
- Verschaf voldoende informatie om de gebruiker in staat te stellen om schattingen en projecties aan te passen naar zijn eigen ideeën over toekomstige ontwikkelingen en zijn eigen mate van risico aversie.

En:

- Laat financiële verslaggeving zoveel mogelijk een voortgangsverslag zijn van de ondernemingstrategie.

- Laat de principaal een deskundige lezer van het financieel verslag zijn, zodat hij de juiste signalen terugzendt naar de agent en de financiële markt.

De in het begin van deze samenvatting genoemde driehoeksverhouding verbindt het vastleggen van voortgang op basis van historische gebeurtenissen met waardeschattingen die gebaseerd zijn op geprojecteerde kasstromen en met economisch kapitaal dat gedreven wordt door de volatiliteit in die kasstromen. Waardeschattingen verkrijgen hun geloofwaardigheid uit de vastlegging van historische gebeurtenissen in relatie tot eerdere projecties. Volatiliteit in toekomstige kasstromen ontleent zijn geloofwaardigheid aan waargenomen volatiliteit in vergelijking tot eerdere schattingen en behelst rechtstreekse informatie over de betrouwbaarheid van de waardeschatting. Historische vastleggingen en analyses ontlenen hun relevantie door de schattingen van waarde en volatiliteit te ondersteunen. Het geheel wordt gedreven door de strategie van de onderneming en het informatiemodel dat het meest past ten aanzien van het meten van de voortgang in het bereiken van de ondernemingsdoelstellingen.

**VERANTWOORDING EN DANKWOORD**

Als je een windmolen ziet draaien, kun je niet zien of hij door de wind wordt aangedreven en daarmee energie toevoegt aan een opslagmedium of dat hij energie aan dat opslagmedium onttrekt. Dit ging door mijn hoofd toen aan het eind van de vorige eeuw de technologiebeurzen zo hard stegen: loopt de beurs op de economie (zoals je zou verwachten) of loopt de economie op de beurs (en vindt er geen fundamentele waardecreatie plaats)? Naar aanleiding van dit mysterieuze spel van gedrag (van beleggers en ondernemers), vraag, aanbod, vertrouwen en de vraagtekens bij de relevantie van het financieel verslag toen het goed ging, van geschokt vertrouwen en hernieuwde belangstelling voor de "boekhoudregels" toen het fout ging, is het idee voor *Reportable Creation* ontstaan. In *Reportable Creation* wordt als uitgangspunt gehanteerd dat waarde goeddeels gebaseerd is op verwachtingen en ambities ten aanzien van de toekomst. Hieruit volgt dat verslaggeving over waardecreatie alleen maar relevant kan zijn wanneer deze voldoende informatie bevat omtrent die verwachtingen en ambities en de onzekerheden en risico's die hiermee gepaard gaan. Dergelijke informatie is alleen maar beschikbaar als het "boekhouden" van waarde en risico op een voldoende robuuste wijze plaatsvindt.
In *Reportable Creation* is een poging ondernomen om de traditionele, robuuste boekhoud-technieken en de veelal op wiskunde en statistiek gebaseerde technieken om toekomstverwachting en onzekerheid te meten, met elkaar te verbinden.
Ik heb met het ontwikkelen van mijn gedachten over de plaats van kwantitatieve technieken in de financiële verslaggeving en op het gebied van de accountantscontrole een lange weg afgelegd en er zijn vele mensen die ik wil bedanken voor het markeren van die weg.

Rob Metzer, oud partner van Ernst & Young en pionier op het gebied van het toepassen van statistiek in de accountantscontrole heeft mij in de eerste fase van mijn loopbaan een andere kijk gegeven op de problematiek waarmee de accountant te maken heeft. De manier van denken die hij me meer dan twintig jaar geleden bijbracht, heeft een grote rol gespeeld bij mijn onderzoek.

Het was Hans Beckman die een aantal jaren geleden mijn nieuwsgierigheid weer aanwakkerde. Zijn spontane bereidheid om als mijn promotor op te treden en het vertrouwen dat hij mij gaf om dit project tot een goed einde te kunnen brengen, hebben mij uiteindelijk het zetje gegeven om aan de slag te gaan. Hans is een veeleisende promotor, maar met veel respect en gevoel voor waar je zelf heen wilt.

Frits Krens heeft gedurende het gehele proces geadviseerd. Zijn kenmerkende vraag: "Ik begrijp hier iets niet, zou je nog eens willen uitleggen ….." leidde meestal tot de ontdekking van een fout of een ongelukkige formulering en uiteindelijk tot een beter product.

Wanneer een accountant met een HBS A vooropleiding zijn gedachten in formules gaat weergeven, gebeuren er soms vreemde dingen. Martien van Zuijlen en Harry Hendriks van de Radboud Universiteit in Nijmegen hebben mij aan de hand genomen om dit aspect van mijn proefschrift tot een goed einde te brengen.

Dan is er de basis van de Praktijkgroep Verzekeringen van Ernst & Young in Den Haag. In deze groep is ondanks de druk die de praktijk van alledag meebrengt, oog voor de ontwikkelingen op

de lange termijn en interesse voor de leuke, nieuwe dingen. Ik dank met name Jan Helderman en Lex van Overmeire voor hun geduld als ik wéér een fantastisch idee tegen ze aan wilde houden.

Michael Rose van het vertaalbureau van Ernst & Young heeft de Engelse tekst beoordeeld vanuit zijn talenkennis en zijn kennis van de materie.

Mijn zoon Robert heeft de kaft ontworpen.

Tenslotte wil ik kwijt dat het schrijven van een proefschift voor mij veel weg had van een ontdekkingsreis. Hiervoor is veel ruimte nodig. Lenneke, bedankt dat je me de ruimte hebt geboden om deze zwerftocht te ondernemen en tot een goed einde te brengen.

## CURRICULUM VITAE

N.G. (Niek) de Jager RA werd geboren op 19 juni 1954. Hij studeerde bedrijfseconomie en accountancy aan de Erasmus Universiteit Rotterdam.
Hij is partner bij Ernst & Young, waar hij voorzitter is van de Praktijkgroep Verzekeringen. Hij heeft diverse publicaties op zijn naam staan op het gebied van financiële verslaggeving en accountancy.