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Financing the embedded value of life insurance portfolios

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Financing the Embedded Value of
Life Insurance Portfolios

by Luise Hölscher, Perham Harding and Gernot M. Becker

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Abstract

In May 2004 the CFO Forum harmonized the various efforts of reporting the embedded value of life insurance companies by issuing the European Embedded Value (EEV) Principles.

In this working paper a methodology is proposed to derive a **maximum lending amount** from EEV figures without much additional data requirements from the originating insurer. The approach chosen is similar to that of other financing areas, e.g. real estate finance, where first a prudent best estimate valuation is done and later risk deductions are performed in the form of applying loan to value ratios, e.g. 60-80 % of the prudent amount. Here, this prudent value is called **bankable embedded value** and the loan to value analysis presented leads to the maximum lending amount. The deductions proposed to arrive at a maximum lending amount are based on parameter adjustments and risk allowances for unexpected risks. There is an analogy with insurers for determining their own capital needs. The methodology proposed is based on the **stress test approach** which increasingly gains popularity with insurance supervisors in Europe.

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Abbreviations:

BEV = bankable embedded value
cf. = confer
CF = confidence level
CFO = Chief Financial Officer
CI = total capital investments
CL = confidence level
CR = subindex for credit risk of originating insurer
CRC = cost of holding required capital
d = subindex for default risk
DCF = discounted cash flow
e = subindex for equity price risk
e.g. = for example
ei = subindex for expense inflation
E = equity holdings
EEV = European Embedded Value
et al. = et alii
FIR = future investment return
FOG = present value of financial options and guarantees
FS = free surplus
FSA = Financial Services Authority
GAAP = generally accepted accounting principles
GBP = Great Britain pounds
IASB = International Accounting Standards Board
ibid = see at the same reference as above
i.e. = id est
IC = invested capital
ICR = individual charge for residual risk
IFRS = International Financial Reporting Standard
ir = subindex for interest rate risk
IR = investment return
liqu = subindex for liquidity risk
lv = subindex for longevity risk
M = subindex for mortality risk
μ = multiplier
MR = modelling and other residual risk
NAV = net asset value
NP = net premium
p = subindex for property price risk
p. = page
para = paragraph
PD = probability of default

pp. = pages
PVEVA = present value of economic value added
PVFP = present value of future profits
q = ratio of individual total modelling and residual risk in relation to maximum total
modelling and residual risk
Θ = cumulative density of standard normal distribution
r = reparametrized
RA = risk allowance
RC = required capital
RD = present value of reinsurance and debt
rr = residual risk identified
sl = subindex for surrender and lapse risk
S = shock disclosed under EEV Principles or otherwise deemed appropriate
t = maturity of the loan
t' = adapted maturity of the loan
UK = United Kingdom
US(A) = United States (of America)
w = weight

1 Executive Summary

In May 2004 the CFO Forum harmonized the various efforts of reporting the embedded value of life insurance companies by issuing the **European Embedded Value** (EEV) Principles.

In this working paper a methodology is proposed to derive a maximum lending amount from EEV figures without much additional data requirements from the originating insurer. This approach is similar to that of other financing areas, e.g. real estate finance, where first a prudent best estimate valuation is done and later risk deductions are performed in the form of applying loan to value ratios, e.g. 60-80 % of the prudent amount. Here, this prudent value is called **bankable embedded value** and the loan to value analysis presented leads to the **maximum lending amount**. The deductions proposed to arrive at a maximum lending amount are based on parameter adjustments and risk allowances for unexpected risks. There is an analogy with insurers for determining their own capital needs. The methodology presented is based on the stress test approach which increasingly gains popularity with insurance supervisors in Europe.

The methodology suggested is quite flexible and thus can be used for a diversity of life insurance blocks with different business profiles, e.g. in terms of age, sex, policy type and country. However, the methodology cannot be used as a black box formula. The credit analyst has to be aware of the various modelling options and their interrelationships and make use of them appropriately in view of the available data in each specific case.

2   Fundamentals

Increasingly, embedded value calculations can be found in the annual reports of European life insurers. They are also used for insurers' internal performance measurement. The **embedded value** is the value to shareholders of a portfolio of written life insurance policies. The term includes among others whole life, term life, pension saving and annuity policies. The portfolio may be limited in size or type or be coextensive with the entire company. In contrast, the **appraisal value** also includes a life insurer's goodwill, e.g. the marketing potential to acquire new business in future years[1].

With the European Embedded Value initiative of the CFO Forum[2] (section 2.2) there is a new impetus for harmonization of embedded value disclosure. Based on this, embedded values will undoubtedly become an integral part of the credit analysis of insurers in the future to determine their profitability. Furthermore, the International Accounting Standards Board (IASB) plans to introduce marking-to-market accounting for insurance contracts with Phase 2 of the Insurance Contract Project under International Financial Reporting Standards. In lack of available market prices present value techniques have to be applied[3].

In addition, the calculation of harmonized embedded values will give an impetus in the developing market of financing the embedded value of blocks of life insurance policies (section 2.3).

2.1   Objective of the working paper

The objective of this working paper is to analyse the degree to which the embedded value can be financed, e.g. which components of the embedded value lenders are willing to lend against. A modelling framework is provided as well as some indications on parameter specification.

Chapter 3 gives an overview of the embedded value methodology, as it relates to shareholder-owned companies, and the parameters to be used based on the recommendations of the CFO Forum (so called **European Embedded Value**). Calculation options and potential for discretion are analysed. This provides a best estimate figure from a shareholders' point of view without consideration of the impact of unexpected risks.

In chapter 4 the embedded value calculations are transformed from the shareholders' perspective to that of creditors. This yields what in the following is called the **bankable embedded value**. This is still a best estimate calculation.

In chapter 5 the risks are analysed which may emerge over the life of a loan pertinent to lenders. The merits of the stochastic and the stress test approaches are discussed in analogy to similar methodologies for determining an insurer's regulatory or internal risk capital need.

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[1]   Cf. CFO Forum (2004b), para 22.
[2]   Cf. CFO Forum (2004a).
[3]   Phase 1 was finalized with the promulgation of IFRS 4 on March 31, 2004 being effective as of Jan. 1, 2005. See Deloitte Touche Tohmatsu (2005) for an overview. For the phase 2 project see Diewald, R. (2004), pp. 1730-1733 and Rockel/Sauer (2004), pp. 303-307.

Based on various stress tests risk components are quantified. A framework for quantification of residual risks is also provided based on a risk mapping procedure. These steps lead to the **maximum lending amount**. Though based on a more deterministic approach, the methodology proposed is benchmarked against more stochastic industry practice in internal capital modelling.

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┌─────────────────────────────────────────────────────┐
│  European Embedded Value  see chapter 3             │
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                        ▼
┌─────────────────────────────────────────────────────┐
│  Bankable embedded value  see chapter 4             │
└─────────────────────────────────────────────────────┘
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                        ▼
┌─────────────────────────────────────────────────────┐
│  Maximum lending amount see chapter 5               │
└─────────────────────────────────────────────────────┘
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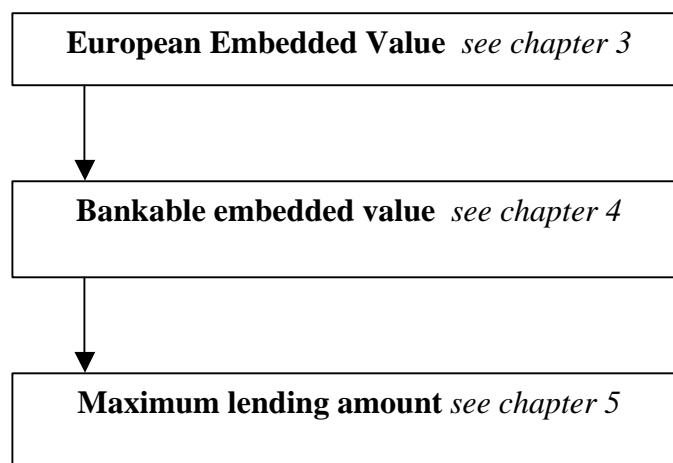
Table 1: The modelling procedure

Thus, this working paper links the areas of embedded value reporting, income stream analysis and risk measurement technology.

2.2 The European Embedded Value initiative of the CFO Forum

Recently, the CFO Forum, a working group of the chief financial officers of 19 European Insurance Groups[4] have issued principles for embedded value reporting, called European Embedded Value (EEV) Principles, in May 2004[5]. Up to now, embedded value disclosures in annual reports were based on subjective assumptions from the individual life insurer. Thus, they were of limited value to the reader of the financial statements since they were relatively non-transparent and not comparable between companies. It is expected that the EEV Principles will gain recognition far beyond Europe[6].

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[4] The members of the CFO Forum are: AEGON N.V., Allianz AG, Assicurazioni Generali S.P.A., AXA SA., Aviva plc, Fortis B.V., Försäkrings AB Skandia, Hannover Rückversicherung AG, ING Groep N.V., Legal & General Group plc, Münchener Rückversicherungs-Gesellschaft, Old Mutual plc, Prudential Assurance Company plc, Scottish Widows Group, The Standard Life Assurance Company, Swiss Reinsurance Company, Swiss Life Group, Winterthur Group, Zurich Financial Services Group. Cf. CFO Forum (2005).

[5] Cf. CFO Forum (2004a) and CFO Forum (2004b).

[6] Cf. Ross (2004), p. 1.

The EEV Principles can be applied to all long-term policies or to life insurance business as defined by local insurance supervisors[7]. Since the focus of this paper is on lending against the value of future profits from a previously defined pool of life insurance policies[8] the following is restricted to long-term life insurance policies.

2.3 Basics of embedded value financing

Similar to securitization in other insurance segments, the basic idea is to carve out insurance policies from the insurer's portfolio and to transfer them to the financing entities directly or indirectly via special purpose vehicles. This **enables the life insurer** among other things

- to **free equity capital**

- to **enhance profitability** and

- to **tap new financing sources**[9].

Lending against the embedded value of life insurance companies appears to be a growing market in view of increasing competitive pressures for life insurers which requires them to look out for possibilities to reduce the regulatory capital and the costs associated with holding it. Furthermore, new impetus can be expected as European citizens look increasingly for private savings structures, many within a life insurance wrapper, in view of a decrease in state pension schemes. This, in turn, also enhances the potential of the embedded value financing market.

In indirect financing deals a special purpose vehicle issues bonds or takes up loans to refinance the acquisition price, mostly **without recourse** to the originating insurer. In this case the risks that future surpluses from the insurance policies do not suffice to meet the required principal and coupon payments of the issued bonds are borne by the creditors. Therefore, lenders in future flows based financing deduct risk allowances from expected flows or alternatively require minimum coverage ratios over stipulated interest and principal payments. Usually, these risk allowances are made in order to convert the discounted cash flows, carrying the business risks of the obligor, e.g. its cash flow volatility risk, into a discounted cash flow with a residual risk commensurate with a bank's acceptable risk. Statistically, the probability of default, i.e. the probability of not meeting expected debt service requirements at least once during the life of a loan, of an single A-rated risk is about 0.10%. In other terms, financing the embedded value of a pool of life insurance policies requires that in 99.90% of all potential scenarios the debt service remains intact even when risks materialize dramatically and cumulate.

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[7]   See CFO Forum (2004a), Guidance G2.1 and G2.2.

[8]   Value in force or block of business lending. Cf. Cummins (2004), p. 25.

[9]   Cf. Cox/Fairchild/Pedersen (2000), p. 52-53 and Cummins (2004), p. 3.

For an overview of the economics of embedded value financing see Cox/Fairchild/Pedersen (2000) and Cummins (2004)[10]. For an overview of a typology and recent transactions see Cummins (2004)[11]. Non-recourse financing is typical[12]. In the case of with recourse financing the creditworthiness of the insurer provides additional backing to the creditor. The larger the pool of policies against which banks lend in comparison with the total size of the insurer, the more without recourse and with recourse financing converge. Since in the case of with recourse financing the debtor remains liable, the maximum lending amount is higher for with recourse finance than for without recourse finance.

3 The European Embedded Value

In this chapter the components of the EEV are presented (sections 3.1 - 3.4) and compared with traditional approaches as well as with the newly emerging market consistent embedded value concepts which strive to calibrate embedded values against market factors (section 3.5).

3.1 Components of the embedded value

The embedded value of a life insurer represents the value of an insurer's portfolio to its shareholders[13]. It is the sum of the current asset values, e.g. the net asset value, and the present value of future profits of the in force business, after deduction of the present value of the insurers' liabilities[14].

$$\textit{Equation 1: EEV = NAV + PVFP – FOG – RD}$$

with: *EEV*   *= European embedded value*

       NAV   *= net asset value*

       PVFP   *= present value of future profits*

       FOG   *= present value of financial options and guarantees*

       RD   *= present value of leverage effect of reinsurance and debt*

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[10] Cf. Cox/Fairchild/Pedersen (2000) pp. 48-56 and Cummins (2004), pp. 3-14 and 22-25.
[11] See Cummins (2004), pp. 27-39.
[12] However, the originating life insurer usually will have to give some representations and warranties, e.g. in respect of misselling liability. Cf. Parsons (2004), p. 51.
[13] Cf. CFO Forum (2004a), Principle 1.
[14] Cf. CFO Forum (2004a), Principle 3 and Guidance G3.4 and 3.5.

The **net asset value** represents the equity as reported in the GAAP financial statements plus adjustments for latent reserves allocated to the in-force business to be valued as well as technical provisions allocated to the covered business to the degree that they are attributable to shareholders[15]. For details see section 3.2.

PVFP is the **present value of future profits**. Future profits may not always coincide with cash flows. Due to

- the predefined payment schedule for insurance premiums making actual payment dates less relevant

- the allocation of overhead and holding company cost and

- the recognition of the cost of required capital

embedded value calculations, in general as well as under the EEV Principles, are based on **idealized cash flows** as they are taken from an insurer's prospective internal accounting. Thus, they are *not* true cash flows, though they are typically called so in embedded value literature. The theory and practice of business valuation recognize, however, also valuation concepts based on **profits** and **economic value added**, which is profit less cost of required capital[16]. Ideally, all lead to the same result based on[17]

Equation 2: DCF = IC + PVEVA

with: DCF   = discounted cash flows

IC   = invested capital

PVEVA = present value of economic value added

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[15] Cf. Schweizerischer Versicherungsverband (1999), p. 4.

[16] Cf. Hoke (2002), p. 766. For firms other than insurance companies or banks there are no specific regulatory rules for a minimum required capital to be held against the risks of the business. Neither is a minimum capital need calculation usually performed internally. Therefore usually the cost is calculated on the capital effectively held which typically would be higher than that *required* to cover the risks of the business. Therefore, the cost of effective capital is set equal to the cost of required capital in the remaining part of this section. All capital in excess of the required capital reduces the risk of the shareholders and thus leads to a reduction of the risk discount rate which compensates this effect. Nevertheless the difference between effective and required capital should be limited since under the EEV Principles this difference, called free surplus, is only allowed to be recognized as part of the net asset value when it is formally allocated to the covered business which in many cases is uneconomical. See section 3.2.

[17] Cf. Hoke (2002), pp. 766-767.

Generally speaking, net asset value and invested capital are identical if both are valued at the fair value of the assets and liabilities. Under the EEV Principles the net asset value is determined after deduction of the cost of holding required capital (CRC)[18]. Thus, the invested capital in a business is identical to the net asset value under the EEV Principles plus the CRC, specifically[19]

$$Equation\ 3(a)\ NAV = IC - CRC \quad or \quad (b)\ IC = NAV + CRC$$

with: CRC = present value of cost of holding required capital.

Since EVA is generally defined as profit minus cost of required capital[20] or

$$Equation\ 4:\ PVEVA = PVFP - CRC,$$

Equation 2 can be rewritten as

$$Equation\ 5:\ DCF = NAV + PVFP$$

DCF in Equation 5 is equal to EEV in Equation 1 when ignoring the value of financial obligations and guarantees and the present value of the leverage effect of reinsurance and debt. In a true cash flow calculation also these components would be part of the cash flow estimates, which corroborates that it is dealt with profits rather than with cash flows.

Furthermore, the advantage of having better data for estimating flow components for a business based on profits rather than cash flows[21] is another indication for this. Whereas cash flow components are typically estimated explicitly for 3-5 years only with the rest of the discounted cash flow accounted for under a less closely estimated terminal value[22], in embedded value calculations flow components are estimated in detail up to their maturity, which may be 30 years or more[23]. Therefore, in contrast to current literature, the flow components in embedded value calculations are called profits rather than cash flows in the following.

For details on profit estimation as well as **financial options and guarantees** see section 3.3 and 3.4.

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[18]   Cf. CFO Forum (2004a), Principle 3.
[19]   Cf. CFO Forum (2004a), Principle 3.
[20]   Cf. Hoke (2002), p. 765.
[21]   Cf. Hoke (2002), pp. 767-768.
[22]   Cf. Hoke (2002), pp. 766-767.
[23]   Cf. Schweizerischer Versicherungsverband (1999), p. 9. There is no comment on this in the EEV Principles, nor is the alternative of determining a residual value as per a certain point of time in the future discussed there.

The leverage effects **from reinsurance and debt**, including subordinated and contingent debt, should be reflected in a risk allowance to be deducted from the embedded value at an amount consistent with that which markets would place on debt with similar characteristics[24]. No further guidance is given by the EEV Principles on this.

3.2 Net asset value

3.2.1 Overview

There are two approaches commonly used for **calculating net asset value** in embedded values[25], the **free surplus only approach** and the **free surplus and required capital approach**.

Under the free surplus only approach, the net asset value is the value of excess assets over that of the liabilities attributable and the **required capital**, e.g. the **free surplus** of the insurer. The required capital is the minimum capital to be maintained, e.g. for regulatory purposes (so called regulatory capital) or that capital that is considered necessary to cover the maximum potential losses which could arise (so called economic capital). The latter is based on probability calculus for a given confidence level, e.g. a minimum survival probability[26].

The value of **excess assets** is equal to the tax-adjusted market value of those assets. This is the value that could be realized on the sale of the excess assets, net of any tax that would be payable. Items such as deferred acquisition costs, subordinated debt, deferred realised gains on surplus assets and deferred tax provisions, participating retained earnings and shareholders retained earnings must be revalued on a basis consistent with the inclusion of such items in the projected profits that are included in the value of the in force business. Thus, the free surplus is the excess market value of any capital and surplus allocated to, but not required to support the in-force covered business[27].

Under the **free surplus and required capital approach** the net asset value is the value of any assets in excess of those assigned to support the liabilities.

The EEV Principles follow the free surplus and required capital approach. Thus Equation 3 (a) becomes:

$$\textit{Equation 6: NAV = FS + RC – CRC}^{28}$$

with: FS = free surplus

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[24] Cf. CFO Forum (2004a), Guidance G3.5. Since in many jurisdictions insurance companies are not permitted to take up senior debt finance (cf. Schubert/Griessmann (2005), p. 58), the effect of debt should be immaterial in most cases.

[25] Cf. Risk Management Metrics Subgroup (2003), p. 7.

[26] See section 3.2.2.

[27] Cf. CFO Forum (2004a), Principle 4.

[28] Cf. CFO Forum (2004a), Principle 3.

RC = required capital.

The free surplus is defined under the EEV Principles as

- any excess of the market value of all assets attributed to the covered business

- after deduction of backing liabilities for the covered business

- over the required capital to support the covered business[29].

The backing liabilities are to be based on prudent valuation[30]. Free surplus not formally allocated to the covered business is not included in the EEV[31].

The required capital and the cost of holding required capital are discussed in a separate subsection.

3.2.2 Determination of the required capital

Required capital should include at least the minimum supervisory level of solvency capital according to the EEV principles[32]. It may also include amounts required to meet internal objectives, e.g. based on internal risk assessment or required to obtain a targeted credit rating[33].

The cost of holding required capital is the difference between the amount of required capital and the present value of future cash releases, allowing for future investment return (FIR) of that capital[34]:

Equation 7: CRC = RC - FIR

Thus, the gross cost of the required capital is set equal to the required capital itself. This assumes an infinite horizon and market-consistent pricing of the required capital investment. This seems correct given the very long-term nature of life insurance policies. Since the required capital is used to support the investment risks, which are financed mostly by the policyholders themselves via their payments, it makes sense to deduct the return on investment of the required capital.

The amount of required capital to be held varies with national solvency regimes. The issue gains momentum as all countries of the EEC prepare to varying extents for the introduction of a new solvency regime (called "Solvency II"). Whereas current regulation in Germany is

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[29] Cf. CFO Forum (2004a), Guidance G4.1.
[30] Cf. CFO Forum (2004b), para 27.
[31] Cf. CFO Forum (2004a), Guidance G4.2.
[32] Cf. CFO Forum (2004a), Guidance G5.1.
[33] Cf. CFO Forum (2004a), Guidance G5.2.
[34] Cf. CFO Forum (2004a), Guidance G5.3.

principally based on the mathematical reserves and future reversionary bonus reserves[35], the regulators in Great Britain, the Netherlands, Denmark, Sweden and Switzerland have already proposed specific capital adequacy rules[36]. In the following a short overview over the respective rules in the UK are given, since they are the most developed and thus could well become a benchmark for the implementation of Solvency II[37]. Furthermore, the approach of the Financial Services Authority (FSA) in the UK incorporates already the supervisory concept of the new capital regulation framework for banks (so called "Basel II"), which was issued in June 2004[38].

The FSA approach is based on regulatory guidelines for determining the required capital and additionally on an individual capital adequacy assessment of the respective insurer. In order to reconcile simultaneously the requirements of the EU Life Insurance Directive with the more sophisticated risk measurement approach intended, the regulatory capital adequacy rules consist of two parts (so called "**twin peaks approach**"). The insurer has to hold equity according to the higher of those two sets of rules. Since the individual capital adequacy requirements are to be taken into account as well, the required capital is the higher of three sets of capital determination frameworks. The following summarizes these three sets of rules[39]:

- **Regulatory peak**: This set of rules is primarily based on the EU Directive. It consists of two elements:

    o Solvency capital: is based only on the mathematical reserves with no allowance for future reversionary bonus for those life insurers subject also to the realistic peak.

    o The so called resilience capital component provides for additional allowances based on stressing certain market risk factors. It consists of a shock of

        ▪ stock prices by 10% of current market values

        ▪ the rental yield for property by 10% for real estate holdings and of

        ▪ the 15-year gilt yield by 20%

- **Realistic peak**: This set of rules has to be observed by those insurers with mathematical reserves of more than GBP 500m[40]. It consists of

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[35] Cf. Bundesanstalt für Finanzdienstleistungsaufsicht (2005), Section E. II. 1).
[36] Cf. Schröder (2004), pp. 1394-1398 and Schubert/Grießmann (2004), pp. 1044-1046. There have been similar regulatory discussions also in Denmark and Sweden. Cf. Thind (2004), p. 36.
[37] Cf. Thind (2004), p. 35.
[38] Cf. Schröder (2004), p. 1398.
[39] Cf. Financial Services Authority (2004), appendix 1, chapter 2.1 and 2.3.
[40] Insurers with lower mathematical reserves may opt in. Cf. Financial Services Authority (2004), appendix 1, para 2.1.17 and 2.1.20.

o   the excess of realistic assets over realistic liabilities, e.g. both based on market values, and

o   another set of stress tests. These are based on a 99.5 % confidence level and a time horizon of one year and thus include an implicit allowance for other risks not tested separately such as operational risk, insurance risk and the risk of increased volatility of equities and fixed interest yields[41]. Specifically, they include

   ▪   a two-way equities test +/- 20 % movement of stock prices

   ▪   a two-way real estate test +/- 12.5 % movement of property prices

   ▪   an interest yield test +/- 17.5 % movement in the 15-year gilt yield

   ▪   a credit spread test depending on credit rating and the yield spread over an equivalent UK government security, applicable to bond investments, reinsurance assets and other credit exposures (e.g. from credit derivatives)

   ▪   a persistency rate test +/- 35 % of discontinuance rates assessed across all with-profits business. This is not applied to non-profit business.

•   **Individual capital adequacy standards**: This is an individual capital adequacy assessment of the respective insurer based on its pertinent risks and the FSA's individual capital guidance. There is little standardization across life insurance firms and no best practice has been established. Based on the specifics of the firm extra allowances for operational and mortality risks may be necessary. The mathematical basis for this capital adequacy assessment is also a confidence level of 99.5 % and a one-year time horizon[42]. In principle, two approaches are possible:

o   Required capital margin plus approach: Here the supervisory method is used but the stress tests are more onerous based on the individual risk profile of the respective company.

o   Stochastic approach: Here the relevant risk drivers are simulated and based on the simulation results the 99.5 % quantile is applied. The main challenge here is to produce a set of consistent forecasts for the various risk drivers. Ideally, correlations between the risk drivers are also accounted for in the determination of the required capital[43]. This method is theoretically superior to the first, but more onerous in terms of modelling challenges and data processing capac-

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[41]   Cf. Towers Perrin Tillinghast (2004b), p. 3.
[42]   Cf. Financial Services Authority (2004), appendix 1, para 2.3.14.
[43]   For an overview of internal capital models for insurance companies see Koch Medina/Krieter/Schreckenberg (2003), pp.29-32 and Kriele/Lim/Reich (2004), pp. 1048-54.

ity. This is especially relevant for forecasting maximum required capital in the tail of the probability distribution, e.g. the 99.5 % quantile[44].

In stochastic approaches the confidence level can be associated with the target ruin probability or probability of default of the insurer[45], e.g. 99.5 % corresponds to a default probability of 0.5 % which can be converted into a rating based on historical default experience recorded by rating agencies or banks[46].

Similar to banks, often the individual capital assessment is lower than the supervisory requirement due to enhanced modelling of maximum losses possible and of diversification effects among the various risk drivers[47]. Furthermore, if higher capital requirements are taken account of in the embedded value, the risk of the profits is lower and thus the risk discount rate should also be lower to avoid double counting of risks[48].

3.3 The present value of future profits

The present value of future profits reflects the net profit from the block of insurance policies to the shareholder discounted back to the reporting date. Thus it consists of

- future revenues minus the pertinent expenditures of the originating insurer (see subsection 3.3.1)

- discounted at a discount rate commensurate with the risk of the net profit (see subsection 3.3.2).

The embedded value only refers to the in force business, as the name suggests. Consequently, the value of future new business is excluded[49]. Nevertheless, renewal of in-force business is considered an integral part of the embedded value under the EEV principles[50]. Here any reasonably predictable variations in the level of renewal premiums should be taken into account[51]. The explanations of the EEV principles give indicators for distinguishing new business from renewal business, e.g. when a new contract is signed, new policies have been entered into the administrative systems and incremental remuneration has become due to the distributor/salesperson[52]. However, these explanations leave room for discretion[53].

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[44] The 99.5 % confidence level seems to develop to an international benchmark for insurance supervision. It is also used in the new Dutch approach for calculating supervisory risk capital. Cf. Schubert/Grießmann (2004), p. 1044.
[45] See Graumann (2001), p. 306 and Gründl (2004), pp. 473+.
[46] Cf. Schulte-Herbrüggen/Becker (2005), p. 59.
[47] Cf. Giese (2003), p. S20.
[48] Cf. Towers Perrin Tillinghast (2004a), p. 5.
[49] Cf. CFO Forum (2004a), Principle 3.
[50] Cf. CFO Forum (2004a), Principle 8.
[51] Cf. CFO Forum (2004a), Guidance G8.2.
[52] Cf. CFO Forum (2004b), Guidance G8.2.

3.3.1 Discountable profits

The EEV require the determination of the present value of the profits to shareholders after deduction of the value of financial options and guarantees from the in-force covered business[54]. The determinants of profits from in-force covered business are premiums, policy charges, claims, future bonus rates for participating business[55], investment return[56], operating expenses, overhead and administration costs[57] and taxation[58] (refer to table 2). All these determinants should be estimated in the long run (for example for a period of 30-50 years).

Premiums

+

Investment return

+

Policy charges and claims

−

Operating expenses, overhead and administration costs

−

Taxes

−

Future bonus rates

Net profit

Table 2 : The main components of profit

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[53] Cf. O'Keeffe et al. (2005), p. 17.
[54] Cf. CFO Forum (2004a) Principle 6.
[55] Cf. CFO Forum (2004a), Principle 11.
[56] Cf. CFO Forum (2004a), Guidance G10.2-G10.5.
[57] Cf. CFO Forum (2004a), Guidance G9.10.
[58] Cf. CFO Forum (2004b), para 93.

Estimation of the profit components has to consider in a consistent way management behaviour, inflation rate[59], development of mortality[60], lapse rate, potential development of the cost structure of the company and possible changes of tax rates[61]. In particular, profit projections should be

- **"best estimates",** based on the assumption of the covered business being part of the going concern of the reporting insurer **and thus not include prudence margins[62]**

- **internally consistent[63]**

- **consistent with other forms of reporting such as those used in statutory accounting, pricing or generally accepted accounting principles accounts[64]**

- based on the **corporate strategy** of the reporting insurer[65]

- actively reviewed and updated, e.g. at least annually[66] and

- considered separately for each product group[67].

The assessment of appropriate assumptions for future experience should have regard to past, current and expected future experience. Changes in future experience should be allowed for when sufficient evidence exists and the changes are reasonably certain[68]. Profits should be net of outward risk reinsurance[69].

The following discusses the most significant determinants of net profits to shareholders.

Investment returns

The returns from investment generally consist of direct (e.g. dividend payments) and indirect earnings (e.g. increase in value). Assumed investment returns should reflect expected future returns of the assets held and allocated to the business covered. All pertinent market and credit risks are to be taken into account based on best estimates[70]. Assumptions for reinvestment of future surpluses should be based **on the expected future investment strategy** and be consistent with other forecast assumptions. On this basis, projecting changes in asset mix is acceptable when the board has formally approved such changes in investment strategies[71].

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[59] Cf. CFO Forum (2004a), Guidance G10.6 and (2004b), para 91.2.
[60] Cf. CFO Forum (2004a), Guidance G9.06.
[61] Cf. CFO Forum (2004a), Guidance G9.12 and (2004b), para 94.
[62] Cf. CFO Forum (2004a) Guidance G9.1, G9.2 and G9.12 and CFO Forum (2004b) para 85, 91 and 100.
[63] Cf. CFO Forum (2004a), Guidance G7.4, G9.2, G9.6, Principle 10, Guidance G10.3 and Principle 11 and CFO Forum (2004b), para 64, 67, 68.1 , 86 and 104.
[64] Cf. CFO Forum (2004a), Guidance G9.2.
[65] Cf. CFO Forum (2004a), Guidance 10.3.
[66] Cf. CFO Forum (2004a), Guidance G9.3 and (2004b), para 68.2.
[67] Cf. CFO Forum (2004a), Guidance G9.5 and (2004b) para 90.
[68] Cf. CFO Forum (2004a), Principle 9 and Guidance G9.4 and (2004b) para 88-89.
[69] Cf. CFO Forum (2004a), Guidance G3.4.
[70] Cf. CFO Forum (2004a), Guidance G10.2 and (2004b), para 97.
[71] Cf. CFO Forum (2004a), Guidance G10.3.

Projections should be done on a holistic basis accounting for the interaction of the various asset and liability components. This is relevant for the later determination of tax amounts and their timing[72]. Smoothing is not allowed[73].

Policy charges and claims

The estimation of policy charges and claims has to reflect management expectations of mortality, invalidity as well as surrenders and lapses[74].

Operating expenses, overhead and administration costs

Future expenses should reflect the expected ongoing expense levels required to manage the in-force business, including investment in systems required to support that business and allowing for future inflation[75].

The EEV Principles follow a full cost approach. **Overhead** should be allocated between new and in-force business appropriately consistent with past allocation, current business plans and future expectations[76]. This also applies to holding and service companies' expenses[77]. All expected expense overruns are to be taken account of[78]. Misestimation of overhead, or misattribution in the case of calculating the embedded value of distinct parts of the business, may have a significant impact on the embedded value calculation. Here the overhead allocation will necessarily be subjective. The main concerns regard

- the distinction between current acquisition cost and maintenance expenses

- the distinction between acquisition cost for new business and those for ongoing renewal and

- development expenses, e.g. for new software systems[79].

Tax

All taxes and regulations in the relevant jurisdictions affecting amounts and timing of shareholder profits of the covered business are to be allowed for, applying current legislation and practice as well as known future changes[80].

Future bonus rates

For participating business assumptions have to be made about future bonus rates and the determination of profit allocation between policyholders and shareholders consistent with as-

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[72] Cf. CFO Forum (2004b), para 100-101.
[73] Cf. CFO Forum (2004a), Guidance G10.10.
[74] Cf. CFO Forum (2004a), Guidance G9.6.
[75] Cf. CFO Forum (2004a), Guidance G9.7.
[76] Cf. CFO Forum (2004a), Guidance G9.8.
[77] Cf. CFO Forum (2004a), Guidance G9.9 and G9.11.
[78] Cf. CFO Forum (2004a), Guidance G9.10.
[79] Cf. O'Keeffe et al. (2005), pp. 16-17.
[80] Cf. CFO Forum (2004a), Guidance G9.12 and (2004b) para 93.

sumed future investment returns, established bonus philosophy, past application of discretion, past external communication, the influence of market practice regarding bonus payment discretion and any payout smoothing strategy[81].

3.3.2 Risk discount rate

The risk discount rate defines the yield which is expected by investors (shareholders) for investments in the life insurance company. It determines the present value of future profits. Up to now it has been one of the most difficult issues in embedded value calculations. The major problems regarding discount rates are[82]:

- the degree of subjectivity associated with its choice

- the lack of a direct link between the risk discount rate and the risks of the underlying business

- the use of a single measure comprising all risks to which shareholder profits are exposed. Formerly, even the valuation of the financial options and guarantees were incorporate in the single discount rate.

Under the EEV Principles the risk discount rate is a combination of a risk free rate plus a risk margin. The margin has to reflect any risk to which shareholder profits are exposed and which is not allowed for elsewhere in the EEV calculation[83]. The risk discount rate *may* vary between product groups and countries or regions[84]. Consequently, it is no longer allowed to reflect the risk to shareholder profits from financial options and guarantees in the risk discount rate, but an explicit allowance for the time value of the financial options and guarantees is required[85].

The EEV Principles, however, do not require a specific method to derive risk discount rates. Thus, this remains the main challenge in practice giving rise to substantial discretion. This is especially seen in the area of market risk[86]. Principally, there are two alternative methods available[87]:

- **Top-down approach**: This more traditional approach uses capital market models, e.g. the capital asset pricing model, which is based on historic volatilities of a company's share prices. This method is theoretically adequate for listed companies, but difficult to apply for unquoted companies since a link between the level of risk of the business and the discount rate is often very difficult to establish. The top-down approach provides a single

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[81] Cf. CFO Forum (2004a), Principle 11 and Guidance G11.1.-G11.4.
[82] Cf. Bause (2005), p.11.
[83] Cf. CFO Forum (2004a), G 10.07.
[84] Cf. CFO Forum (2004a), G 10.09.
[85] Cf. CFO Forum (2004b), para 33-34.
[86] Cf. O'Keeffe et al. (2005), pp. 25+.
[87] Cf. Bause (2005), p.12.

discount rate for all parts of the business (potentially adjusted by currency zones) and thus often cannot be applied properly for specific products. So there is a risk of misestimating the discount rate for above and below average risk products depending on the product mix.

- **Bottom-up approach**: The bottom-up approach seems to be favoured by the CFO Forum as it determines the risk discount rates separately by products in accordance with the individual risk profile of each product[88].

While it is required that risk discount rates reflect any risks to distributable earnings (if not accounted for elsewhere in the valuation), risk discount rates fully consistent with objective market rates are not demanded either[89]. Though a more rigorous approach of linking discount rates to risks is demanded, the lack of specific guidance may lead to a broader *variety of methodologies* used in practice[90].

3.4 Financial options and guarantees

The potential effect of financial options and guarantees within the covered business is to be deducted on a present value basis[91]. Thus, it includes most guaranteed annuity options, guarantees underlying participating contracts and guarantees underlying unit-linked contracts, but does not include insurance-based options such as the right of the policyholders to increase insurance cover[92]. The impact must be based on stochastic techniques in order to recognize the asymmetric impact of financial options and guarantees as market conditions change[93].

The starting assumption of the allowance should be the actual asset mix[94]. Where management discretion exists and has been formally approved, the impact of this discretion *may* be anticipated in the allowance, but should allow for market reaction to such action[95]. Otherwise, incorporation of policyholder behaviour is not required[96]. Thus the impact on surrender and/or expense remains unclear[97].

Within the framework of the EEV Principles, especially the requirements of consistency and for regular updates, the insurer has free choice of models, techniques and assumptions used[98].

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[88] Cf. CFO Forum (2004b), para 112.
[89] Cf. True/Foroughi (2004), pp. 12-13.
[90] Cf. Ross (2004), p. 3.
[91] Cf. CFO Forum (2004a), Principle 7.
[92] Cf. CFO Forum (2004b), para 62.
[93] Cf. CFO Forum (2004a), Principle 7 and (2004b) para 65.
[94] Cf. CFO Forum (2004a), Guidance G7.1.
[95] Cf. CFO Forum (2004a), Guidance G7.2.
[96] Cf. Taverner/Abbink (2004), p. 2.
[97] Cf. Taverner/Abbink (2004), p. 2 and Ross (2004), p. 2..
[98] Cf. CFO Forum (2004a), Guidance G7.4 and (2004b), para 68.

However, he has to disclose them as well as the resulting values and sensitivities, where appropriate and material[99]. Management discretion exists especially in the following areas[100]:

- the determination of the discount rates for discounting financial options and guarantees in the stochastic scenarios

- the choice of the asset model and calibration of the scenarios to the other embedded value assumptions

- the treatment of financial options and guarantees in hedging assets.

3.5 Analysis of the European embedded value

3.5.1 Calculation options and discretion

Compliance with the EEV Principles is mandatory whereas compliance with the guidance is not. Where guidance is not complied with, the reasons for this should be disclosed[101]. An explicit sign-off by management and a review or audit by an independent third party is recommended[102]. Where methodology, assumptions and results have been subject to external review, this, the basis of the external review and the name of the reviewing firm should be disclosed[103].

Table 3 gives an overview of accounting options and the potential for management discretion under the EEV. Management discretion is mitigated by extensive disclosure requirements regarding embedded value sensitivities to various risk drivers and explanations of methods and assumptions used[104]. Specific shock levels for calculating the sensitivities are not required however.

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[99] Cf. CFO Forum (2004b), para 71.
[100] Cf. Ross (2004), p. 1.
[101] Cf. CFO Forum (2004a), Guidance G12.1.
[102] Cf. CFO Forum (2004b), para 127.
[103] Cf. CFO Forum (2004a), Guidance G12.4.
[104] Cf. CFO Forum (2004a), Guidance G12.2. and G12.4.

Type of cal-culation flexibility	Area of calculation flexibility	Available alternatives or scope of discretion
Calculation options:	Discount rate derivation	• "top-down approach" or • "bottom-up approach"
	Determination of required capital	• regulatory or • internal or • credit rating dependent capital
Areas for potential dis-cretions:	Delineation between new business and renewal business	
	Estimation of profit compo-nents, namely:	• interest rate, stock, credit and real estate market risk parame-ters in investment returns • demographic assumptions • reinsurance policy • future surrender behaviour • overhead allocation • treatment of development costs[105] • degree of recognition of productivity gains[106] • approach used to allow for tax and future tax rates • evolution of operating expenses • profit allocation between policyholders and shareholders • translation of profit components in foreign currencies[107]
	Estimation of discount rate	• more discretion in the top-down approach and for non-listed companies • less discretion in the bottom-up approach due to separate es-timation for sub-pools of insurance policies
	Treatment of financial op-tions and guarantees	• forecast of future asset mix • determination of the discount rates for discounting financial options and guarantees in the stochastic scenarios • the choice of the asset model and calibration of the scenarios to the other embedded value assumptions • treatment of financial options and guarantees in hedging assets
	Notes to EEV calculations	• selection of shocks to perform under EEV sensitivities • shock levels in reporting sensitivities

Table 3: Modelling options and discretion in EEV calculations

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[105] Cf. CFO Forum (2004a), Guidance 12.4 (k).
[106] Ibid.
[107] Ibid.

3.5.2 Comparison of the EEV with traditional and market consistent embedded value concepts

Traditional embedded value calculations are based on deterministic "best estimate" forecasts of future distributable profits, i.e. less the increase in provisions and the capital needed to support the life insurance policies, discounted at a single risk adjusted discount rate. Thus, risks are only taken account of implicitly[108]. On the other hand, promoted by actuarial consultants **market consistent embedded value concepts** have emerged. This is a generic term for several approaches which strive to link the embedded value to market conditions. They include explicit market-to-market valuation of assets and liabilities and base valuation of profits on a discount rate consistent with that applied to financial flows with similar risk in capital markets. Additionally, **frictional costs** to the shareholders are taken into account. That are the (usually indirect) costs of the shareholders of doing insurance business via an insurance company instead of doing it themselves. These costs comprise

- the costs of double taxation, when distributed profits are taxed at the level of the company as well as the level of the individual shareholders

- the cost of raising new capital to support the business

- the compensation of shareholders for credit and operational risks, e.g. agency or intransparency costs commonly reflected in traded stock prices[109].

Table 4 sets out differences of the European Embedded Value from traditional approaches and the market consistent approaches. The main differences are in the areas of[110]:

- the risk discount rate

- the cost of options and guarantees

- the cost for required capital.

The major problem of the traditional approach with regard to the risk discount rate is the degree of subjectivity in determining it. This often has the biggest impact on the embedded value result. Also, there is no direct link between the risk discount rate and the risk of the business itself. Typically, a single measure has been used to reflect all areas of risk[111]. In the past often discount rates in embedded value calculations were marked against those of competitors thus not always reflecting the true riskiness of the underlying business[112].

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[108] Cf. Towers Perrin Tillinghast (without year), p. 6.

[109] Cf. Ross (2004), p. 3, Cf. O'Keeffe et al. (2005), pp. 18-19 and 45-46 and Towers Perrin Tillinghast (without year), pp. 2-3.

[110] Cf. O'Keeffe at al. (2005), p. 19.

[111] Cf. Bause (2005), p. 13.

[112] Cf. Towers Perrin Tillinghast (2004a), p. 4.

In contrast, the market consistent approach is more objective as it is based on observable market rates of return at the valuation date. The EEV Principles do not give explicit recommendations concerning the risk discount rate, however favour the bottom-up approach thus giving consideration to the different riskiness of products and regions. Market consistent concepts in practice always follow the bottom-up approach[113]. But, they do not propose a homogeneous methodology for deriving the risk discount rate, either.

The traditional treatment of financial options and guarantees under traditional approaches has been heavily criticised by financial analysts. Within traditional approaches the calculation is often based on a single scenario. Thus it cannot capture the value of options intrinsic in the liabilities and assets, even if an option is in the money. Without explicit adjustment there is little or no allowance for optionality[114]. Alternatively, a simplistic adjustment is made to the risk discount rate, which often results in an overstatement of the embedded value[115]. The EEV Principles[116] prompt insurers to carry out an explicit valuation of the financial options and guarantees by means of stochastic methods. This is a significant improvement compared to traditional approaches[117]. It also takes into account the interest rate risk arising from duration gaps. Market consistent approaches go a step further by aiming at the arbitrage free valuation of the financial options and guarantees, which differ, when an EEV calculation is based on a risk valuation incorporating subjective market views of the originating insurer[118].

Another point of critique of the traditional method, which was amended in the EEV Principles, is the explicit recognition of the cost for required capital. The key change is to require companies to base calculations on a standard definition of required capital[119]. The market consistent approach additionally requires recognition of frictional costs[120].

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[113] Cf. O'Keeffe et al. (2005), p. 42.

[114] Presently, the treatment of financial options and guarantees is very heterogeneous. For an empirical overview of large UK and other European life insurers see Ernst & Young (2004) pp. 22-23.

[115] Cf. Towers Perrin Tillinghast (without year), p. 7.

[116] Cf. CFO Forum (2004a), Principle 7.

[117] However, the EEV Principles will not do away with heterogeneity in the area of financial options and guarantees. See Bause/Schepers (2005) pp. 883-884 for an overview of the treatment of financial options and guarantees in the first EEV publications in early 2005.

[118] Cf. Bause (2005), p. 13, Taverner/Abbink (2004), p. 2 and O'Keeffe at al. (2005), pp. 9 and 52.

[119] Cf. O'Keeffe at al. (2005), p. 19.

[120] Cf. O'Keeffe at al. (2005), p. 49.

	Traditional embedded value concepts	**European Embedded Value**	**Market consistent embedded value concepts**
Estimation of the profit components	Deterministic projection	Partially stochastic simulation and dynamic sensitivities	Stochastic simulation and dynamic sensitivities
Risk discount rate	Discount rate is mostly independent from the business structure	Discount rate depends on product and region	Market-calibrated arbitrage-free discount rate
Options and guarantees	Deterministic integration of risks from guarantees in risk discount rate Often significant under-estimation of option risk	Separate allowance from present value of future profits based on stochastic techniques. Potential underestimation of options and guarantees due to market inconsistent approach	Arbitrage-free appreciation of options and guarantees and direct recognition of impact in the related profit components
Recognition of asset liability mismatch risks	ALM risk has no impact	Takes the ALM-risk in consideration	
Underlying capital need concept	Statutory capital need	Statutory or internal or rating based capital need	Based on internal capital need, ideally probabilistic calculation of economic capital

Table 4: Comparison of the EEV with traditional and market-consistent approaches

The EEV is a step towards market consistent embedded value calculations. Though a big change from traditional approaches used by most insurers, the CFO Forum did not introduce a fully market consistent embedded value due to the high data and modelling requirements and the risk of double counting some risk elements[121]. Thus the EEV presents a compromise between these two concepts.

Comparing the attributes of the EEV and market consistent approaches, the latter fulfil all criteria of the EEV. However, this does not apply the other way round.

4 Determining the bankable embedded value

The preceding chapter gave an overview of the EEV, relevant modelling options and potentials for discretion and competitive applications. In this section we analyse the appropriateness of various embedded value components to support borrowing. Adapting these from a credit perspective yields the bankable embedded value which is still a "best estimate" figure. In particular it does not consider risks to which lenders may be exposed beyond average expectations (so called unexpected risks).

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[121] Cf. CFO Forum (2004b), para 36 and Taverner/Abbink (2004), p. 2.

Accounting for unexpected risks is done in the following chapter yielding the maximum lending amount. Thus, the EEV and the bankable embedded value take account of the *cost* of holding required capital, but not the required capital itself which is representative of unexpected risks to policyholders and lenders.

In a second subsection we discuss the implications of modelling risk and propose an approach to handle it.

4.1   Adjusting European Embedded Value figures

In this subsection the input parameters in the EEV are contrasted with market consistent approaches with regard to lending. In the following, the **bankable embedded value** is defined as being the embedded value disclosed adjusted to reflect expected values from a creditor's point of view.

European Embedded Value *see chapter 3*

- *Adjust cost of required capital for time horizon of loan, where applicable*
- *Reapply risk creditor's discount rates discount rate = refinancing cost + credit margin*
- *Reverse the cost of double taxation, where applicable*
- *Make allowance, when needed, for:*
- *Insurers bankruptcy and operational costs*
- *Cost of raising capital of the insurers*

Bankable embedded value

Maximum lending amount *see chapter5*

Table 5: Bankable embedded value adjustments

While the required capital is part of the net asset value the same amount is added back as proxy for the discounted cost of the required capital over the residual life of the policies[122]. The mathematically **infinite time horizon** assumed by this approach seems intuitively correct, given the long-term nature of life insurance policies. It also applies for lenders in long-term financing, e.g. more than 20 years. In the case of short-term financing it may however be

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[122] See Equation 6.

advisable to adjust the cost of required capital for the shorter life of the loan, since otherwise the cost of the required capital is too high. Similarly, the time horizon for the future investment return of the required capital is to be matched.

For determining the maximum lending amount a market-consistent approach at first glance seems preferable due to its calibration against market data. **Profit estimates and discount rates** in combination ideally should be market-consistent. However, since the EEV will begin to be published in 2005, there is no empirical evidence available yet to which degree differences between the EEV and market consistent concepts are material. With the increasing integration of market-consistent techniques into regulatory capital, as in the UK's with profit business, and in insurers' shareholder value and hedging strategies[123] the differences can be expected to diminish in future. Unbridgeable differences would only remain if the EEV explicitly precludes market-consistent techniques which cannot be recognized. However, the EEV interpretation of the individual insurer needs more careful analysis in embedded value financing which is also provided by disclosure requirements in the EEV framework[124]. Nevertheless, the advantage of market consistent embedded value concepts is only optical from a lender's point of view, where contracts are only thinly traded and thus no market exists, which is especially relevant for long-term contracts[125]. Furthermore, market consistent valuation techniques are not fully developed, yet, and thus may also underrate risk and overstate embedded values[126]. Thus, careful analysis of the methodology used is equally required for the actuary[127], the auditor as well as the credit analyst. Based on these findings the analyst should adapt the parameters of the embedded value calculations and recalculate it. Due to estimation problems it would alternatively make sense to renounce recalculation at this stage and to evaluate modelling risk on a more qualitative basis in the residual risk allowance[128].

If a lender or a pool of lenders takes influence on the investment policy of the insurer, e.g. when its whole portfolio is lent against, this change in investment strategy is also to be taken into account by revising the investment return estimates correspondingly.

The remarks above on market consistency apply also to the consideration of **options and guarantees**. Furthermore, an adequate determination is still an unsolved issue[129]. Here also careful analysis is required. Due to the uncertainty associated with calculating expected values for options and guarantees it seems in most cases the best to include these findings also in the residual risk allowance.

Differences between statutory and internal or rating-based capital need can be significant. However, in those cases where statutory capital is used, very often no internal risk capital need figures will be available. In general, statutory capital is higher than probabilistic risk

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[123] Cf. Bause (2005), p. 13.
[124] Cf. CFO Forum (2004b), para 35.
[125] Cf. CFO Forum (2004b), para 38.
[126] Cf. O'Keeffe et al. (2005), pp. 25+27.
[127] Cf. O'Keeffe et al. (2005), p. 27.
[128] See section 5.5.
[129] Cf. Kovacevic/Willomitzer (2005), pp. 491-494.

capital[130]. Since the amount of required capital is deducted from the net asset value in recognition of cost of required capital, the bankable embedded value may be too low rather than too high, which is less a problem to the lender. Furthermore, a higher risk capital buffer is associated with lower risk and thus lower risk discount rates so that this effect should be compensated within the EEV calculation.

Since the embedded value is a concept designed for shareholders, discount rates are to consider shareholders' perspective. Within market consistent embedded value concepts increasingly the exclusion of **diversifiable risk** is proposed, e.g. based on the capital asset pricing model[131]. This is correct from a shareholders point of view who can diversify risks, but not from a creditors' point of view due to the asymmetry of credit risk. Creditors can suffer a very high loss, e.g. loss of most of principal and expected interest rate payments, at a very low probability. On the other hand they gain very little, e.g. the credit margin over refinancing cost with a high probability, e.g. the probability of non-default[132]. Thus, the exclusion of non-diversifiable risk from the discount rate is not appropriate for lending.

But, due to the fact that creditors are only exposed to default risk and unlike shareholders not to the earnings volatility risk originating from the underlying asset pool (e.g. the life policies), the best would be to substitute risk discount rates by interest rates as required from a creditor's point of view. A creditor's risk discount rate should include refinancing costs plus credit margin as of the date of the cash disbursement of the loan financing the embedded value.

The **double taxation effect**, sometimes part of frictional cost in embedded value concepts, is not required for determining a maximum lending amount from a creditor's point of view since creditors will receive debt service before taxable profit is determined. Thus, for determining the maximum lending amount the impact of this may be reversed, if it were integrated in the disclosed embedded value.

An allowance for an **insurers' bankruptcy and operational costs** is also sometimes part of disclosed embedded values. This makes sense with regard to the insurer's expected credit, reputation and operational risk and thus needs no reversal from the lender's point of view. This also refers to the cost of raising capital as long as it supports the reputation of the insurer and thus the value of the covered business to shareholders as well as creditors. In fact, if it is not integrated this should be done at this stage. If data are not available this should also be taken up in the **residual risk allowance**, later.

Though not mentioned under the EEV principles embedded value calculations may incorporate the value of a put option of shareholders due to their limited liability and thus the possibility to let a company go bankrupt[133]. The option to let a business go bankrupt increases the embedded value of a block of insurance policies to the shareholder. As this value component

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[130] See section 3.2.2.
[131] Cf. Towers Perrin Tillinghast (without year), pp. 2+3 and O'Keeffe et al. (2005), p. 11.
[132] Cf. Schulte-Herbrüggen/Becker (2005), p. 59.
[133] Cf. O'Keeffe et al. (2005), p. 44.

is not relevant to lenders it should be reversed when it is effectively included. Due to insurance supervision this effect should however be immaterial in most cases.

Based on the aforementioned, the **bankable embedded value is not an objective amount** but still depends on the modelling assumptions of the originating insurers. Due to uncertainty, it seems most appropriate to focus on a good result of the maximum lending amount rather than arbitrarily define interim values which may give rise to increased modelling risk by the credit analyst, e.g. by double counting some effects.

$$Equation\ 8:\ BEV = r[EEV]$$

with: BEV   = bankable embedded value

    r   = reparametrization

    EEV   = European embedded value

4.2 Accounting for modelling risk

Modelling risk can arise in two dimensions:

1) Modelling risk as the **risk of disclosure of a too high embedded value** based on the accounting or calculation policy of the insurer. This might be well within the framework allowed under the EEV, but deviate from what a lender might consider as best estimate[134].

2) Modelling risk of the lending bank itself due to the **vagueness of the parameters used and the lack of hard data**. It may emerge in determining the bankable embedded value and even more so later in the determination of the maximum lending amount.

The latter is an overall problem which should be taken account of on a comprehensive basis once the various risk allowances for unexpected risks in the next chapter have been determined.

Modelling risk in an insurer's EEV disclosure may be handled by adjusting parameters as discussed in the previous section. Similar to the financial data analysis in traditional credit analysis an analyst should evaluate the assumptions and methodology section in detail. Based on this a qualitative evaluation could be done and a lump-sum valuation allowance be applied. This approach seems to be promising given the firm intention of the EEV Principles for analysts

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[134] For modelling options and potential discretion see section 3.5.1.

- to understand the impact of different events, risks and drivers

- to understand management's view of the business and its interpretation of the Principles "with particular attention to areas in which these leave room for different approaches"[135] and "to enable the credibility of the valuation to be judged"[136], and

- to make valid comparisons with other companies[137].

When determining valuation allowances for overvaluation **double counting with risk allowances for unexpected risks**, to be discussed in the following chapter, should be minimized. Double counting arises to the degree that risk allowances for the various individual risk components to be discussed later take already implicitly account of deviations from best estimate values. Where modelling risk can be attributed to a specific risk driver and this can be quantified, this should be given precedence since qualitative evaluation of modelling risk mostly yields cruder results. Therefore, risk allowance based on qualitative evaluation should be limited to those modelling elements not covered under other risk categories. Those elements already adjusted should then be excluded from evaluation of modelling risk. Also, a valuation allowance for modelling risk seems not necessary when data and embedded value modelling is provided by an independent third party, e.g. an actuary consultant, and beyond compliance with the EEV Principles being confirmed as best estimate also from the lenders' point of view. Thus, qualitatively based valuation allowances should be limited to **residual risk** to lenders.

Therefore, here again, for avoidance of double counting it is not proposed to obtain the most exact bankable embedded value, but to focus more on the end result of our efforts, e.g. the maximum lending amount. Thus, the idea is to **combine the two dimensions of modelling risk** in a final step of the calculation of the maximum lending amount in section 5.5.

5   Determining the maximum lending amount

In this chapter the maximum amount lenders can lend against is derived taking account of unexpected risks. Most risks are allowed for in embedded value calculations to deduce meaningful figures. However, all these risk factors integrated in the EEV, and adapted under the bankable embedded value adjustments, are based only on best estimates. Risks may well **materialize beyond arbitrage-free market expectations or individual risk assumptions** of the insurer as of the reporting date. Materialization of these risks could even lead to financial flows from the covered business to fall short of debt service. Thus, these unexpected risks have to be accounted for separately and need to be deducted from the bankable embedded value. The result of this is called the **maximum lending amount**, e.g. the maximum amount a lender is willing to lend against.

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[135]   See CFO Forum (2004b), para 122.
[136]   See CFO Forum (2004b), para 122.
[137]   Cf. CFO Forum (2004b), para 122.

Section 5.1 details the approach for recognizing unexpected risks.

Section 5.2 determines the risk allowances for the various risk components where appropriate.

To reduce the uncertainty of the lender in determining unexpected risks, it is proposed to cross-check unexpected risks for lending purposes with regulatory or internal or rating-based capital requirements, which is to be held as buffer against unexpected risks by the insurer for the respective pool of life policies, in section 5.3.

These components are taken together in section 5.4 to determine the maximum lending amount *before* residual risk.

In section 5.5 modelling and residual risks are analysed on a qualitative basis and an approach for integration is suggested.

Section 0 incorporates the previous steps into a comprehensive framework and determines the maximum lending amount *after* residual risks. The main challenge is to take account of all required adaptations and deductions while at the same time avoid double-counting of risks. While potential areas of double-counting are identified where they are found throughout the preceding and this chapter, this section provides a comprehensive overview of the modelling framework. The analyst has to be aware of alternatives available and choose the most appropriate alternative in view of the specific insurance policy pool to be lent against and the available data in each transaction.

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┌─────────────────────────────────────────────┐
│   European Embedded Value  see chapter 3     │
└─────────────────────────────────────────────┘
                      │
                      ▼
┌─────────────────────────────────────────────┐
│   Bankable embedded value  see chapter 4     │
└─────────────────────────────────────────────┘
        │       • Account for unexpected risks, section 5.2
        │       • Apply the (modified) regulatory capital floor or check for con-
        │         sistency, section 5.3
        │       • Aggregate and account for diversification effect and maturity
        │         section 5.4
        ▼
┌─────────────────────────────────────────────┐
│          Maximum lending amount             │
│           before residual risk              │
│                                             │
│   • Adjust for modelling and residual risk, section 5.5 │
│                                             │
│      Maximum lending amount after residual risk │
│                  section 0                  │
└─────────────────────────────────────────────┘
```

Table 6: Determining the maximum lending amount

All in all, the need for detailed analysis is confirmed by the fact that the adaptations for the various elements in total can be substantial. For example, in the Gracechurch Life deal in 2003 only GBP 400m out of GBP 750m underlying embedded value were financed though credit-enhanced by a AAA-rated monoliner[138].

5.1 Taking account of unexpected risks

5.1.1 Conceptual approach

As mentioned before, the maximum amount lending by banks depends on their risk preferences. For simplification and in line with usual risk preferences of commercial banks it is assumed in the following that a bank is not willing to provide finance on a first loss or equity-basis. For this reason a bank financing the embedded value of a portfolio of life insurance policies would make deductions from the bankable embedded value in order to arrive at a quasi-riskless amount considered to be the maximum lending amount. These deductions are to

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[138] Cf. Parsons (2004), p.52.

account for unexpected negative evolutions of the various profit components which may reduce future flows and thus endanger the pay-back of the loan.

Theoretically, these unexpected negative deviations from expected future in- and outflows should be captured based on probability analysis in line with current best practice in some insurance companies for determining the risk capital, e.g. Ernst & Young's EV at risk^{TM} model[139]. Common approaches focus on the value at risk which is determined based on

- a certain probability distribution

- a certain confidence level

- bilateral correlations of the risk types under review and

- a data base upon deviations of comparable policy flows in the past[140].

The **confidence level** reflects the risk appetite of the insurer or in this case the lender. The higher the confidence level the higher the value at risk deduction from the embedded value. The amounts deducted are not financed by the lender and thus remain with the originating insurer. As in tranched securitizations these amounts can be financed by investors with different risk return preferences, e.g. certain investment funds[141].

While intuitively appealing, this approach has significant drawbacks. The easiest and most often used distribution law is the normal distribution. However, as with other applications of the value at risk concept, it is questionable if this distribution law captures adequately the true underlying probability distribution. Often, event probabilities in the tail of the distribution are higher than suggested by the normal distribution ("**fat tail problem**")[142]. Additionally, beyond selecting an appropriate risk distribution for insurance risks, it is questionable

- which probability distributions to use for other risk types, e.g. lapse experience

- how to allow for selective behaviour of policyholders and

- how to incorporate embedded guarantees and options[143].

These problems are enhanced by the fact that also the interaction between the risk categories have to be incorporated, which is not easily done. Even in financial institutions' internal

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[139] Cf. Ernst & Young (2002), pp. 22-24.

[140] See also section 3.2.2.

[141] Cf. Rudin (2005), p. 45.

[142] Cf. Darlington et al. (2001), p. 18 therefore refer to extreme value theory which adds complexity. The fat tail problem is circumvented when a lower confidence level is chosen, such as 95 %. Interestingly, Ernst & Young (2002), p. 23 use for the EV at risk^{TM}, which is based on stochastic scenario analysis, the 95 % confidence level.

[143] Cf. Darlington et al. (2001), p. 33.

capital modelling the **factor approach**, which relates all risk factors to a set of higher order economic drivers (e.g. GDP growth, interest rates, stock market indexes), is abandoned in favour of the cruder **correlation approach** in which interaction effects between risk categories are calculated based on aggregate correlations, often even only based on cruder estimates of "market average" figures[144].

All these conceptual problems are aggravated by the **lack of data available** with regard to the various risks and the correlations between them. This applies even more to a financing bank than to an insurance company calculating individual capital needs. This lack of data does not only exclude the use of another potentially better fitting probability distributions, but it makes the use of the probability-theoretic approach generally impossible[145]. Furthermore, bilateral correlations based on average market parameters pay little regard to a firm's individual business profile.

Modelling unexpected risks for life insurers **over longer time horizons**, which would seem adequate given the very long-term nature of the business, can theoretically be done by cointegration, autoregressive conditional heteroskedasticity or multi-step Monte Carlo approaches[146]. This is however very rarely performed by life insurers themselves for real life capital need calculations, not least because of data constraints[147].

Based on the aforementioned a cruder approach seems necessary for credit analysis in embedded value financing.

5.1.2 Second best approach

Therefore, the focus in the following is on more heuristic approaches – in line with current market practice[148] – tailored to the individual risk types while having recourse to elementary value at risk concepts where appropriate. Specifically it is proposed to

- use the sensitivity data provided under the EEV Principles or considered pertinent to embedded value financing in the respective transaction

- adjust for confidence level and time horizon, where deemed appropriate

- aggregate the risk allowances for the various risk types and deduct them from the bankable embedded value, and

- adjust for residual risks.

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[144] Cf. Giese (2003), pp. S18-S19.
[145] For this reason international insurers and banks complement statistical probability analysis with stress tests scenarios to arrive at meaningful risk capital figures at high probability levels. Cf. Koch Medina/Krieter/Schreckenberg (2003), p. 31 and Kriele/Lim/Reich (2004), p. 1049.
[146] See for a short overview Porteous (2004), p. 4 and 8.
[147] Cf. Giese (2003), pp. S19-S20.
[148] Cf. Cummins (2004), p. 18.

For many risk types the EEV Principles require **shock tests** to disclose the direct impact of major changes in certain variables[149]. Indirect effects via correlation effects with other variables sometimes are to be taken account of. The lender should make use of this information where available. Based on the adaptations of the bankable embedded value, the sensitivities should be recalculated under this concept where there are material differences to the EEV. The various shock tests to be applied are discussed in section 5.2.

Lenders require a specific confidence level depending on their risk preferences, e.g. 95%, 99% or 99.9%. The confidence level is also associated with the risk margin to be charged for the financing. An indication for an appropriate confidence level may also be derived from the lender's own economic capital depending on its own target rating[150] or the premises of the new capital regulations for banks (so called Basel II)[151]. The FSA assumes for the realistic peak and the individual capital assessment in its capital requirements for insurance companies a confidence level of 99.5%[152]. **Rescaling for different confidence levels** can be easily done by converting a given risk amount from one confidence level into another based on the following relationship[153]:

$$\text{Equation 9: } RA_1 = S * \boldsymbol{m}$$

with: RA_1 = risk allowance for one year

 S = shock disclosed under EEV Principles (or otherwise deemed appropriate)

 and

$$\text{Equation 10: } \boldsymbol{m} = \boldsymbol{Q}\,(CF_2)\,/\,\boldsymbol{Q}\,(CF_1)$$

with: μ = multiplier

 CF = confidence level

 Θ = cumulative density of standard normal distribution[154].

$\boldsymbol{Q}$ is based on the cumulative standard normal distribution and thus may understate the value at risk in the tail of the distribution (**"fat tail problem"**)[155]. Table 7 gives the cumulative densities for selected confidence levels. Based on this, converting for example a 99.5 % confi-

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[149] See CFO Forum (2004a), para G12.2 and CFO Forum (2004b), para 122-124.

[150] The confidence levels typically used in internal capital modelling ranges from 99.0% to 99.98 % with 99.9% corresponding to an A-rating based on rating agencies' historic default tables. Cf. Giese (2003), p. S17.

[151] The Basel II formulas imply a confidence level of 99.9%. Cf. Basel Committee on Banking Supervision (2004), para 272.

[152] Cf. Towers Perrin Tillinghast, Update - Policy Statement 04/16, July 2004, pp. 3+4.

[153] Cf. Wilson (1994), p. 74.

[154] Function NORMINV in Excel.

[155] See section 5.1.1.

dence level embedded value sensitivity to a 95% confidence level allowance would simply require to multiply the risk allowance with µ which in this case is 1.645/2.576 or 0.639.

While rescaling is technically easy done, in many cases disclosed shocks will not be based on a specific confidence level as this is not required under the EEV. It may be increasingly available when scenario-based embedded value at risk techniques are used by insurers. If not available, it is up to the analyst to determine an appropriate multiplier µ, e.g. scaling up a disclosed sensitivity to one considered commensurate with the desired confidence level. This may have to be done on a judgemental basis when sufficient data history for risk driver volatilities are not available. Due to this and parameter uncertainty, it may sometimes make more sense to choose a not too high confidence level, e.g. 95%[156], and adjust for the fat tail problem qualitatively under the modelling risk allowance[157]. However, in some cases due to data quality, uncertainty may be so great that it may be advisable to apply shocks without confidence level adjustment altogether when the analyst considers rescaling to be of little meaning. In this case the multiplier µ should be set to 1.

Confidence level	Cumulative density (µ)
90.00%	1.282
95.00%	1.645
97.50%	1.960
99.00%	2.326
99.50%	2.576
99.90%	3.090
99.95%	3.290
99.99%	3.719

Table 7: Confidence levels and related cumulative densities

A similar adjustment, equally based on the cumulative standard normal distribution with the same potential for understatement in the tail of the distribution, should be applied in order to **convert the time horizon** of a risk sensitivity into the loan's maturity by applying the standard time adjustment formula[158]

$$\text{Equation 11: } RA_t = RA_1 * \sqrt{t}$$

with: RA = risk allowance

t = maturity of the loan in years

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[156] This is in line with Ernst & Young's EV at risk[TM]. Cf. Ernst & Young (2002), p. 23.
[157] See section 5.5.
[158] Cf. Wilson (1994), p. 74.

Based on standard value at risk applications for banks in non-trading books and in line with the FSA's approach under the realistic peak and the individual capital assessment[159] it seems reasonable to assume a one year horizon for a disclosed embedded value risk shock if not stated otherwise. This is also implied by the EEV Principles which require embedded value calculations at least annually[160].

The various risk allowances for the individual risk types are then to be **aggregated**, ideally taking account of correlation effects under stress conditions.

Modelling and residual risks are to be taken separately into account based on qualitative analysis. The parameters used in sections 5.4 and 5.5 are fine-tuned once the quality of the available data and the residual risks present are analysed.

5.2   Types of unexpected risks

In the **internal capital modelling literature** the following key risk categories for life insurers are addressed[161]:

- capital market risks, e.g. asset price risk and credit risk (for details see section 5.2.1)

- biometric risks, e.g. mortality (section 5.2.3) and longevity risk (section 5.2.4)

- surrender or persistency risk (section 5.2.2)

- operational risk (section 5.2.6)

- liquidity risk (section 5.2.9)

Internal capital modelling is usually short-term, e.g. referring to a horizon of one year. The financing of embedded value however extends over many years so that risks less pertinent in the short run may gain new momentum. Thus, in addition to those risks mentioned the **following risk components are also pertinent**:

- expense inflation risk, arising from expenses rising markedly quicker than expected (section 5.2.5),

- the credit risk of the insurer to the degree relevant to the lender under the financing scheme proposed (section 5.2.6)

- adverse selection risk, e.g. a natural bias towards higher claims expenses based on rational behaviour of the insured (section 5.2.7) and

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[159] Cf. Towers Perrin Tillinghast, Update - Policy Statement 04/16, July 2004, pp. 3+4.
[160] Cf. CFO Forum (2004a), Guidance G12.3.
[161] Cf. Kriele/Lim/Reich /(2004), p. 1050 and Schubert/Grießmann (2004), p. 1044.

- embedded guarantee and option risk (section 5.2.8)[162].

As with other areas of accounting and reporting there are also **modelling risks** which may arise from different interpretations of existing accounting rules. In this case this would be the EEV Principles.

In the following the various risk categories are analysed and stress tests are defined for determining the allowances required for calculating the bankable embedded value.

In the following it is assumed that the respective shock sensitivities are disclosed under EEV Principles and/or can be provided from the respective life insurer. Due to potential data constraints approximations are presented for the case that the insurer cannot determine the level of shock to be applied probabilistically, e.g. based on a historical data base and a given confidence level. This is also based on the fact that there is no requirement in the EEV Principles that the assumed shock levels have to be in relation with historical experience or a certain confidence level. This simplification seems not so problematic since the capital requirements for the business in force is applied separately as a floor to risk allowances.

5.2.1 Investment return risk

Based on the capital market fluctuations of the last years investment return risk seems to be the risk source with the largest impact. Investment return risk may hit the business in force of a life insurer through

- decreasing stock prices

- rising interest rates and thus decreasing bond prices

- lowered interest rates leading to lower reinvestment return and higher values of liabilities

- rising credit spreads and thus decreasing bond prices as well as default risk

- diminishing property prices.

In determining the risk allowances for these subcategories the extent of price change is to be defined for the shock tests to be applied.

Most often the embedded value sensitivity of changing **interest yields** will be disclosed as this is required under the EEV[163]. This is the amount by which the embedded value changes under the interest rate shock defined and can be regarded as a first-shot risk allowance to be

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[162] Cf. Cummins (2004), pp. 17 and 44 and Porteous (2004), p. 12.
[163] Cf. CFO Forum (2004b), para 124.

deducted from the embedded value to arrive at the bankable embedded value. If several interest rate shocks are disclosed, e.g. for a linear rise or fall in interest rates or a change in the yield curve the most onerous embedded value sensitivity should be taken.

Under the EEV principles only the **direct impact** of changing interest rates is to be measured. However this is defined more extensively and includes in the case of interest rates the following effects:

- an immediate reduction in the value of fixed interest assets

- higher expected future returns on such assets

- possible knock-on effects for other types of asset and discount rates

- changes in future bonus rates

- change in value of guarantees/options

- possible changes in policyholder behaviour, e.g. in persistency or take-up of guarantees/options[164].

When reported as such the correlation between interest rate risk and surrender risk should be taken care of adequately by the shock test applied by the originating insurer. The point however may be more significant for more onerous shocks which even may increase correlations[165] and therefore should be reviewed carefully by the analyst.

$$\textit{Equation 12: } RA_{ir\,1} \;=\; \mathbf{\mu}_{ir} \,*\, S_{ir}$$

with: $RA_{ir\,1}$ = risk allowance for interest rate risk for a one year horizon

μ_{ir} = multiplier for rescaling confidence level

S_{ir} = disclosed shock sensitivity for interest rate risk

The allowance thus determined can be converted to the desired confidence level of the lender by applying the respective factor of the cumulative standard normal distribution as shown in section 5.1.2. While this seems technically easy, the challenge is to associate confidence level with real life data. It is then up to the analyst to determine an appropriate multiplier μ, e.g. scaling up a disclosed sensitivity to one considered commensurate with the desired confidence level based on his own experience. This may have to be done on a judgemental basis when

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[164] Cf. CFO Forum (2004b), para 124.

[165] Misestimation of the correlation between poor investment returns and surrender behaviour was the reason for the poor performance of the first life insurance securitization deal in 1998 which in turn prevented origination of similar deals for some years. Cf. Parsons (2004) pp. 51-52.

sufficient data history for interest rate volatilities are not available. For comparison, the UK's FSA regulation for life insurances demands a two-way shock of +/- 17.5 % movements in the 15-year gilt yield under the realistic peak, which assumes a confidence level of 99.5 % and a one-year horizon[166]. Determining the two shocks, the higher of the two should be applied to determine the risk allowance.

Similarly, the FSA regulation for life insurances demands a two-way 20 % shock for **equity prices** and a two-way 12.5 % shock for **real estate prices** based on the same confidence level and time horizon. Here too, the higher of the two shocks should be applied in the risk allowance in each case. The EEV disclosure rules do not require specific disclosure on equity and real estate price sensitivities. However, where material this information can be expected to be disclosed.

$$\text{Equation 13: } RA_{e\,1} \;=\; \mu_e * S_e$$

with: $RA_{e\,1}$ = risk allowance for equity price risk for one year

μ_e = multiplier for rescaling confidence level

S_e = disclosed shock sensitivity for equity price risk

$$\text{Equation 14: } RA_{p\,1} \;=\; \mu_p * S_p$$

with: $RA_{p\,1}$ = shock allowance for property price risk for one year

μ_p = multiplier for rescaling confidence level

S_p = disclosed shock sensitivity for property price risk

If data is not available from the insurer the analyst will have to make a judgemental allowance, e.g. based on the percentage of investment return in total ordinary revenues and the average asset mix percentages in the capital investments of last year's profit and loss and balance sheet figures. It is up to the analyst to perform this for the last year or the average of the last, e.g. three business years depending on past and/or expected stability of investment returns.

Depending on the type and mix of equity holdings and the type, location and mix of properties an analyst may wish to perform separate calculations for stock price and property price risk.

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[166] See section 3.2.2.

In the case of equity risk the simplified formula is

$$\textit{Equation 15: } S_e \; = \; IR/(NP + IR) \; * \; E/CI$$

with: IR   = investment return

NP   = net premium

E   = equity holdings

CI   = total capital investments

The simplified calculation under Equation 13 – Equation 15 does not take account of more indirect effects, such as changes of future bonus rates and in policyholder behaviour. This may be acceptable when the share of these types of investment is comparatively small. If considered material, the originator should provide such a figure or an extra allowance for modelling risk should be incorporated.

The credit risk of the capital investments can be analysed based on the composition of fixed income investments by rating classes. Based on this an average portfolio rating can be calculated based on historic default data provided by all major rating agencies. A shock allowance of credit risk would then measure the impact of a certain percentage of higher average default in the portfolio than the current average default probability.

$$\textit{Equation 16: } RA_d \; = \; \mathbf{m}_d \; * \; S_d$$

with: RA_d = risk allowance for default risk

μ_d = multiplier for rescaling confidence level

S_d = disclosed shock sensitivity for default risk

An adequate shock level to be applied can be drawn from migration probability tables issued by rating agencies. Here, historic probabilities of transition from one rating class to another are presented for a given time horizon, e.g. 1, 2 or more years[167]. Based on the average maturity of the fixed income portfolio and the respective transition probabilities a confidence level can be easily chosen. Depending on the rating level associated with this downside confidence level, a new average default probability can be derived.

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[167] Cf. for instance Moody's Investors Service (1997), pp. 19-25.

Due to the low granularity of default probabilities for lower rating classes[168] it is proposed to choose a confidence level not too high, as otherwise the shock leads too easily to rating class D, e.g. default, for the whole portfolio with consequently little meaning for embedded value shock analysis. Instead it is proposed to use a lower confidence level, e.g. 95 %, and to rescale the obtained shock to the desired confidence level afterwards. The fat tail problem is taken account of later in the residual allowance for modelling risk.

Let us assume, for example, an average rating of Aa3 and an average maturity of the fixed yield portfolio of 5 years. The desired confidence level is 95 %. Rescaling the data for withdrawn ratings and based on Moody's default statistics for five-year rating transition[169] a confidence level of 95 % is reached at a rating of Baa1. This is associated with a five-year default probability of 1.4% compared to 0.4% for Aa3[170]. Thus, embedded value sensitivity would then be calculated based on a default probability of 1.4 % instead of 0.4 %. The shock test result would then be rescaled to the desired confidence level of the lender.

The result of this then has to be rescaled to the respective risk allowance for one year based on Equation 11 to make this risk allowance homogeneous with the others.

Strictly speaking, spread risks from declining bond prices due to rating changes are to be taken account of separately. Especially for high average portfolio ratings the impact of this should be quite small, however, due to the small size of spreads to be earned. Therefore, qualitative analysis is recommended. Where considered material, it should be taken account of in the residual modelling risk allowance.

5.2.2 Surrender or persistency risk

Surrender or persistency risk is the risk of early cancellation by policyholders. Any early surrender of a policy will create an immediate cash demand for repayment while depriving the insurer of at least some expected future income. Consequently, it is required to assume a realistic level of early surrenders when calculating the embedded value. However, when surrenders start to escalate and represent a significant reduction of expected future profits and thus their present value. Historically, persistency has gone down after an equity market downturn. Then future surpluses will be affected by lower investment returns and by lower persistency[171]. The same applies when interest yields go up. As long as increased surrender is due to changes in capital market returns it is reflected in the sensitivity disclosed for investment re-

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[168] E.g. the five-year default probability for Ba3 is 15.4% and for B1 is 20.1% with no intermediate rating class available. Cf. Moody's Investors Service (1997), p. 22. Alternatively, loglinear interpolation of default probabilities would be possible, but more cumbersome in processing. Furthermore, available data is comparatively scarce (14,000 issuers in total, cf. ibid, p. 3), so that we do not recommend this.

[169] Cf. Moody's Investors Service (1997), p. 22. On a 5 year horizon the withdrawn rating percentage is 20.0%. Rescaling the transition probabilities, e.g. * 100.0/80.0, a confidence level of 95 % is reached in the Baa1 rating class.

[170] Ibid.

[171] Cf. Standard & Poor's (2004b), p. 6.

turn risk[172]. Thus, an additional surrender risk allowance should be based only on those surrenders which are not due to capital market influences accounted for already under investment return risk allowances.

Ideally, product-specific lapse rates should be taken into account. Similarly, separate shocks for high lapse rate changes in one year and more continuous lapse rate changes over a longer period of time may be desirable. If this information is available the highest risk allowances under the various scenarios should be applied.

Where such tests is not available a comprehensive lapse rate over all products over the residual life of the business in force should be applied separately for increases and decreases in the lapse rate. Then the higher of the two embedded value sensitivities should be used for calculating the allowance for surrender risk. In absence of better information for the desired confidence level, the standard assumptions of the realistic peak in the UK capital requirement for life insurers of +/- 35 % on current estimates[173] seems to be a sensible first shot. When higher levels are used for internal capital need calculations, higher discontinuance rates may also be necessary here depending on the individual business profile of the life insurer.

$$Equation\ 17:\ RA_{sl\ 1}\ =\ m_{sl}\ *\ S_{sl}$$

with: $RA_{sl\ 1}$ = shock allowance for unexpected surrender and lapse rate risk for 1 year

μ_{sl} = multiplier for rescaling confidence level

S_{sl} = disclosed shock sensitivity for surrender and lapse rate risk

5.2.3 Mortality risk

Mortality risk is the risk that a larger amount of life insurance policies become due than estimated under the European Embedded Value base case based on an increase in mortality and thus quicker payouts under the policies than anticipated. Blocks of life insurance policies may be subject to differing mortality behaviour based on age, sex, occupation, average mortality payout rates by policy type, medical underwriting and acceptance procedures applied by each insurer[174].

Ideally, stress scenarios for instantaneous shocks, e.g. accounting for catastrophic events, and a long-term deterioration in mortality experience, e.g. in recognition of more secular trends, should be performed. The highest of the embedded value sensitivities calculated under these scenarios should the be used as risk allowance for mortality risk. If this is not available a

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[172] See section 5.2.1.
[173] See section 3.2.2.
[174] Cf. Standard & Poor's (2004b), p. 6.

straight rate should be applied. The overall change rate is then to be determined by the analyst. Here industry practice differs widely based on the individual business profile of the respective life insurer. In some cases change rates of up to 50 % are used for the whole maturity[175], e.g. after maturity adjustment.

$$\textit{Equation 18: } RA_m \;=\; \boldsymbol{\mu}_m \; * \; S_m$$

with: $\quad RA_m \qquad$ = risk allowance for mortality risk

$\qquad \mu_m \quad$ = multiplier for rescaling confidence level

$\qquad S_m \quad$ = disclosed shock sensitivity for mortality risk

5.2.4 Longevity risk

Longevity risk is the risk of a longer pay out time by the insurer to policyholders due to longer lives than expected. Key components in this risk category are

- random fluctuations in the number of deaths experienced

- random fluctuations in the relative rates of amounts versus life experience, e.g. depending on the distribution of differing life experience over policy amounts

- changes in market practices arising from newly published mortality tables, e.g. reflecting medical progress.

Ideally, separate stress tests should be performed for each of these components and than the highest should be taken as basis for the EEV sensitivity calculation. If these data are not available, here again a flat rate is to be applied which is to be determined based on the individual portfolio composition of the insurer. For 99.5 %/one year stresses longevity stress tests of up to 10 % on current estimates can be seen in the market, however, the figures are too vague for attributing market-wide confidence levels.

$$\textit{Equation 19: } RA_{lv\ 1} \;=\; \boldsymbol{\mu}_{lv} \; * \; S_{lv}$$

with: $\quad RA_{lv\ 1} \qquad$ = risk allowance for longevity risk for 1 year

$\qquad \mu_{lv} \qquad$ = multiplier for rescaling confidence level

$\qquad S_{lv} \qquad$ = disclosed shock sensitivity for longevity risk

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[175] Cf. Standard & Poor's (2004b), p. 6.

5.2.5 Expense inflation risk

Expense inflation risk arises primarily from

- more or less one-time exceptional increases in expense, e.g. from new computer investments in processing the business in force

- changes in secular expense cost trends.

Here again, separate scenarios for the various components should be used ideally. Where not appropriate, flat rates have to be taken. Expense inflation change rates should be based on the individual product mix, policy amount distribution, maturity mix and the location of the insurance business (in case of multinational portfolios) of the respective insurer. Starting point for the analysis of expense inflation risk can be the evolution of salaries over the past years. Another major determinant is system costs, which has risen considerably in recent years and will continue to do so with regard to the introduction of Solvency II and new International Financial Reporting Standards. Higher administrative cost can also derive from an increased regulatory burden.

In Continental Europe flat change rates of up to 8 % per year for horizons of one year have been seen in recent years. This seems appropriate when considering annual rises in staff expenses of 2% to 4% under steady state conditions due to general salary increases, given the desired high shock level (e.g. based on the desired confidence level).

$$\text{Equation 20: } RA_{ei\,1} \; = \; \mu_{ei} \; * \; S_{ei}$$

with: $RA_{ei\,1}$ = risk allowance for expense inflation risk for 1 year

μ_{ei} = multiplier for rescaling confidence level

S_{ei} = disclosed shock sensitivity for expense inflation risk

5.2.6 Credit risk of the originating insurer

When title of the insurance policies are passed to the lender there is no risk of default of the insurer to be considered[176]. However, the embedded value will depend on the operational management and the reputation of the insurer.

Operational risk may arise from inadequate or failed internal processes, people and systems or from external events[177]. It thus comprises risks from

- fraud

- human error, e.g. due to inadequate training

- control failures, e.g. in claim processing

- unit pricing errors

- misselling and

- technology failure.

Each component is based on other subsets of risk drivers and depend on the business mix of the respective insurer. Due to the large number or risk drivers and the complexity of their interrelatedness calculation of risk allowances is more difficult than for other main risk categories. For this reason it is still often excluded from insurers' internal capital calculations up to now[178] or based on heuristic approaches[179]. Therefore, only cruder approaches seem to be adequate. These could be based on expenses or on gross premium income.

The first approach is used under the basic indicator and the standard approaches of Basel II, where the latter differentiates by business lines[180]. First it may be doubted if the percentages used there are readily transferable to insurers. In any case, this approach produces the counterintuitive result that savings in process control and operational risk management reduce expenses and thus the risk allowance for operational risk. Similarly, fixing a percentage allowance for operational risk on premium income would penalize those insurers who have above-

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[176] Effectively segregating the business in force to be financed from the insurance company can be a problem in securitization deals with a special purpose vehicle acting as the refinancing entity. Therefore, sometimes the business in force to be lent against is reinsured before financing in order to delink the embedded value financing from rating downgrades of the originating insurer. Cf. Parsons (2004), p. 52 and Weliky (2004), p. 34. However, capital requirements for the reinsurer have to be taken account of when designing the structure. See Rudin (2005), p. 44 for details.

[177] Cf. Financial Services Authority (2004), appendix 1, para 1.2.32 (1).

[178] Though it is an area of intensive research also in the insurance area. Cf. Koch Medina/Krieter/Schreckenberg (2003), p. 30.

[179] Cf. Giese (2003), p. S19.

[180] Basel Committee on Banking Supervision (2004), para 649-654.

average profitability with which operational losses are cushioned. Due to these drawbacks neither of these approaches seems acceptable.

Since new business does not form part of the embedded value, **reputation risk** seems less relevant as it regards mostly new business which is not part of the embedded value. Where reputation risk refers to early surrender of policies it should already be covered by the allowance for surrender risk. Reputation risk is however relevant to the extent that the EEV includes renewal business. To this extent it is not only limited to the reputation of the originating insurer, but also to that of other members belonging to the same group. This is especially relevant, when these are perceived in the market as being affiliated which is the case if the two companies sell under the same brand. Due to its impact on renewal business a stable market reputation of an insurer is a key factor for making embedded value financing possible at inception[181].

A promising approach to integrate operational and reputation risk is to apply a risk allowance commensurate with the financial strength rating of the originating insurer[182] and historic default rates for the loan's maturity:

$$\textit{Equation 21: } RA_{CR} \; = \; BEV * (1\text{-}PD)$$

with: RA_{CR} = risk allowance for own credit risk of originating insurer for loan's maturity

          BEV = bankable embedded value

          PD = probability of default based on the rating of the insurer and historic default tables.

Here again, it is preferable to use the true default rate for the respective maturity and then scale RA_{CR} back to one year based on Equation 11 to make it homogeneous with the other risk allowances.

5.2.7 Adverse selection risk

The insurance business is based on the concept of diversification and thus the law of large numbers. Thus, it is assumed that the distribution of risks in the pool is representative of the distribution in the population. However, policyholders act rationally based on their own cir-

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[181] Cf. Parsons (2004), p. 52.

[182] In its rating analysis Standard & Poor's here applies a rating cap based on the insurer's financial strength rating of the insurer. In some occasions, also due to the potential risk of regulatory intervention and low granularity of the life insurance pool the rating cap is one notch less than the insurer's financial strength rating. Cf. Standard & Poor's (2004a), p. 2.

cumstances and tend to get insured when they consider it of value to them. Thus, there is a systematic bias from overall market behaviour. This is called adverse selection risk[183].

This risk is also very difficult to quantify. Therefore, a crude percentage of the embedded value should be deducted as such. This percentage should be determined based on the individual profile of the life insurer, where market share may play a key factor, e.g. as a percentage of the credit risk allowance. Alternatively, it may be taken up in evaluating modelling risk.

5.2.8 Embedded guarantee and option risk

Sometimes marketing efforts for life insurance policies have led to increased incorporation of guarantees and options into the policies. While immaterial as long as these embedded guarantees and options remain out of the money, e.g. do not increase payout requirements they do not impact the embedded value lenders. However, the case of Equitable Life in December 2000 showed that commitments may also reach uncontrollable volumes[184].

Embedded guarantees and options are a central point where the EEV principles fall short of market consistent embedded values[185]. Since market consistent data resemble the requirements of the lenders more closely, efforts would be necessary to approximate market consistent values on an ex post basis. In any case, the nature of financial guarantees and options is to be disclosed under the EEV Principles, as well as the techniques used to value them[186]. As shown above, stochastic evaluation of financial guarantees and options will lead to higher volatility than with traditional embedded value calculations[187] demonstrating the need for a risk allowance in financing. Anyway, non-financial options and guarantees are not taken account of in the EEV.

An indication of the risk allowance required for embedded value financing can also be the respective capital requirement, which in some jurisdictions can however be too high[188].

The calculation of unexpected risks from financial guarantees and options is however difficult due to the limited tradability of insurance contracts. Furthermore, data availability may be a problem – at least in the first years of EEV implementation - since neither US-GAAP, nor International Financial Reporting Standards require this currently[189]. Therefore, despite of the materiality of financial options and guarantees in many cases it is proposed to renounce a

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[183] Cf. Standard & Poor's (2004b), p. 7 and Kovacevic/Willomitzer (2005), p. 493. Cummins (2004) pp. 45-46 also mentions an adverse selection risk in the relationship between insurer and investors which he considers to be perhaps the greatest impediment to the embedded value financing market.

[184] Cf. Standard & Poor's (2004b) p. 8.

[185] See section 3.5.2.

[186] Cf. CFO Forum (2004a), Guidance 12.4. (n).

[187] Cf. O'Keeffe et al. (2005), p. 16.

[188] If local regulatory requirements are considered too high, the insurer may amend the capital requirement accordingly, but has to disclose amount and reason for doing so. Cf. CFO Forum (2004a), Guidance G5.4 and G12.4. (n) and CFO Forum (2004b), Para 55.

[189] Cf. Kovacevic/Willomitzer (2005), pp. 492-493.

separate risk allowance, but to include guarantees and options in the consideration of modelling risk. This seems promising also in view of the disclosure requirements of the EEV Principles.

5.2.9 Liquidity risk

Liquidity risk refers to the risk of having inadequate or insufficient liquidity available to meet obligations as they fall due. Liquidity risk is indicated when at certain maturities cash flow shortfalls arise and these reach percentages of the scheduled payouts appearing critical. Thus, liquidity risk in this context can also be termed asset liability mismatch risk. Since the value in force is transferred to the bank in embedded value lending liquidity risk is no more dependent on the credit standing of the insurer. Liquidity risk may additionally become pertinent in times of unexpectedly high surrenders. In this case however, liquidity shortfalls are direct consequence of surrender risk and need no special attention under a liquidity risk allowance.

To capture liquidity risk a lender should apply a risk allowance based on the shortfalls of payout, administrative costs and bonus payments over net premium and net investment income, and an adequate financing rate for this shortfall. Since these flows are discounted to the present value based on the selected risk discount rate, financing cost should be based only on an adequate extra margin for credit risk over a period commensurate with the length of the cash flow shortfall. This may be quite complex in relation to the mostly less material risk involved, especially when there are positive asset liability mismatch gaps in prior years.

Alternatively, a shock analogous to the Financial Services Authority's 2.5% shock in the market value of assets at realization compared to their current market value can be applied here. This is in recognition of residual risks which may arise even in asset liability matched portfolios[190].

$$Equation\ 22:\ RA_{liqu\ 1}\ =\ \boldsymbol{\mu}_{liqu}\ *\ S_{liqu}$$

with: $RA_{liqu\ 1}$ = risk allowance for liquidity risk for one year

   μ_{liqu} = multiplier for rescaling confidence level

   S_{liqu} = disclosed shock sensitivity for liquidity risk

Where considered immaterial the asset liability mismatch gaps can also be integrated qualitatively as part of the evaluation of the residual allowance for modelling risk.

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[190] Cf. Financial Services Authority (2004), appendix 1, annex A, para A.41. This refers to the individual capital assessment.

5.2.10 Tax risk

As creditors are paid out of available cash flows gross of taxes a material tax risk cannot be identified.

5.3 Inclusion of capital requirements as floor

In the EEV the regulatory capital is part of the net asset value[191]. For determining the maximum lending amount allowances for unexpected risks have to be deducted. On the other hand the purpose of regulatory capital requirements is the quantification of unexpected risk, e.g. ensuring the going concern of the respective insurance entity by providing a buffer against unexpected deviations from the assumed in- and outflows from the life insurance policies. Thus, the purpose of regulatory capital requirements is essentially the same as the point of view of a non-first loss lender. Therefore, since a bank is not in a better position than the insurer or its supervisor to quantify unexpected risks, it seems advisable to accept the regulatory capital requirements as a **floor where capital regulations are sufficiently detailed** to account for the most pertinent risks as is the case for example in the UK.

Depending on the nature of the capital rules in the relevant jurisdiction(s), these may be too crude, when not all relevant risks are taken account of. In some legislations, such as Germany, regulatory solvency requirements are based only on the amount of mathematical reserves for insurance capital and bonus payments. Thus, capital market risks are not explicitly included. On the other hand regulatory capital requirements may be set so high as to cover the other risks implicitly as well. So the regulatory capital may or may not cover adequately the underlying unexpected risks. In this case for transparency reasons the credit analyst should decide whether he **applies the floor at all, in part or not at all**. For a detailed analysis of lendability, also in the interest of the borrower, it may make more sense to calculate the various risks directly. A potential area of undue regulatory capital requirement in part is financial guarantees and options in some jurisdictions[192].

In any case, he may use the regulatory capital at least **as a cross check** for his own calculations to identify inconsistencies.

By the same token, the individual capital assessment of an insurer also provides a floor for unexpected risk allowance, when it is used in reporting the EEV. The risks the insurance company considers itself to be pertinent, generally seem to be relevant for the lender as well. The same applies for the required capital as determined under rating agency requirements.

For determining the lending embedded value disclosure of capital requirements for the business in force to be lent against thus seems to be necessary in most cases. Anyway, based on

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[191] See section 3.2.2.
[192] See section 5.2.8.

the upcoming of Solvency II by 2009 this will be a supervisory requirement all over the European Union[193].

Where a floor is effectively applied it should be scaled back to the same confidence level as the risk allowances for achieving consistency in the following modelling steps.

5.4 Maximum lending amount before residual risk

5.4.1 Recognizing diversification effects

Once the risk allowances determined, based on an identical confidence level, and aggregated an analyst may wish to take account of diversification effects, even though they may not be recognized under regulatory required capital rules.

Theoretically correlation effects have to be considered which reduce the total amount of risk allowances. Empirical data for this is however very scarce. For internal capital modelling mostly subjective best guesses are used[194]. Porteous (2004) uses long-term correlations between inflation and equity dividend yields of 0.3 and between inflation and government bond yields of 0.6 as an example. "Market average correlations" for financial institutions are estimated at crudely 0.8 between credit and market risks, 0.4 between credit and operational risk and 0.4 between market and operational risk[195]. Up to now the authors could not find correlations between surrender, mortality and longevity risk variables different from 1.

Given the crude estimation of shock levels the quantification of diversification effects with best guess data in the total risk allowance is only of little help. Furthermore, correlation effects are partly taken account of in the shock tests based on embedded value sensitivity disclosures[196]. The approximations of correlations are more than overcompensated by the fact that the adjustment formulas for confidence level and time horizon are based on the normal distribution whereas more realistic probability distributions usually lead to higher amounts[197]. Therefore it is recommended to apply bonus amounts only **when diversification effects can be reliably quantified** under avoidance of double-counting, e.g. when already accounted for in the shock tests. In most cases therefore diversification effects will probably have to be neglected.

5.4.2 Accounting for maturity

Before deduction of the total risk allowances, adjusted for correlation and the regulatory capital floor, from the bankable embedded value these have to be adjusted for maturity. This can be done on the interim sum thus assuming equally a horizon of one year for the regulatory

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[193] Cf. Schubert/Griessmann (2005), p. 57.
[194] Cf. Porteous (2004), p. 25.
[195] Cf. Oliver Wyman (2001) quoted from Giese (2003), p. S19.
[196] E.g. between interest rate risk and surrender risk. See section 5.2.1.
[197] See section 5.1.1.

capital floor. This is the base case for the realistic peak in the UK capital requirement for life insurers[198]. If the horizon is more or less than one year, it should be rescaled to 1 year based on Equation 11.

As mentioned, the maturity adjustment formula presented in Equation 11 is rather crude and may not be representative of the true behaviour of the underlying risk factors in all cases. Especially for longer maturities risk allowances may be overstated. For the same reason, the maturity-adjusted capital formulas for banks under Basel II set a maximum maturity of 5 years[199]. However, Basel II regulations are to some degree, and especially in this point, the result of political compromises. Thus, a maturity floor is too crude for the purpose of embedded value financing. Therefore, an approach smoothed over time based on own estimations is proposed:

$$\textit{Equation 23: } RA_t = RA_1 * \ddot{O}\,t'$$

with   t' $= t - 2 * t^2 /100$

This results in the following effective time parameters (Table 8):

Maturity (t) in years	Adjusted maturity (t') in years	Maturity adjustment factor ($\sqrt{t'}$)
2	1.9	1.4
3	2.8	1.7
4	3.6	1.9
5	4.5	2.1
6	5.3	2.3
7	6.0	2.5
8	6.7	2.6
10	8.0	2.8
12	9.1	3.0
15	10.5	3.2

Table 8: Time parameters in calculating maturity adjustments

When the smoothed maturity adaptation (Equation 23) is used, the same formula should also be used for rescaling multi-period risk allowances to the one-year risk allowances where those

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[198] See section 3.2.2.

[199] This refers to the advanced approach under the internal rating based approach. Cf. Basel Committee on Banking Supervision (2004), para 272 and 320.

were considered more appropriate. This regards the risk allowances for default risk, mortality and the own credit risk of the originating insurer[200].

5.5 Accounting for residual risk

The quantification of the risk allowances is subject to modelling risk also on the part of the bank itself due to the vagueness of the parameters used and the data available on the various risk categories. While modelling risk is considered the most important category, other risks not accounted for elsewhere should be taken account of here, too. A risk mapping[201] methodology is proposed.

In a first step a five-grade evaluation scale is set up based on materiality and individual modelling risk in the specific case to be analysed (see Table 9). It may make sense to integrate on this basis also the modelling risk of the embedded value disclosed [202]. Table 3 in section 3.5.1 is the starting point for this methodology, which is supplemented by the findings of sections 4.2 and 5.2. Weights for the impact of modelling risk are proposed based on a subjective evaluation of importance and a standard scale of 5 grades with very low = 0,5, low = 1, medium = 2, high = 3 and very high = 5. As mentioned before, the specifics of each block of insurances to be lent against depend on business, asset and product mix and other factors, so that there should be some discretion to the analyst with regard to the weights. Based on present practice in the UK and the first EEV disclosures[203] and the vagueness of the EEV Principles for financial guarantees and options the highest modelling risk is seen in this area, when no market consistent embedded value techniques are applied in this particular area. This may however be less material depending on the product mix. Modelling risk in determining the required capital is considered low due to the fact that different risk capital is compensated by higher free surplus. Additionally, the risk discount rate (ideally) also reflects the riskiness of the profits after taking the volume of risk capital into account.

In a second step the analyst should evaluate the residual risk inherent in the individual modelling strategies of the originating insurer and in determining the bankable embedded value and the unexpected risk allowances. The same scale as above is proposed here, too.

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[200] See Equation 16, Equation 18 and Equation 21.

[201] Risk maps are often suggested for ranking risks with dominantly qualitative characteristics. For a theoretical overview see Darlington et al. (2001), p. 18.

[202] See section 4.2.

[203] See footnotes 114 and 117.

Type of residual risk	Area of calculation flexibility or other residual risk	Weights for impact of residual risk (w_i)	Degree of residual risk identified (rr_i)
Modelling risk in disclosed EEV, e.g. evaluation of <u>expected</u> components *(refer to section 3.5.1):* *Evaluate only <u>residual</u> modelling risk, e.g. after eventual adaptations as discussed in section 4.2*	Determination of required capital	Low (1)	
	Delineation between new business and renewal business	Low (1)	
	Estimation of profit components	Medium (2)	
	Estimation of discount rate a) when top-down approach is selected b) when bottom-up approach is selected	Medium (2) Low (1)	
	Treatment of financial options and guarantees	High (3)	
	Additional available data for embedded value sensitivities	Very high (5)	
Other modelling risk in bankable EEV *(refer to section 4.2)* *Only evaluate components, not included in modelling risk in disclosed EEV*	Modelling risk in eventual adjustment for discount rate, double taxation effect, put option and other	Low (2)	
Modelling risks in accounting for <u>un</u>expected risks in … *Evaluate only <u>residual</u> modelling risk, e.g. those not accounted for or arising from adaptations in section 5.2*	… investment return risk	Very low (0.5)	
	… surrender or persistency risk	Low (1)	
	… mortality risk	Low (1)	
	… longevity risk	Medium (2)	
	… expense inflation risk	Low (1)	
	… credit risk	Very low (0,5)	
	… adverse selection risk	Low (1)	
	… embedded guarantee and option risk	Very high (5)	
	… liquidity risk	Very low (0,5)	
Other	Pool concentration by biometric characteristics	Medium (2)	
	specify	*specify*	
Total		**S w_i**	**S w_i * rr_i**

Table 9: Accounting for modelling and other residual risk

In a third step the total allowance for modelling and other residual risk (MR) has to be determined as a percentage of the maximum lending amount calculated so far, e.g. bankable embedded value less risk allowances plus eventual bonuses for diversification. In any case MR should be in line with the risk allowances applied before, especially the selected confidence level, in order to avoid double counting of risk elements and undue misstatement of residual risk. Thus, MR should be a multiple of the confidence level selected before. Due to the fat tail problem and modelling and residual risks not accounted for, e.g. when the reported EEV is more traditionally oriented and thus less market consistent,

$$\textit{Equation 24: } MR = 2 * (1 - CL)$$

is proposed, with CL = confidence level in decimals. Thus, based on a confidence level of 95 % or 0.95 MR is 0.10 or 10 % of the maximum lending amount before residual risk allowance. The determination of the fat tail factor 2 in Equation 24 should also depend on the risk preferences of the lender. In view of the fat tail problem and residual risks difficult to identify at all, factors of 3 or 4 could also be justified.

In a fourth step weights (w_i) and risk factors (r_i) should be multiplied. The total sum $\Sigma \ w_i \ * rr_i$ then has to be set into relationship to the total residual risk possible. The latter is the sum of the weights multiplied with the maximum risk factors possible (e.g. $\Sigma \ w_i \ * rr_i^{max}$ with $rr_i^{max} = 5$ in all instances):

$$\textit{Equation 25: } q \ = \ \textbf{\textit{S}} \, w_i \ * rr_i \ * 100 \, / \, \textbf{\textit{S}} \, w_i \ * rr_i^{max}$$

Thus, q is a simplified value of residual risk in a specific transaction in decimals of total residual risk possible. The total residual risk possible is then set equal to the allowance of modelling and residual risk MR:

$$\textit{Equation 26: } MR = \ \textbf{\textit{S}} \, w_i \ * rr_i^{max}$$

Multiplying the maximum charge for residual risk MR with q results in the individual charge for residual risk (ICR) in % of the maximum lending amount before residual risk allowance:

$$\textit{Equation 27: } ICR = MR * q$$

Suppose for example a maximum lending amount before residual risk allowance of €100m, MR of 10 % and a q of 0.45 based on the evaluation of the residual risk components. This yields an ICR of 4.5 % or €4.5m.

5.6 A comprehensive modelling framework

The preceding chapter and sections have outlined a modelling approach which takes account of the various risks to be encountered in determining the lending amount in embedded value financing. Table 10 gives an overview of the modelling framework:
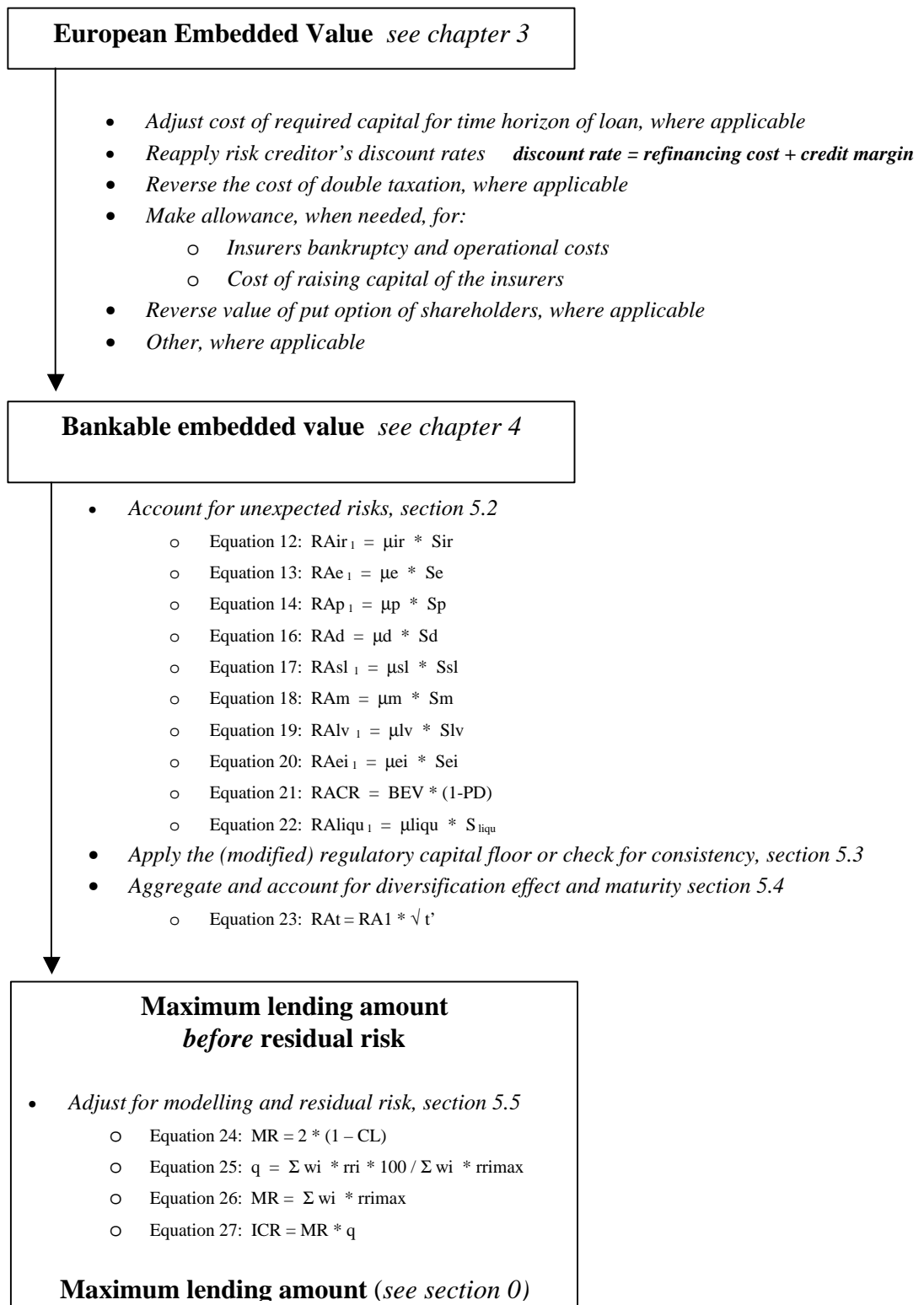
<div style="border:1px solid;">

European Embedded Value *see chapter 3*

</div>

- *Adjust cost of required capital for time horizon of loan, where applicable*
- *Reapply risk creditor's discount rates* **discount rate = refinancing cost + credit margin**
- *Reverse the cost of double taxation, where applicable*
- *Make allowance, when needed, for:*
    - *Insurers bankruptcy and operational costs*
    - *Cost of raising capital of the insurers*
- *Reverse value of put option of shareholders, where applicable*
- *Other, where applicable*

<div style="border:1px solid;">

Bankable embedded value *see chapter 4*

</div>

- *Account for unexpected risks, section 5.2*
    - Equation 12: $RAir_1 = \mu ir * Sir$
    - Equation 13: $RAe_1 = \mu e * Se$
    - Equation 14: $RAp_1 = \mu p * Sp$
    - Equation 16: $RAd = \mu d * Sd$
    - Equation 17: $RAsl_1 = \mu sl * Ssl$
    - Equation 18: $RAm = \mu m * Sm$
    - Equation 19: $RAlv_1 = \mu lv * Slv$
    - Equation 20: $RAei_1 = \mu ei * Sei$
    - Equation 21: $RACR = BEV * (1-PD)$
    - Equation 22: $RAliqu_1 = \mu liqu * S_{liqu}$
- *Apply the (modified) regulatory capital floor or check for consistency, section 5.3*
- *Aggregate and account for diversification effect and maturity section 5.4*
    - Equation 23: $RAt = RA1 * \sqrt{t'}$

<div style="border:1px solid;">

Maximum lending amount
before **residual risk**

- *Adjust for modelling and residual risk, section 5.5*
    - Equation 24: $MR = 2 * (1 - CL)$
    - Equation 25: $q = \Sigma wi * rri * 100 / \Sigma wi * rrimax$
    - Equation 26: $MR = \Sigma wi * rrimax$
    - Equation 27: $ICR = MR * q$

Maximum lending amount (*see section 0*)

</div>

Table 10: The comprehensive framework

The various discussions gave an idea of the remaining uncertainty in determining the various parameters. Several means to integrate prudence were presented, e.g. by

- converting EEV figures to BEV figures

- prudently estimating the shock parameters and/or setting confidence levels

- applying an (eventually modified) regulatory capital floor and

- applying the modelling risk allowance.

The main challenge will be an optimal mix of the various means proposed in order to avoid excessive risk on the side of the lender, but also not to distort unnecessarily the maximum amount lending by double counting. Due to the crudeness of the confidence level conversion formula in view of the "fat tail problem" of probability distributions, the recommendation is reiterated to choose confidence levels not too high, but to take account of residual risk qualitatively. All shocks should be converted to the same confidence level before applying the residual risk charge. Based on available data quality we believe a confidence level of 95 % is adequate given available data quality. The fat tail factor in Equation 24 should take account of the volume of diversification effects considered before.

In contrast to other areas of financing, such as real estate finance the financing of embedded values is still in its infancy and thus does require much more subjective evaluation than standard financing areas do. Therefore the credit analyst should not only carefully evaluate the parameters in themselves, but weigh them carefully in line of the various options of the modelling framework proposed. In this he should focus not only on the various calculation steps but also on the modelling process and its result as a whole.

6 Conclusion

This working paper presented the European Embedded Value as reporting instrument as proposed by the CFO Forum as basis for determining a bankable embedded value. The EEV Principles do not result in a single result, but provide a range of different values based on various methodologies and assumptions acceptable. Furthermore, the EEV do not exclude the newly upcoming market-consistent embedded value concepts.

A methodology is proposed to derive a maximum lending amount from EEV figures without much additional data requirements from the originating insurer. It is similar to other financing areas, e.g. real estate finance, where first a prudent valuation is done and later risk deductions are performed in the form of applying loan to value ratios, e.g. 60-80 % of the prudent amount. Here, the prudent value is called bankable embedded value and the loan to value analysis leads to the maximum lending amount. Here, however, based on the relatively new state of the market the range of possible "prudent values" is much larger.

The methodology is based on parameter adjustments and risk allowances for unexpected risks. For lenders' analysis of the unexpected risks there is an analogy with insurers for determining their own capital needs. Here, two approaches are available:

- the stress test (or risk capital margin plus) approach and

- the stochastic approach.

The latter is considered the benchmark approach as it better takes account of the probabilities of the various risks to materialize and the correlations between them. However, due to the very high confidence levels required it may be doubted that the most often used normal distribution reflects adequately the risk in the tails of the distribution. Due to the fat tail problem risks are understated.

While data availability may be a concern for life insurers, it is even more so for lenders. For this reason a methodology is proposed which is more akin to the stress test method. What is not quantifiable is captured by a risk mapping procedure which naturally is prone to some subjectivity. The goal here is to obtain an approximation of the residual risks where more objective estimation is not possible at the current state of development.

The methodology suggested is quite flexible and thus can be used for a diversity of life insurance blocks with different business profiles, e.g. in terms of age, sex, policy type and country. However, the methodology should not be used as a black box formula. The credit analyst has to be aware of the various modelling options and their interrelationships – as well as the underlying assumptions – and make use of them in an appropriate way in view of the available data in each individual case. The more restrictive the available data base and thus the underlying assumptions, the higher the risk discount for residual risks should be in order to avoid failures of embedded value financing deals in the future. As in other cases of market innovations modelling is always to some degree a trial and error process which goes hand in hand with market maturation[204] and the embedded value financing market is still in its infancy today.

Further areas of research should be directed to the correlations between the various risk categories, the quantification of risks which currently cannot be estimated reliably (e.g. from financial guarantees and options) as well as the calibration of the methodology proposed to market data. This, however, requires further development of the embedded value financing market beforehand.

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[204] The market for embedded value financing is not safe from this typical evolutionary behaviour of the modelling process. Due to data and modelling constraints the first deal in the market, originated in 1998, experienced difficulties by underestimation of inherent risks. This was principally misestimation of surrender risk (see footnote 165) and of risks resulting from embedded financial guarantees within an adverse interest rate environment. Cf. Parsons (2004), pp. 51-52.

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