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Measuring and Ranking Value Drivers

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Measuring and Ranking Value Drivers:
A Shareholder Value Perspective

Mehari Mekonnen Akalu[†]

Abstract

Analysis of the strength of value drivers is crucial to understand their influence in the process of free cash flow generation. The paper addresses the issue of value driver measurement and ranking. The research reveals that, value drivers have similar pattern across industries. Furthermore, it is found that the effect of operating cost and interest expenses, on free cash flow, is much more important than sales (revenue).

Key words: Free cash flow, Value Management Techniques, Shareholder Value Analysis, Value drivers, Performance measurements, Sensitivity analysis.

1. Introduction

1.1 Background

A number of methods are available to measure the value of a firm or a project (Akalu, 2001; Remer and Nieto, 1995a, 1995b). In 1980s, the seminal work of Alfred Rappaport opens another approach to value measurement. It is called shareholder value analysis, SVA (Rappaport, 1986). The approach argues and utilizes discounted cash flow technique to evaluate future benefits and costs. The method can be used to mark the changes in the value of a business or a project over a period of time.

As most of the theories of finance and economics, the SVA is also based on a number of assumptions. In this regard, the firm is assumed to identify true value creating activities in its operation. Long-range time horizon, the time value of money, risk-return analysis and consistent capital mix are fundamental assumptions of the model (Ruhl and Cowen, 1990; Devlin, 1989).

Numerous advantages are associated with the application of shareholder value (SV) approach. Shareholder value is consistent with value maximizing objective of a firm and to the objectives of managers. It facilitates better resource allocation and prevents from mere growth without profitability. It provides a good base for executive compensation, which further aligns owner-manager goals (Rappaport, 1998; Myhran, 1993). It can be used as a strategy for firms and individual business units (Salter and Zwirlein, 1992). Moreover, SV is also regarded as a prime goal for firms (Balachandran, *et al*, 1986). Shareholder value helps

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to identify the sources of value creation and destruction (Arzac, 1986). The method is not only strengthens the planning and forecasting capacity of a firm, but also minimizes value gaps between incoming and outgoing CEOs of a firm (Barfield, 1991).

Recent studies show a shift in the attitude of companies from traditional valuation to the shareholder value approach both as an objective and as a tool of valuation. More than fifteen years have passed since most American firms began to apply shareholder value as a central mission of corporate strategy (Rice, 1996). In addition, a survey conducted by Philip (1998), for Canadian Chartered Accountants and Financial Executives, reveals that 90% of the companies participated in the survey specifically stated that they use shareholder value as an objective and as a means of both internal and external communication. In the academics, researches focused on the linkage and evaluations of R&D project to shareholder value are examples of SVA's continued momentum (Boer, 1994; Kelm, *et al*, 1995).

1.2 Value Drivers

The SV approach is centered on a number of value drivers. The term *value driver* is coined for those economic variables that are critical to revenue and cost functions of a firm. Researchers vary as to the number of these value drivers; for instance, five (Ruhl and Cowen, 1990), six (Moskowitz, 1988), and seven (Rappaport, 1998; Mills and Print, 1995; Mills, *et al*, 1992). Turner (1998) has identified eight value drivers. These are: sales growth rate, operating profit margin, income tax rate, incremental investment in working capital, incremental investment in fixed capital, replacement of fixed capital, cost of financing (cost of capital) and forecast duration (the planning period).

The sales growth rate, the rate of profit margin and the cash tax rate are used to determine the net cash inflow of a firm. Fixed and working capital increments added with replacement of fixed cost of investment form the total cost of investment. The difference between the net cash inflows and cost of investment gives the free cash flow of a company. A defined planning period and an appropriate discount rate are also required to compute the net benefit. By adding the market value of temporary investments, the value of the firm will be obtained. Finally, the value of shareholders can be found by deducting the market value of external financing from the total value of the firm.

An area of interest in the shareholder value approach is the sensitivity of free cash flows to the value drivers. This sensitivity analysis may help to rank the value drivers according to their degree of influence on cash flows of a firm. In addition, the understanding of such sensitivity greatly assists the management in credit analysis, cost restructuring, profit planning and other operating activities. A limited number of researches have been done to investigate the sensitivity of value drivers. Balchandran, *et al*, (1986) have made a sensitivity analysis taking no growth, growth and inflation situations of a firm. By deriving the value drivers from accounting ratios, Turner (1998) has shown the impact of time, cost and functionality on the performance of projects.

Value drivers of a firm are generic in a sense that they can further be decomposed into smaller components. For instance, sales growth may be obtained by increasing sales price, diversifying the sales mix, increasing the sales volume (by increasing production) and etc. In addition, profit margin is easily adjustable by changing the cost structure of the firm; for instance, the reduction in labor cost may reduce the total direct cost of sales; and, hence, increase the magnitude of profit margin. Such decomposition will assist managers to identify the most critical factors, among the sub elements of the value drivers, in the process of maximizing SV. Thus, the sensitivity study of such sub elements further enhances the importance of the analysis of value drivers from the grass root level.

1.3 Objectives

The objective of this paper is to measure the degree of influence of value drivers in the process of generating firm's free cash flow. In addition, it tries to compare the strength of value drivers across industries.

The paper is organized as follows. The second section is about the data and empirical model specification. Analysis of the result will be dealt in section three. Section four concludes the paper.

2. Methodology

2.1 Data

Twenty-two Dutch Public Limited companies (*Naamloze Vennootschap*, *N.V*), operating in manufacturing sector, are considered for the study[1]. The data covers the period from 1 January 1994 to 31 December 1999. In order to smooth out the size difference among companies, all value drivers are computed per total asset basis. The industry grouping of companies is presented in Table 1.

Table 1: Samples by Industry

Industry	Number of Companies
Chemicals	3
Constructions	3
Electronics	2
Food	4
Machinery & Equip.	5
Printing and Publishing	2
Others	3
Total	22

The sample companies are among the largest corporate entities in the Netherlands. They represent about 53% of the total industry labour force and 11% of the total country's employed workforce (OECD, 2000). Additional information is given in Table 2.

Table 2: Year ending 1999
($ Billion)

Market capitalisation	329.43
Assets	186.37
Sales/Revenue	191.4
EAIT[2]	19.56
Number of Employees	852,636

2.2 Model Specification

[1]Financial data is obtained from Henley Management College e-database, which consists of company annual reports and market information (accessed in February 2001). List of companies are available on request.
[2]Earning After Interest and Taxes.

In order to investigate the effect of value drivers on companies' free cash flow, both within cross sections and across time, a panel data analysis is chosen. It is argued that this method can provide more information on variability and efficiency as compared to time series (Baltagi, 1995, p. 4). Accordingly, four alternative panel models are specified. The first model is the Ordinary Least Square (OLS), which can be specified by assuming common intercept and common slope for all cross-sections and for all time periods. The basic regression model is given by:

$$[1] \qquad FCF_{i,t} = \alpha + \beta_1 NSL_{i,t} + \beta_2 OPC_{i,t} + \beta_3 IEX_{i,t} + \beta_4 ITX_{i,t} + \beta_5 FCI_{i,t} + \beta_6 RCI_{i,t} + \beta_7 WCI_{i,t} + \varepsilon_{i,t}$$

Where FCF, NSL, OPC, IEX, ITX, FCI, RCI and WCI are the free cash flow, net sales, operating cost, interest expense on long term debt, income taxes, fixed cost of investment, replacement cost of investment and working capital investment (k x 1 vector explanatory variables) respectively. And α (k x 1 vector) is the constant term, while β (k x 1 vector) denotes the coefficients of the respective value drivers. ε, i (i=1, …N) and t (t=1, …T) denotes the disturbance term, the individual company and the time respectively. The computation technique of the above variables is presented in the appendix.

In specifying Equation [1], the disturbance term (ε) is considered to be white noise ($0,\sigma^2\varepsilon$) and no correlation with the independent variables is assumed. With this in view, the OLS estimation produces the result as shown in Table 3 (t-values are given in brackets)[3].

The regression result shows significant positive relationship between free cash flow and sales value, which is the major source of cash to many companies. On the other hand, the relationship between free cash flow and cost of operation and cost of investments are also taking their expected, negative, relationship. In terms of magnitude, however, the effect of income tax is higher as compared to other value drivers.

With a very similar premises to equation [1], but based on the average values across the cross-section, a mean value model can also be specified (Pindyck and Rubinfeld, 1998, p. 256). The average pooled model is given by:

$$[2] \qquad \overline{FCF}_i = \alpha + \beta_1 \overline{NSL}_i + \beta_2 \overline{OPC}_i + \beta_3 \overline{IEX}_i + \beta_4 \overline{ITX}_i + \beta_5 \overline{FCI}_i + \beta_6 \overline{RCI}_i + \beta_7 \overline{WCI}_i + \varepsilon_i$$

Note that average values (variables with upper bar) are found by taking the mean of the variables. The regression result is depicted in Table 3.

Referring to Table 3 mean OLS, sales, operating cost and working capital maintain their previous sign. However, the coefficients have shown greater size as compared to the initial result. Since the model doesn't allow firm specific differences, it is likely to over estimates the coefficients of value drivers.

The sample companies are heterogeneous in size, year of establishment and type of product. The model specification used in equation [1] and [2], therefore, can't reveal such firm specific behaviours. In addition, the assumption of constant intercept and slope across all firms may not be reasonable for such heterogeneity. One way of approaching this problem is to allow the intercept to vary over time and over cross-sections by adding dummy variables to the model. Such a model is known as the fixed effect model. The fixed-effect model is specified as follows (for detail specification see Baltagi, 1995, p. 11):

$$[3] \qquad FCF_{i,t} = \beta_1 NSL_{i,t} + \beta_2 OPC_{i,t} + \beta_3 IEX_{i,t} + \beta_4 ITX_{i,t} + \beta_5 FCI_{i,t} + \beta_6 RCI_{i,t} + \beta_7 WCI_{i,t} + \varepsilon_{i,t}$$

[3]The table contains the value of all specified models.

Where;

$$[3a] \quad \varepsilon_{i,t} = \mu_i + \nu_{i,t}$$

In the above equations [3a], μ_i is assumed to be a fixed parameter to be estimated along with other variables, and $v_{i,t}$ is assumed stochastic with i.i.d $(0,\sigma^2 v)$ behaviour. Furthermore, all explanatory variables are assumed to be independent with the $v_{i,t}$ for all i and t. Rearranging the above equations, the fixed-effect model will take the following form:

$$[4] \quad FCF_{i,t} = \beta_1 NSL_{i,t} + \beta_2 OPC_{i,t} + \beta_3 IEX_{i,t} + \beta_4 ITX_{i,t} + \beta_5 FCI_{i,t} + \beta_6 RCI_{i,t} + \beta_7 WCI_{i,t} + \mu_i + v_{i,t}$$

In this model, the effect of income tax, working capital and replacement costs are pronounced. However, the positive sign of interest expense is somewhat unusual, as it doesn’t have a direct positive effect on free cash flows. In the fixed effect model, addition of dummy variable may imply scarcity of information on the specific behaviour of firms; thus, it is natural to associate this information gap through the disturbance term. In order to explain such issue, we might choose a pooled cross-section and time series model in which error terms may be correlated across time and individual units. This model is what is called the random effect or error component model. It is specified as follows:

$$[5] \quad FCF_{i,t} = \alpha + \beta_1 NSL_{i,t} + \beta_2 OPC_{i,t} + \beta_3 IEX_{i,t} + \beta_4 ITX_{i,t} + \beta_5 FCI_{i,t} + \beta_6 RCI_{i,t} + \beta_7 WCI_{i,t} + \varepsilon_{i,t}$$

Where;

$$[5a] \quad \varepsilon_{i,t} = \mu_i + \nu_i + w_{i,t}$$

In the above specification [5], the disturbance term is dissected into three [5a]: the cross-section part (μ), the time series part (v) and the part of combined error (w). The random effect model result is also similar to that of the fixed effect model, with income tax and interest expense having positive relationship to free cash flows (Table 3).

So which model best captures the data? The choice between fixed-effect (the covariance) and random-effect (the error component) model is based on the nature of the data and on results of statistical tests. In the fixed-effect model, the emphasis is on separate intercept term for each cross-section, while in the random-effect model, the specific characteristic is normally distributed as a random variable. Previous studies on the use of panel model have indicated some clues on how to use fixed or random effect models. Chakraborty, *et al*, (2000) argue that if the data exhaustively lists the population under investigation, fixed effect model is preferable as it produces results based on the size of the data. In addition, Baltagi (1995) found it appropriate to use the fixed effect model if the study focuses on specific set of firms. Furthermore, statistical tests can also help to differentiate between the uses of fixed or random effect models.

Table 3: Regression Results

Coefficients	Models			
	OLS	Mean OLS	Fixed-Effect	Random-Effect
α	0.05(2.33)	-0.03(-0.35)*	…	0.06(2.02)*
β_1 (NSL)	0.03(0.41)	0.06(0.21) *	0.02(0.79)*	0.02(0.59)*
β_2 (OPC)	-0.06(-0.73)*	-0.08(-0.25) *	-0.01(-0.23)*	-0.02(-0.42)*
β_3 (IEX)	0.26(0.65)	1.00(0.83) *	0.26(0.77)*	0.14(0.29)
β_4 (ITX)	1.28(4.35)	2.43(1.57) *	1.15(7.29)	1.19(5.57)
β_5 (FCI)	-0.66(-5.01)	1.33(0.93) *	-0.84(-9.65)	-0.83(-11.4)
β_6 (RCI)	0.23(0.72)*	0.98(0.65) *	-0.92(-2.78) *	-0.61(-1.52)*
β_7 (WCI)	-0.96(-19.5)	-1.55(-3.50) *	-0.94(-27.4)	-0.94(-27.5)

*Significant at 5%

2.3 Tests

Scholars have applied various tests to discriminate and validate panel models. The most common tests are the test for homogeneity of slops and intercepts, test for homogeneity of slops, and test of equality among intercepts (Hsiao, 1986). In addition, Chakraborty, *et al,* (2000) applies three procedures to test the panel model: (a) general test for heteroskedasticiy & autocorrelation; (b) test on groupwise heteroskedasticiy & cross-sectional correlation; and (c) test on groupwise heteroskedasticiy & cross-sectional correlation with common autocorrelation. On the other hand, Baltagi (1995) classifies panel model tests into poolability (for individual and time effects) and the Hausman specification tests. In this paper, the following tests are performed.

(a) Testing for fixed effects

This is a joint test for the dummies of the fixed effect model. The null hypothesis of this test is the equality of coefficients; i.e., $\mu_1 = \mu_2 \ldots = \mu_{N-1} = 0$. The F-statistic is computed by comparing the OLS and fixed effect models as suggested by Baltagi (1995, p. 12). Accordingly, hypothesis is rejected at 5% significant level[4]. Thus, the test confirms the presence of firm specific behaviour, which can't be picked up by the OLS models.

(b) Hausman specification test

Various empirical works in panel data compare fixed and random effect models by performing validity test between the regressors and their specific effects (Rhoads and Gerking, 2000; Chakaborty, *et al,* 2000; Dessus and Herrera, 2000). The most common test for such purpose is the Hausman specification test. The Hausman statistic is computed based on fixed verses random effect models as suggested by Baltagi (1995) and Mateyas and Sevestre (1996). The model is checked against the Hausman specification test and the resulting chi-square statistics (98.49) is not significant at 5% level[5]. Hence, we don't reject the null hypothesis of no correlation between individual specific effects and explanatory. In

[4] $F_{N-1, N(T-1)-K}$ at 5% is 1.52. F-statistic, 40.94.

[5] χ^2 Distribution critical values, at 5%, with 7 degree of freedom is 2.17.

such circumstances, Mateyas and Sevestre (1996, p. 112) argue that the fixed effect model is consistent and efficient.

3. Analysis

Using the fixed effect model, the data is analysed at two different levels. The first is based on the whole sample irrespective of their industrial groupings, which helps to identify the effects of value drivers on the total samples. In the second part, the sample is decomposed into industry groupings. Although the number of companies in each industry is small, such analysis may provide some clues as how the value driver ranking is different (similar) from (to) the aggregate.

3.1 Aggregate

In the aggregate, the most critical determinants of company free cash flow show the expected sign of relationship (Table 3). However, the effect of income tax is higher than other value drivers. With regard to the effects of investment costs, cost of working capital is taking the lead. The working capital account (in the balance sheet) of manufacturing companies contains three distinct inventories: raw material finished goods and working-in-progress inventories. Thus, it is logical that the amount of money tied by the working capital will have significant influence on free cash flows. Then, followed by the replacement cost of investment and incremental fixed cost of investment. It should be noted that the annual depreciation is the proxy to the amount of investment to replace the existing infrastructure. Since depreciation is computed using various accounting techniques, this estimate may contain some arbitrariness.

The effect of operating cost is smaller in the determination of free cash flows, which is contrary to what we normally assume. That is, manufacturing companies have a huge amount of operating cost and it is the most susceptible variable for price fluctuation and inflation. Similarly, the magnitude of net sales is not so big as compared to other value drivers. This is contrary to the findings of Court and Loch (1999), in which sales value is the number one value driver. In addition, sales value has also been regarded as the first driver in company value creation (Mills, 1998, p.25).

An attempt is also made to see the effect of exogenous variable on free cash flows and if it causes a change in the parameter values of the drivers. The exogenous value driver chosen is the market capitalisation. The regression result shows a strong positive relationship between market capitalisation and free cash flow of a company and there is no effect on the previous results. This is true that the variable contains the perception of investors who provide fresh cash to companies with anticipation of profitable projects.

3.2 Industry

It is also important to see whether the above value driver rankings are stable as we decompose the pool into separate industries. For such analysis the chemical, food and machinery & equipment industries are considered.

i. Chemicals

According to their primary activity, three companies are considered that are engaged in the production, distribution and sale of chemical products. The regression result is depicted in Table 4.

In terms of magnitude, the income tax effect is higher than any value driver. And followed by operating costs and sales value. The effects of interest expense on long-term loan and replacement cost of investment are also significant although week in their coefficients. In addition, interest expense and fixed cost of investment have shown a different sign than the usually assumed (Table 4).

ii. Food processing

Similarly, four companies are taken in from this category. The result of this industry is more or less similar to the previous one with regard to rankings. Thus, interest expense is followed by income tax and operating costs.

iii. Machinery & Equipment

The metal, machinery and equipment industry produces machinery and equipment for other industries. This is the heavy industry group in terms of production complexity. In this industry, five companies are considered for analysis. In these companies, the effect of income tax is much more pronounced, and is followed by interest expense on debt. Operating cost and net sales have shown the same value diver strength (Table 4).

In summary, the rankings of the aggregate and the individual industries are not identical. However, there are similarities in the position of value drivers. And this similarity is even much more common across industries. In over all analysis, income tax is taking the first or second rank among the group. As this variable is out of the control of company managers, it has less importance for managerial decision-making. If we take out the income tax, value drivers related with the cost of investment are placed between 3rd and 6th ranks among the group. The four most important value drivers are: interest expense on debt, the operating cost, sales, and replacement cost of capital. Table 5 portrays the rankings of the value drivers based on their coefficient magnitude.

Table 4: Industry analysis

Coefficients	Chemicals	Food	Mach. & Equip.
β_1 (NSL)	2.65(2.3)*	1.29(5.9)	1.07(18.1)
β_2 (OPC)	-2.76(-2.2) *	-1.31(-5.7)	-1.07(-17.9)
β_3 (IEX)	0.03(0.01) *	-2.30(-1.9)^	-1.16(-10.0)
β_4 (ITX)	-3.30(-1.8) *	-1.72(-3.0)^	-1.23(-6.5)
β_5 (FCI)	0.02(0.1) *	-0.99(-37.5)	-1.02(-48.9)
β_6 (RCI)	-0.63(-0.3) *	-1.17(-2.2)^	-0.72(-3.2)^
β_7 (WCI)	-0.52(-2.3) *	-0.95(-20.5)	-0.99(-107.8)

* Significant at 5%, ^ significant at 1%,

4. Discussions

This empirical work is an attempt to evaluate the sensitivity of value drivers to free cash flows based on the theory of shareholder value analysis. Panel models are considered in an effort to incorporate firms' specific behaviour into the analysis. Statistical tests are employed to check the validity of the models. Accordingly, all tests favor the fixed-effect model, which is also in line with the theoretical justifications for such type of sample and data structure (Baltagi, 1995; Rhoads and Gerking, 2000).

The sample data, which contains 924 observations, is regressed using the fixed-effect model. From this estimate, the effect of income tax is found strong although the variable is out of the control of company managers. However, investments cost related value drivers are comparatively small. In addition, the sales value has got a lower overall rank (between 3rd and 6th) among the value drivers. Market capitalisation, an exogenous variable, is also added to see its effect on free cash flow. The result reveals the presence of positive and strong relationship with free cash flow.

Table 5: Value Drivers Rankings

Value Driver	Total	Industry Ranks		
		Chem.	Food	Mach. & Equip.
NSL	6	3	4	3
OPC	7	2	3	4
IEX	5	7	1	2
FCI	4	6	6	5
RCI	3	4	5	7
WCI	2	5	7	6
ITX	1	1	2	1

In order to investigate the ranking difference among industries, a separate analysis is made for chemical, food and Machinery & Equipment industries. There are small variations in the order of value drivers. However, in overall rankings, the income tax, interest expenses, operating cost and net sales are found important.

Thus, in order to boost the cash flow potential of a company, increasing sales is not only the solution. That is, the effect of operating costs and interest expense (capital structure) on debt materially affects the cash flow generating processes. According to this study, the effect of operating cost and interest is much more important than sales.

Appendix

Computation of free cash flow

FCF = NSL-OPC-ITX-IEX-FCI-RCI-WCI

FCI Computed by taking the yearly changes in the net balances of property, plant and equipment.

IEX Annual interest expenses on debt.

ITX Periodic cash income tax.

NSL Gross sales less sales returns, allowances and discounts.

OPC All cash costs, which includes cost of goods sold (without depletion, depreciation and amortisation) and administration costs.

RCI The annual depreciation and amortisation is used as a proxy for replacement of the existing fixed investment.

WCI Computed by taking the yearly changes in the balances of net working capital (That is current asset less current liabilities). Note that, the sum of FCI, RCI and WCI gives the total cost of investment.

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