Using VAR to Determine the Value of a Company

SÁNDOR BOZSIK, Ph.D. – JUDIT SZEMÁN
ASSOCIATE PROFESSOR ASSISTANT PROFESSOR

E-mail: pzbozsi@uni-miskolc.hu – pzszeman@uni-miskolc.hu

SUMMARY

This paper deals with one particular basic problem of discounted cash flow methods, and one of their possible solutions. the most accepted company evaluation method determines the market value of an enterprise to estimate the incremental cash flows from the operation (free cash flow), then to discount them with the weighted average cost of capital (WACC), which fits to the risk of the company operation. The problem occurs, when we should like to determine the weights for WACC calculation, because theoretically these weights are the market value of capital elements – among them the market value of equity, so we should know the result before the calculation. This dilemma cannot be solved in the frame of discounted cash flow methods, therefore alternative company methods – first of all – the option pricing model – emerged. However the application of option pricing models come together also with serious problems, that's why the authors offer another methods to solve the dilemma – the application of VAR methods. This method is presented by the case of Elmü Rt – which is the largest electricity utility in Hungary.

INTRODUCTION

The methods of the company valuation can be classified into 6 groups. (Fernandez, 2002; page 1): methods based on balance sheet, methods based on income statement, mixed methods, methods based on value creation capacity, methods based on option pricing and methods based on discounted cash flows. Theoretically those methods are „fair" among these, which are based on discounted cash flows, since these meet the general value principle, respectively „every asset's value is equal to the present value of their operating cash flows."

In equation: $GPV = \sum_{i=1}^{n} \frac{CF_i}{(1+r)^i}$

where, GPV – internal value of particular asset (Gross Present Value); CF_i – amount of Cash Flow i; r – hurdle rate adjusted by the risk of cash flows; n – life span of particular assets.

I only list the other methods, since these are not „fair" theoretically, but they are used in wide range due to the problems of discounted cash flow method discussed later. The calculation of these methods is simpler than the methods based on discounted cash flows.

The main groups of company evaluation and the major methods are shown the table 1.

Table 1. Overview of company evaluation methods

Based on balances sheet	Based on income statement	Mixed (Goodwill)	Value creation	Discounted cash flows	Option pricing
Book value Adjusted book value Liquidation value Market value	Sales multiplier P/EBITDA Other multiplier	Classic Adjusted profit Other	APV EVA Economic profit CFROI	Free cash flow Equity cash flow Dividend yield	Black and Scholes Investment options Enlargement option Investment delay option

(Source: Fernandez: page 2.)

WHAT ARE THE PURPOSES OF COMPANY EVALUATION?

The value of a company is not an objective one. The value is different for the buyer and the seller. There are several reasons, why the value of a company is willing to determine. The most important ones are the followings: (Wiesenrieder, 2002; page 10)

1. In case of takeover:
   - ➢ It tells the buyer, what the maximum price is for the company.
   - ➢ It tells the vendor, what the minimum selling price of the company is.
2. Valuation of registered companies:
   - ➢ The company value per share can be compared with the price of the share.
3. Share issues:
   - ➢ Determining the price of issued shares.
4. Transformation and liquidation
   - ➢ The book value of new company's assets mirrors the real value.
5. Applying incentives based on value creation
   - ➢ The appraisal of company or division is vital, if the managers are rewarded on the incremental value caused by them.
6. Determining the value drivers
   - ➢ The company evaluation model encourages identifying and optimizing the main value drivers.
7. In case of strategic decisions on company survival
   - ➢ The value appraisal precedes the decision on selling, amalgamating or taking over a company or merging with an other one.
8. In case of strategic planning:
   - ➢ The company evaluation is vital, if we make decisions, if we keep or liquidate a division.

Below we deal with the discounted cash flow methods, since these are in accordance with the general value equation. On the other hand, we need some benchmark to employ other evolutional methods, but the Hungarian economy offers rare opportunity for that due to its small size.

DISCOUNTED CASH FLOW METHODS

The common characteristic of these methods is to estimate the operating cash flows produced by the company in future and to discount them with the hurdle rate adjusted by the risk of that operating cash flows. In that view the company is a cash producing machine and the value of the company is equal of the present value of this cash stream. (Price Waterhouse, 1999; page 122)

The discounted cash flow methods are based on the detailed, careful estimation of that factors (sales, operating costs, change in working capital), which influence the cash flow. The determination of each item needs appropriate hurdle rate, that's why one of the most important tasks is to select this rate.

GENERAL APPROACH OF DISCOUNTED CASH FLOW

The various discounted cash flow methods begins with the following equation:

$$V = \sum_{i=1}^{n-1} \frac{CF_i}{(1+r)^i} + \frac{V_n}{(1+r)^n},$$

where V – value of the company; CF_i – operating cash flow of the company in year i; r – hurdle rate adjusted by the risk of operating cash flow; V_n – value of the company in year n.

However it seems to be in first sight, that the above equation considers the future stream of cash flow only in a certain period, this is not absolutely true, and since the scrap value of the company (V_n) can be calculated with the equation of perpetuities. Supposing an incremental perpetuity, we get the value of a company in year with the help of the following equation:

$$V_n = \frac{CF_n \cdot (1+g)}{r-g},$$

where V_n – scrap value of company; Cf_n – company operating cash flow in year n, r – hurdle rate; g – annual growth rate of operating cash flow.

The various discounted cash flow methods diverge, how they calculate the cash flow, the discounted cash flow and the scrap value.

IDENTIFYING THE APPROPRIATE CASH FLOW

The discounted cash flow methods define three cash flows. Their names and the related hurdle rates are shown by table 2.

Table 2. The company cash flows and the related hurdle rates

Cash flow	Hurdle rate
Free Cash Flow	Weighted Average Cost of Capital
Equity Cash Flow	Return On Equity (r_e)
Debt Cash Flow	Return on Debt (r_d)

The cash flow of debt is the annual debt service of liabilities (amortization and interest). To determine the present value of debt, we should discount the debt service with the return on debt – which is mostly the interest rate of debt. This method gives us the book value of debt in case of market rate debt. However the present value of debt is less than the book value, if the rate of debt is less,

than the market rate, thus it's create wealth for shareholders.
The managers are tending to enhance their company over their optimal size. The enlargement increases the power of managers, since it raises the scope of controllable resources. This enlargement is in strong correlation with the managers' salaries. (Murphy, 1985, page 16)
If the company hasn't got enough internal sources, to finance this enlargement, the managers often borrow the required cash. The borrowings increase the company capital leverage over the optimal level, which reduces the shareholders' value. An exact company evaluation helps to detect this agency problem and force the management to act for the benefit of shareholders.
So let's look, how the discounted cash flow methods measure the company wealth!

FREE CASH FLOW

Free cash flow is the incremental cash inflow, which the company produces after financing all investment opportunities with positive NPV. The free cash flow is a taxed cash income comes from the operation of company which excludes the effect of borrowings. This is the extra cash, which is available for the company after financing its investments in fixed assets and working capital, supposing, that the company is unlevered hence it hasn't got interest expenditure. The interest conflict between shareholders and managers is extremely strong, when the firm produces meaningful free cash flow. The managers always tend to keep the money to enlarge their power, while the shareholders want an extra return above their hurdle rate. How can we stimulate the managers to pay the cash as dividend and not to invest it below hurdle rate!

+ Net Sales, other revenues
- Cost of Sales
= Gros Contribution
- Overheads
- Other expenditures
+ Amortization of goodwill
= Earnings Before Interest Taxes and Amortisation (EBITA)
- Corporate Tax on EBITA
= Net Operating Profit Less Adjusted Taxes (NOPLAT)
+ Depreciation of operating fixed assets
± Change in working capital
- Operating investments
= Free Cash Flow (FCF)
- New investments
= Cash Flow before Financing

To calculate the free cash flow, we should forecast the amount of the cash inflow and cash outflow in certain periods. The financial accounting doesn't give us this value directly; as the accounting employs operating view, not cash one.
The deduction of free cash flow is shown by the enclosed Figures. We should clear the operating profit from the goodwill, as the goodwill is the amortization of market value, which we should determine. After the deduction of corporate tax from the operating profit enhanced with the amortization of goodwill, we get the net operating profit after taxes (NOPLAT), from which the expenditure devoted for supplemental investments should be deducted. The depreciation of operating assets should be added to NOPLAT. The final result is the free cash flow, which we discount. (Price Waterhouse, 1999; page 67)

THE METHODOLOGY OF COMPANY EVALUATION

In company evaluation we tried to set up the trend of company variables analyzing the five years actual figures. We have used the data from period between 1998 and 2002, as the last audited report at the paper preparation was the one of 2002.
We have chosen the following method to determining the free cash flow of the company:

1. We determined the main factors influencing the sales of Elmü. We worked on the basis of the customer segmentation presented by the firm's annual report. The Elmü committed the quantity and revenue from electricity sold to each segment. Based on this, we calculated the unit price applied in each segment. In the estimation of future sales we considered the trend of electricity sales to each segments, and the price increase as well. The unit price increased was determined to multiply the current unit price with the forecasted future inflation multiplier.
2. In case of bought electricity we multiplied the whole quantity with the future inflation multiplier. We don't consider that the state gives meaningful subsidy through the Hungarian Electricity Works and this subsidy should be canceled after the joining to the EC. Furthermore the entitled customers can choose another supplier after the liberalization. We supposed, that the electricity supplier can pass the price of purchased electricity to the consumers, so the price margin remains unchanged, furthermore the entitled consumers could be kept.
3. We forecast a staff reduction in the following years according to the detected trend in the five year data.
4. The other operating costs and the working capital were determined in the proportion of sales and we forecasted them with the help of last actual figures.
5. To forecast the depreciation, we needed the size of fixed assets and the average depreciation rate. We supposed a moderate increase in the depreciation rate, as the proportion of assets, which require quicker depreciation, will increase due to the result of investments in the information technology. We estimated the size of fixed assets in proportion of net sales supposing a moderate increase in asset turnover.

Table 3 contains the free cash flow of Elmü. 5 years' figures are fact, the remainders are budget. We have chosen the Elmü, because the forecast of big utilities may

cause the smallest problems, as the customer potential is given, which modifies the changes in technology and market to a minimal extent. However the planned liberalization and the free electricity purchases of entitled consumers can change this situation in future and the competition comes together with the volatility increase of free cash flow, thus with the increase of risk.

Table 3. The shape of Elmü free cash flow

Free Cash Flow	Actual					Budget								
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Operating Cash Flow														
NOPLAT	6 954	7 934	9 713	6 758	10 041	11 603	12 522	13 427	14 267	15 077	15 925	16 820	17 766	18 764
Depreciation	8 702	9 470	10 428	11 592	12 177	12 238	13 433	14 466	15 504	16 456	17 381	18 358	19 390	20 480
EBITDA	15 656	17 404	20 141	18 350	22 218	23 841	25 955	27 894	29 771	31 533	33 306	35 178	37 155	39 244
Increase in working capital	6 064	1 098	33	-2 302	5 521	358	310	311	285	277	293	310	327	345
Investments	-13 482	-14 250	-15 208	-16 372	-16 957	-17 018	-18 213	-19 246	-20 284	-21 236	-22 161	-23 138	-24 170	-25 260
Gros Investments	-7 418	-13 152	-15 175	-18 674	-11 436	-16 660	-17 903	-18 935	-19 999	-20 958	-21 868	-22 828	-23 843	-24 914
Free Cash Flow	8 238	4 252	4 966	-324	10 782	7 182	8 052	8 959	9 773	10 575	11 438	12 350	13 312	14 329

THE WEIGHTED AVERAGE COST OF CAPITAL

After estimating the future value of free cash flows, especially paying attention to the scrap value, we should find an appropriate discount rate, which is in direct proportion with to the their risk. The teaching book formula of discount rate determination is the weighted average cost of capital, whose calculation is made by the following equation:

$$WACC = r_e \cdot \frac{E}{D+E} + r_d \cdot \frac{D}{D+E}, \text{ where}$$

r_e – expected yield of equity;
r_d – expected yield of debt;
E – net market value of equity;
D – net market value of debt.

The calculation of expected yields is made by the following equation (considering the tax shield of interest expenditure.)

$$r_e = \frac{Div_0 \cdot (1+g)}{P_e} + g \quad \text{, where}$$
$$r_d = \frac{I \cdot (1-T_c)}{P_d}$$

Div0 – dividend paid in time 0 (thus now),
g – long term growth rate of dividend,
I – interest rate of debt,
T_c – corporate tax rate (or the tax advantage of debt over equity),
P_e – net market value of one share in proportion of its nominal value,
P_d – received amount of debt in proportion of its nominal value, or the net market value of bond in proportion of its nominal value.

If the capital markets are efficient, the expected yields of capital structure elements are risk adjusted, thus their average is the appropriate discount rate. However we meet difficulties calculating the WACC.

1. In case of capital elements calculation we should consider only the interest or dividend bearing sources, hence the non-interest bearing liabilities are deducted from the current assets. There is not clear answer, how to handle the short term loans, whose interest expense can be deducted from free cash flow or can be considered in the calculation of WACC. In the latter case the free cash flow shouldn't be deducted with the interest expenses of short term loan.
2. We shouldn't consider the book value of capital elements, as the investors expect return not for the book value, but the market value of debt and equity. The market value of equity is not available before calculating the market value of the company. But the company evaluation requires the WACC calculation – if we appraise the company based on discounted cash flows.
3. The calculation of market value of capital elements may happen with the help of CAPM model, however it requires, that the debt and equity of the company are registered in the Stock Exchange; furthermore the market of capital elements should be efficient. In that case there would be no need to make company appraisal, since the stock exchange itself make it.
4. The determination of long term dividend yield is strongly subjective, further problem is, and that the expected return of equity is very sensitive to this yield.
5. Due to the retained profit or newly issued debt for investments the weights may change in the future. Furthermore the market yields are also tending to make rapid changes.

OPPORTUNITIES TO AVOID THE PROBLEMS EMERGED BY USING WACC – APPLYING THE OPTION PRICING MODEL

An alternative way of company evaluation is the application of option pricing model. The model sets out from the recognition, that the equity of a legal entity is a call option, which is written out by the lenders of the company for the owners of the company, who can buy the company for the future value of loans. The owners would call the option, if the value of company assets is higher, than the maturity value of loans. In this case they get the difference between these two values. If the value of loans is higher, than the value of assets, the owners don't call the option, thus the company goes to the property of lenders during the liquidation process. The value of equity in function of asset value is shown by Figures 2.

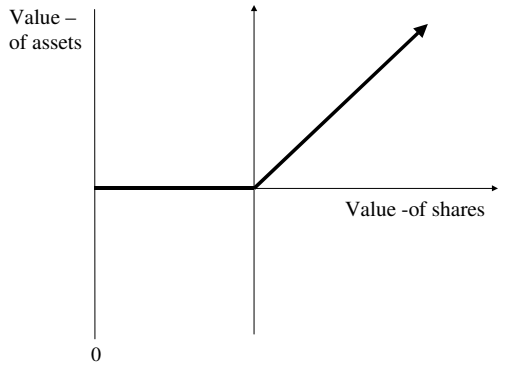

Figure 2 The value of company shares in function of value of company assets

If the shares are call options, the option pricing model tell us the value of shares and therefore the value of the company. Five parameters should be given to the Black-Scholes option pricing model. Table 4 shows the input parameters required by the option evaluation.

Table 4. Parameters required appraising the value of shares

Parameters	In case of financial underlying asset	In case of company shares
S	Price of underlying asset	Value of company asset
X	Exercise price of option	Maturity value of debt
σ	Coefficient of variation of asset price	Coefficient of variation of operating cash flow
T	Maturity of option	Maturity of debt
R_f	Risk free rate	Risk free rate

We need the value of assets for applying the option pricing. This figure is came from the discounted cash flow method, so the option pricing cannot solve the problems emerged by using WACC. The method can be applied, if the assets' value can be directly evaluated. The following condition should be meeting for that: (Hull, 1999; page 426)

1. A wide secondary market of assets should exist, which makes possible the direct appraisal.
2. The synergy effect should be negligible, so the value potential of human resources should be small in the given sector.
3. The maturity of debt should be identical.

COMPANY EVALUATION BASED ON VAR

The VAR means the scope of risk in forint at given period and given significance level. If the VAR of an investment is – let's say – 150 million HUF at significance level of 95% and in 10 days, it means, that the value of the investment won't decrease by 150 million HUF in 95 cases from 100 during 10 days. The big advantage of VAR method is to express the bearing risk of an investment directly in forint. The method is used by financial service providers to determine their risk exposure and capital requirements.

Our idea is to use the VAR method for determining the value of a company. The main point of our method, that we determine the value of a company as a difference with two factors. We suppose, that the operating cash flows of the company are risk free, thus we get their present value, it we discount them with the risk free rate. From this value we deduct the risk exposure determined by the VAR method, and then we get the value of a risk bearing company.

The way of calculation in our proposed solution is the following:

1. We estimate the free cash flow produced by the company for the foreseeable period similar to the discounted cash flow method.
2. We discount the free cash flow with the yield of long term T-bond with appropriate maturity. Mostly the yield of T-bond with 15 year maturity can be offered, since the duration of that is closest to the potential life time of the firm. The sum of discounted cash flow will be the value of the company without considering the risk.
3. We fit a regression curve to the actual and budgeted cash flow figures, and determine the standard deviation of residuals, which consider as the measurement of risk. We choose the standard deviation of residuals to query the trend effect. An alternative way to determine the risk can be, if we determine the standard deviation of free cash flow of various scenarios using sensitivity analysis or Monte-Carlo simulation. The latter method produces better result, but requires detailed knowledge about the economic circumstances of the firm, thus it can be applied in risk appraisal made by internal specialists.

4. After calculating the risk, it should be examined, if the residuals have got normal distribution or not. As generally few data are available, the Shapiro-Wilk test may be offered. Regarding to the fact, that the factors influencing the company free cash flow have generally normal distribution, we can suppose the normal distribution of residuals as well.
5. Then we choose a significance level, which is appropriate for the risk averse of investors. Let's say this should be 95% in our example. Then we depute the variables into the equation of VAR (Jorion, 1999; page 96):

$$VAR = -W \cdot \sigma \cdot \alpha \cdot \sqrt{T} \ ,$$

where

W – the value of the company discounted with the chosen risk free rate,

σ – the coefficient of variation of free cash flow,

α – the value of z test appropriate to the significance level,

T – the number of forecasted years (if the forecasted free cash flows are annual ones).

The VAR calculated with the above equation should be simple deducted from the company value calculated with the risk free rate.

THE VALUE OF ELMÜ USING THE VAR METHOD

In case of Elmü, we get the followings:
The function of fitted regression line to the Elmü free cash flow is the following:

$$Y=2121+428 \cdot x.$$

The standard error of parameter „a" is 1198, thus we can't deny the hypothesis at significance level of 95%, that the theoretical value of "a" is not 0. The standard error of parameter "b" is 124, thus we can state at significance level of 95%, that its value is positive. The graph of actual and budgeted figures of free cash flow is shown by Figures 3.

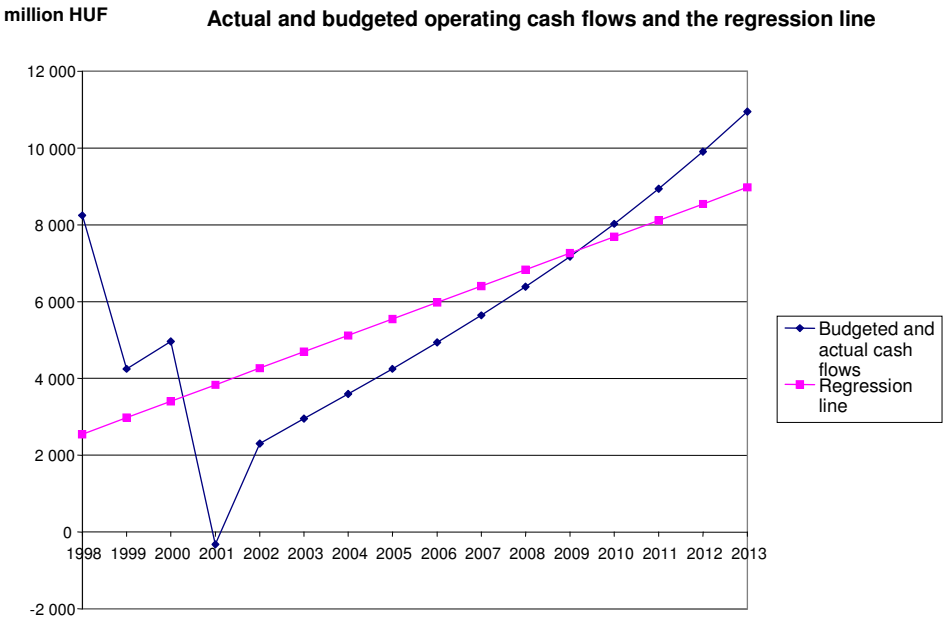

Figure 3 The free cash flow and its regression line

The standard deviation of residuals is 2206. Consequently the coefficient of variation is 1,89%. The time period is 15 years. Supposing, that the investors should like to hedge their risk in 95%, the appropriate value for alpha is 1,64. Deputing it to the equation of VAR, we get the following risk exposure:
VAR=116.421·1,89%·1,64·15^0,5= 14.014 million HUF.
Deducting this sum from the value of the company, we get the risk adjusted company value, which is 102.406 million HUF.

The advantages of our proposed method compared with the discount cash flow methods are, that we can avoid the above mentioned problems related to WACC calculation. However applying the VAR model to the company cash flow has got limitations as well:

1. The determination of the significance level doesn't lack the subjective elements. Consequently the method is not an objective one. It gives different results for different investors. This is not drawback by all means; hence the other company evaluation methods also give various results depending on different forecasting, expectation and researcher.
2. The uncertainty of method emerges mainly from the estimation of risk. The statistically correct applying of equation requires three conditions.

a. The trend fitted to the free cash flows should strongly correlate the actual figures.
b. The residuals should be independent, with normal distribution and zero expected value.
c. Furthermore we need enough data to diminish the standard error of our estimation.

The current case doesn't meet any of the above mentioned conditions that are why we can worry, if the coefficient of variation derived from this model perfectly mirrors the risk. We need more statistical data or better risk map to find a more suitable measure of risk. However an external researcher has rarely the opportunity to make such analysis.

3. The estimation of standard deviation comes mainly from forecasted future figures, which may distort the result. The budgeted figures don't contain the scrap value, but its value also reflects high risk.

Nevertheless we think that it worth preparing the company evaluation based on VAR method, and it has got a place as an alternative approach among the company appraisal methods.

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Összefoglaló

A cikk a diszkontált cash flow módszerek egy alapvető problémájával és annak egy lehetséges megoldásával foglalkozik. A legelfogadottabb vállalatértékelési módszerek úgy határozzák meg egy vállalat piaci értékét, hogy megbecslik a vállalat működéséből származó többletpénzáramot (szabad pénzáram) és ezt diszkontálják a pénzáram kockázatának megfelelő elvárt hozammal (WACC). Azonban, mikor meg akarjuk határozni a WACC súlyait, már tudnunk kellene a vagyonelemek értékét, ami nem áll rendelkezésünkre. Ezt a dilemmát próbálja meg feloldani a cikk, a VAR módszerek alkalmazását javasolva a kockázattal kiigazított vállalati érték meghatározásához.

Резюме

В статье описывается одна из основных проблем дисконтирования методом cash flow и возможность решения этой проблемы. Всеобще прийнятые методы стоимости фирмы определяют рыночную стоимость фирмы следующим образом: примерно определяют излишек свободного деньежного потока от деятельности предприятия и эту сумму деньег дисконтируют с рискованным потоком ожидаемой доходности (WACC).
Когда мы пробуем определить удельный вес WACC, нам необходимо было бы уже знать составные элементы стоимости предприятия, которыми мы к сожалению не обладаем. Эту проблему пробует решить автор в данной статье, предлагая использовать методы VAR, которые более точно определяют стоимость фирмы, так-как они включают в себя и рискованные выправления.