ISSUES ON USING THE DISCOUNTED CASH FLOWS METHODS FOR ASSET VALUATION

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Abstract:
Valuation of an asset, a project or an entire company may be done following different approaches, one of them being the "Discounted Cash Flows", based on financial mathematics. This method use various expected cash flows and, therefore, different discount rates are considered appropriate regarding the different related risks. This paper emphasizes the differences between calculations of the most used cash flow streams, i.e. Free Cash Flow, Capital Cash Flow and Equity Cash Flow. Regarding the companies' valuation using the discounting-based methods, many authors argue that no matter which expected cash flows is used, they provide the same results for the present value of the company. In this paper, we present the Discounted Capital Cash Flow valuation method, arguing that choice through a greater simplicity of calculations.

Key words: *cash flow, discounted cash flow, discount rate, present value, valuation*

JEL classification: *G31, M41*

1. Introduction

For valuing an asset, a project or an entire business, different methods may be used, either the traditional ones, like as standard asset, market and income valuation approaches, but also more recent financial performance measurements based on Economic Profit, Economic Value Added (EVA^{TM}), or Market Value Added. Generally, academics and practitioners are agreeing that financial statements reporting book values do not always reflect the true financial performances. That is why looking at the present value of anticipated future income or cash flows generated by an asset or an enterprise is more useful in computing the value of that asset or company.

The Discounted Cash Flows (DCF) methodology is widely used to evaluate capital projects. In the DCF approach, the value of a project is the future-expected cash flows discounted at a rate that reflects the risk of the projected cash flows. The DCF methodology is founded on the principle that it is inappropriate to capitalize earnings per se, as it must also be taken into account the investment required to generate those earnings. Since companies are portfolios of projects, the DCF approach is widely used in valuation of companies as well.

The paper is structured in the following sections: in Section 2 we explain the basic principles of the Income Valuation approach, as the Discounted Cash Flow methodology is representative for this approach; in Section 3 we briefly review the definitions of the most relevant cash flow streams used in corporate financial management, theoretically and practically revealing the similarities and differences in their calculations; in Section 4 we explain the mechanics of discounting the capital cash flow, adding a numerical example; finally, in Section 5 we draw the conclusions of the paper.

2. The Income Valuation approach

This approach is based on the premise that the value of business depends on its future economic benefits. Its goal is to determine what the value of a projected income stream would be worth today by taking into account the risk associated with a company's income generating capacity (Spivey and McMillan, 2001). In order to use this method, estimation on future earnings or cash flows must be made, and then discounted to the present, based on a discount rate. Since firms have an indefinite life, specific income or cash flow forecasts may have a date beyond which specific estimates are not made. Beyond that date, known as terminal date, specific projections become highly uncertain and growth is assuming to be constant.

Common valuation methods used under this approach include **the capitalization of earnings or cash flows** and **the discount of future earnings or cash flows**. Capitalization works when past operations are the best indicator of future operations of the enterprise. The capitalized earnings stream is often a simple or weighted average of the previous five-year operating history and the capitalization rate is based on the risks of the investment or company. According to Rich, more risks, higher capitalization rate, which lowers the resulting value determination (Rich, 2008).

McKinsey's method, based on future earnings or cash flows discounting, is best used for enterprises for which past operations are not consistent with expected future operations. In mathematical terms, projected future earnings are discounted to today's present value by a *discount rate* that depends on risks associated with the investment or company. Rich (2008) notes that, more risks equate to a higher discount rate and a lower valuation. Economically speaking, the discount rate is an "opportunity cost" or expected rate of return that one would give up by investing in one alternative instead of other investments with comparable risk characteristics. The discount rate used is generally the appropriate Weighted Average Cost of Capital (WACC) that reflects the risk of the cash flows. The discount rate reflects:

- *the time value of money (risk-free rate)* – according to the theory of time preference, investors would rather have cash immediately than having to wait and must therefore be compensated by paying for the delay;
- *a risk premium* – reflects the extra return investors demand because they want to be compensated for the risk that the cash flow might not materialize after all.

In this article, we consider the Income Valuation approach based on discounted future cash flows, as we subscribe the opinion that "value arises from expectations of the future cash flows" (Vélez-Pareja and Tham, 2001). According to Damodaran (2002), the method of Discounted Cash Flow (DCF) "relates the value of an asset to the present value of expected future cash flows on that asset". Historically, cash flows have been discounted because they represent cold hard tangible assets (Elmerraji, 2007). They are also devoid of income statement items like depreciation expenses that affect company's income without affecting the amount of money the company has.

Originally, the index of the classical cash flow has been created by security analysts at the beginning of 1950 in USA in order to analyse shares. It represents a payment flow oriented concept that describes an operating cash surplus of a certain period (Schön, 2003). Being a financing power deriving from inside the company cash flows can be used in order to undertake investments, to pay off debts, to pay out dividends or to maintain the liquidity for operational activities. The direct approach on computing (gross) cash flow is subtracting the disbursements of one financial year, from the deposits of one financial year.

Still, this classical cash flow does not involve important elements, such as tax payments, distribution of generated cash streams either to equity or debt holders, expenditures on fixed assets, replacements and extension investments, which are input and output flows contributing to the long-term continuation of the business. Therefore,

different types of cash flow are used in valuation, such as Free Cash Flow, Capital Cash Flow and Equity Cash Flow. The reason for defining various cash flow streams is that, in terms of valuation, there is an interrelationship between the type of cash flow and the corresponding discount rate. In opinion of Mian and Vélez-Pareja (2005), the difference between the various cash flows is solely in their treatment of the leverage value.

The view that the appropriate value for an asset is the discounted stream of the future net revenues that can be attributed to it was actively advocated by Irving Fisher: "The flow of services issuing from an article of capital may have any duration and any distribution of rate. In every case the capital value of the article is the discounted value of its anticipated services." (Fisher, 1897, cited by Dievert, 2005). In the accounting literature, estimating a current asset value as the discounted stream of its future expected returns is known as the *economic approach to asset valuation*. Accountants pointed out that the "economic" approach to asset valuation suffers from two flaws:

- future discounted net returns are generally not known with any degree of certainty and hence the resulting estimates will not be reliable, and
- even if we did know future revenue flows with certainty, revenue flows are produced by the joint efforts of all assets and it is generally impossible to allocate the resulting joint net revenue flows to individual assets (Dievert, 2005).

The first objection to the economic approach is that the economic values do not generally pass the *reproducibility test*; i.e., different accountants will generally obtain different estimates for economic values. The second objection may be overcome by applying an econometric model, but there would be reproducibility problems with the resulting estimates. The resulting values would depend on somewhat arbitrary assumptions about future technical progress, about future expected input and output prices that the firm is expected to face, and about functional forms and stochastic specification that are sure to vary among econometricians. In spite of the above rather negative evaluation of the economic approach to asset valuation, accountants have recognized that, for certain unique assets held by a business unit, the economic approach may be the only relevant approach for obtaining current asset values. In order for economic valuations to pass the objectivity or reproducibility test, it seems necessary that these valuations be done by specialized valuation firms, which could be accredited by the relevant accounting standards board or by the relevant governmental authority.

3. Free Cash Flow, Capital Cash Flow and Equity Cash Flow

Free Cash Flow (FCF) is generated by operations after tax, without taking into account the company's debt level, that is, without subtracting its interest expenses. According to Fernández (2006), it assumes a "hypothetical all equity capital structure", i.e. no payments of interest and principal to debt holders, that is, the company has to cover only capital investments and working capital requirements. Cohen and Graham (2001) have made connections between the value of Free Cash Flow and the financial requirements of the company. If FCF is positive, the business does not have to seek new financing. If FCF is negative and the business does not have enough cash from previous years to finance its operations, it may have to attract new investment or take on more debt. If FCF is negative for a long time, the company will not be able to get additional financing and may eventually go bankrupt. Moreover, in terms of shareholder value creation, we express the opinion that Free Cash Flow is an important measure of the ability of the company to provide positive returns to its shareholders.

For valuation purpose, the appropriate discount rate for Free Cash Flows is considered the after-tax Weighted Average Cost of Capital ($WACC_{AT}$), calculated using the after-tax cost of debt in the WACC formula. The explanation is that since FCF are available to all investors, the discount factor must represent the risk faced by all investors. The particularity of FCF method is that tax shields are excluded and the tax

deductibility of interest is treated as a decrease in the cost of capital using the after-tax WACC. The interest and principal payments and tax benefits due to deductible interest payments are incorporated in the discount rate. A disadvantage of using FCF Discounting-based method is the constantly changing capital structure of the company, resulting in the need of computing the appropriate WACC along with these changing.

Capital Cash Flow (CCF) is the cash flow available for all holders of the company's securities, whether these are debt or shares (Fernández, 2008). CCF includes all of the cash flows that are paid or could be paid to any capital provider, measuring all of the after-tax cash generated by the assets. Since it measures the after-tax cash flows from the enterprise, the present value of these cash flows equals the value of the enterprise. The difference between FCF and CCF is the Interest Tax Shield (ITS) that is the Income Tax on the Interest Expenses. The CCF approach clearly separates the tax-shield benefits of debt financing from the discount rate by including the ITS due to debt financing as an added cash flow in the numerator of the present value calculation. The appropriate rate used for discounting the capital cash flow is the cost of assets (Ruback, 2002), known as the Return on Assets (ROA). This rate is considered independent of the firm's capital structure.

Equity Cash Flow (ECF) includes debt payments (principal and interest) to debt holders. According to Fernández (2006), ECF is the money remains available in the company after tax, having covered capital investments requirements and the increase in working capital requirements, having paid financial expenses, having repaid the debt's principal, and having received new debt. The resulting cash flow is net to the equity shareholders and, accordingly, it can be used for dividends or share repurchases. This is "the classic cash flow and portrays a true image of the cash balance at the company's treasury" (Mian and Vélez-Pareja, 2005). On the other way around, Equity Cash Flow is the cash flow left from the Free Cash Flow after the debt holders are paid. Since the debt cash flows are included in the ECF, the cost of equity is considered more appropriate for discounting rather than the WACC.

We summarize the basics of cash flow valuation methods in table 1.

Table 1. Cash flow valuation methods

Free cash flow	**Capital cash flow**	**Equity cash flow**
Whole Firm	Whole Firm	Equity Value
Measures value of whole firm - cash flows do not include tax benefits of debt since that is in discount rate	Like Free cash flow, measures cash flow available to both equity and debt holders	Measures cash flow available to stockholders after payments to debt holders are deducted from operating cash flows
Represents cash flows available to firm if interest was not a tax-deductible expense	Includes benefits of tax deductible interest payments	Equity cash flows equal capital cash flows minus debt cash flows
Includes benefit of tax deductible interest in discount rate, so after-tax discount rate is appropriate	Discount rate is pre-tax rate that corresponds to riskiness of firm	Equity cash flows are riskier than cash flows with debt, so discount rate is higher
Appropriate discount rate is WACC. Since FCF values whole firm, WACC is: WACC = (Debt / Value) (1 - Tax Rate) × Cost of debt K_d + (Equity / Value) × Cost of Equity K_e	Use Capital Asset Pricing Model (CAPM) to determine appropriate discount rate, use the asset beta. Since CCF values whole firm: Expected Return = Risk-free rate + Asset Beta $ß_a$ × Market Risk Premium R_{pm} Note: Before Tax Rates	Use Capital Asset Pricing Model to determine appropriate discount rate, but use equity beta. Since ECF values equity cash flows: Expected Return = Risk-free rate + Equity Beta $ß_e$ × Market Risk Premium R_{pm}

Purpose of cash flow measures is to transform accounting recognition of receipts and expenses into cash flow definitions. Adjustments include subtracting capital expenditures; adding depreciation; subtracting changes in working capital. Computing various cash flows is similar to a point where differences occur, as it can be seen in table 2.

Table 2. Similarities and differences in FCF, CCF and ECF calculation

Accounting measure	Free Cash Flow	Capital Cash Flow	Equity Cash Flow
	EBIT (Earnings Before Interest and Taxes)	EBIT (Earnings Before Interest and Taxes)	EBIT (Earnings Before Interest and Taxes)
Treatment of depreciation	*Adjustment for an accounting deduction that did not involve a cash outflow:*		
	Add: Depreciation expense	*Add*: Depreciation expense	*Add*: Depreciation expense
Treatment of capital expenditures	*Adjustment for a cash outflow that did not involve an accounting deduction:*		
	Subtract: Capital Expenditures	*Subtract*: Capital Expenditures	*Subtract*: Capital Expenditures
Treatment of change in net working capital (NWC)	*Converts sales into cash receipts and inventory and payables into cash expenses:*		
	Add: Decrease in NWC or *Subtract*: Increase in NWC	*Add*: Decrease in NWC or *Subtract*: Increase in NWC	*Add*: Decrease in NWC or *Subtract*: Increase in NWC
Treatment of taxes (T)	*Deducts taxes that would have been paid if company was all equity financed; treats tax benefits of debt in the discount rate:*	*Deducts taxes on ordinary taxable income, so treats tax benefits of debt in the cash flow measure:*	
	Subtract: "Hypothetical" Income Taxes [EBIT × T]	*Subtract*: Income Taxes [(EBIT - interest) × T]	*Subtract*: Income Taxes [(EBIT - interest) × T]
Additional adjustments			*Subtract*: Interest and Debt principal payments *Add*: New Debt/Equity Issues

The mathematical correlations between FCF, CCF and ECF are the following:

CCF = FCF + Interest Tax Shield (1)

ECF = FCF – [Interest payments × (1- T)] - Debt principal payments + New debt/Equity Issues (2)

In order to see the differences we consider a simplified numeric example that shows how each stream of cash flow is computed. Then we compare the results from the various cash flow streams, based on Table 3, and we verify the above equations. The additional assumptions are that Interest Expenses are of €206 and Income Tax (T) is 20%.

Table 3. FCF, CCF and ECF calculation

(Euros)

Income statement (simplified)	FCF	CCF	ECF
Gross Income	5,000	5,000	5,000
Operating Expenses	(500)	(500)	(500)
Depreciation	(2,500)	(2,500)	(2,500)
EBIT	2,000	2,000	2,000
Depreciation	2,500	2,500	2,500
Tax on EBIT	(400)		
Tax on (EBIT-Interest Expenses)		(359)	(359)
Interest payments			(206)
Debt principal Payments			(624)
Cash Flow Streams calculation	4,100	4,141	3,311

We verify the correlations between FCF, CCF and ECF, based on the equations (1) and (2):

CCF = FCF + Interest Tax Shield = €4,100 + (€206 × 20%) = €4,141

ECF = FCF – [Interest payments × (1- T)] - Debt principal payments + New debt/Equity Issues = €4,100 – [€206 × (1 - 20%)] – €624 = €3,311

4. Capital Cash Flow Discounting

Valuation methods using the Discounted Cash Flow (DCF) go back to the Modigliani and Miller theorem. They seek to determine the asset or company's value by estimating the cash flows it will generate in the future and then discounting them at a

discount rate matched to the flow's risk. According to Fernández (2002), these methods are generally used because they are the only conceptually correct valuation methods. They are based on the detailed, careful forecast, for each period, of each of the financial items related with the generation of the cash flows corresponding to the company's operations, such as collection of sales, personnel, raw materials, administrative and sale expenses, loan repayments.

The most commonly used discounted cash flow valuation methods (e.g. Free Cash Flow method, the Capital Cash Flow method) always give the same value, as all of them analyze the same reality under the same hypothesis. The differences occur only in the cash flows considered as the starting point for the valuation. Fernández (2003, 2008) and Ruback (2002) are only a few authors that proved the algebraic equivalence of these methods. Therefore, we exemplify the valuation based on Discounted Capital Cash Flow, arguing that choice through the simplicity of calculations. Ruback (2002) emphasizes other advantages of using the discounted CCF over FCF, which are summarized below:

- The WACC has to be re-calculated each time the capital structure is changing; the expected asset return which is the appropriate discount rate for CCF depends on the asset risk and, therefore, does not change when capital structure changes; as a result, the discount rate does not have to be re-estimated every period;

- Because the WACC depends on value-weights, the value of the firm has to be estimated simultaneously. The CCF method avoids this complexity so that it is especially useful in valuing highly levered firms whose debt is usually forecasted in levels and whose capital structure changes substantially over time.

The discounted cash flows formula is derived from the future value formula for computing the time value of money and compounding returns:

$$DPV = FV / (1 + i)^n, \quad (3)$$

where: *DPV* is the discounted present value of the future cash flow (FV), *FV* is the nominal value of a cash flow amount in a future period, *i* is the interest rate that reflects the cost of capital and the risk that the payment may not be received in full, and *n* is the time (in years) before the future cash flow occurs.

Based on the equation (3), the discounted capital cash flows is:

$$DCF = CCF / (1 + K_a)^n, \quad (4)$$

where: *DCF* is the discounted future CCF and K_a is the appropriate discount rate.

Where multiple cash flows in multiple periods are discounted, it is necessary to sum them as follows, the sum being used as the present value (PV) of the enterprise:

$$PV = \sum_{t=0}^{n} CCF_t / (1 + K_a)^t \quad (5)$$

In order to exemplify the calculation of the present value of an asset, we consider the example of Company ABC that undertakes a project that lasts 4 years and requires an initial investment of 10,000 euros. We are making the following assumptions:

- The project is financed with debt and equity; the debt value at the beginning of each year is €2,000; the asset is uniformly depreciating over the 4 years (€2,500 per year);

- Increasing in NWC requirements, as of €1,000 (constant each year);

- The income tax rate of 20% is constant;

- The necessary assumptions for computing the discounting rate are the following: risk-free rate is 6%, the market premium is 4% and the project beta is 1.0 (constant in all four years); the debt beta is 0.25 (reflecting the funding structure of the project: debt of €2,000 and equity of €8,000).

The assumptions regarding the Income statement (simplified) for the next 4 years are presented in Table 4, which shows the operating profit generated by the asset. Based

on these data the capital cash flow can be computed and, furthermore, discounted. We recall that in Section 3 we mentioned that the present value of the capital cash flows equals the value of the enterprise. Consequently, summing the present values of each year's CCF we are going to calculate the total value of the Company ABC.

Table 4. ABC Co.'s Capital Cash Flow calculation and discounting

(Euros)

Income statement	Year 1	Year 2	Year 3	Year 4
Operating Profit	6,000	7,000	8,000	10,000
Depreciation	(2,500)	(2,500)	(2,500)	(2,500)
EBIT	3,500	4,500	5,500	7,500
Depreciation	2,500	2,500	2,500	2,500
Increasing in NWC requirements	(1,000)	(1,000)	(1,000)	(1,000)
Tax on (EBIT – Interest Expenses)	(672)	(872)	(1,072)	(1,472)
Capital Cash Flow	4,328	5,128	5,928	7,528
Cost of Assets	10%	10%	10%	10%
Discount Factor	0.909	0.826	0,751	0.683
Present Value of CCF	3,934	4,236	4,452	5,142
Total Enterprise Value	17,764			

The expected Interest Expenses for the 4 years can be computed as Cost of Debt times the beginning debt of each year. Cost of Debt is calculated based on the Capital Asset Pricing Model (CAPM):

$$K_d = R_f + \beta_d \times R_{pm}, \quad (6)$$

where: K_d is the cost of debt, R_f is the assumed risk-free rate, β_d is the assumed debt beta and R_{pm} is the assumed Market Risk Premium (MRP).

K_d = 6% + 0.25 × 4% = 7% times the beginning debt of €2,000 result in Expected Interest as of €140.

The Total Enterprise Value is calculated by discounting the CCF with the appropriate rate, which is the Cost of Assets. The CAP Model is the solution for computing the Cost of Assets:

$$K_a = R_f + \beta_a \times R_{pm}, \quad (7)$$

where: K_a is the Cost of Assets and β_a is the asset beta, i.e. the assumed project beta of 1.0.

K_a = 6% + 1.0 × 4% = 10% (constant in all four years, as β_a remains the same)

The discount factor (r_a) used for the discounted capital cash flow is calculated with the general formula:

$$r_{an} = 1 / (1 + K_a)^n \quad (8)$$

Then, the Present Value is the CCF multiplied with the discount factor. Adding the Present Values of the capital cash flows for the 4 years the Total Value of Company ABC is computed, which is €17,764. Summing the capital cash flow (not discounted) the result is €22,912, showing a difference of €5,148. Thus, we conclude that for a more accurate financial analysis, the financial manager should use the value-based methods.

5. Conclusions

Although different cash flow streams can be calculated based on the company's financial statements, when it comes to determine what that company or its assets worth today these cash flows has to de discounted, in order to evaluate their present value. The Discounted Cash Flow method is widely used in investment finance and corporate financial management. Its accuracy depends on identifying the appropriate discount rate and estimating the future cash flows. The discount rate used is generally the appropriate WACC that reflects the risk of the cash flows, related to the time value of money and to the investors' extra-compensation demand.

This paper focuses on the differences between the valuations of various cash flow streams that may be individualized within the enterprise, for the purpose of

financial analyses. Although the first steps of calculation are similar between free cash flows, capital cash flows and equity cash flows, there are major differences in treatment of taxes and interest tax shield, which leads to different results. Additionally, the paper explains and illustrates the mechanics of Discounted Capital Cash Flow valuation, based on the opinion that the present value of a company results from the summation of the discounted future capital cash flows. In the considered example, the present value is lower than the sum of not-discounted capital cash flows. Based on this finding, we prove the usefulness of using the value-based methods in business valuation and, generally, in financial management.

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