Estimating Cash Flows for Project Appraisal and Firm Valuation

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Abstract

This teaching note is devoted to the definition and calculation of cash flows, namely, cash flow to debt, (CFD), cash flow to equity, (CFE), capital cash flow, (CCF), tax savings, (TS) and free cash flow, (FCF). We use the direct and the indirect methods to derive the relevant cash flow profiles for the different stakeholders. These cash flows are the basis for the valuation of a firm or project.

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Introduction

Forecasting financial statements for the firm is imperative for management because it provides insight into the company's future performance. It is a very important tool for developing strategies to anticipate and overcome the cash flow difficulties that always arise.

Most firms in the world are unlisted. More than 99.5% of the firms do not know their market values. On the other hand, the management for a listed firm knows the value of the firm every single minute. The name of the game is value. For management, value is more important than return or profitability. If the firm creates value, then it will have good return. Greater profitability does not mean greater value. Only discounted cash flows measure value.

We propose a financial planning model that allows management to use it for different actions, such as

1. Assessment tool: designed for unlisted companies
2. Estimation of future cash flows and value: Cash flows are derived from financial statements.
3. Keeping track of value: maintaining a financial planning model allows management to measure the value and the impact of future decisions on it.

We build three financial statements: Balance Sheet, Income Statement and Cash Budget, without plugs or circularity. These three items constitute a comprehensive and consistent financial model

A financial planning model is also useful for other purposes:

• When planning to raise funds for a new firm or a new project for an existing concern.

• When planning to sell or merge a businesses.

• When planning to issue bonds.

Instead of asking questions to see "what happened" and answering some questions such as: Did the firm liquidity last year? Was it profitable? How was financed? How was the money spent?, we should ask questions on what to do in the future. In a financial model, policies are designed according to value creation. That is, we examine, in the light of the creation or destruction of value, whether it is good or not to change a policy.

With the financial planning model, we derive relevant cash flows for valuation. A detailed description of the model we use in this note is found in Velez-Pareja 2009. Finally, a detailed financial planning model is like a scalpel, rather than an ax, that has to be utilized in crisis times.

Discounted Cash Flow Approach

This method relies on the ability of the firm to generate wealth in the future. To arrive at the value of the firm or project, it is necessary to forecast free cash flow FCF, discounted at an appropriate cost of capital

This note focuses on cash flows. These cash flows might be used to calculate indicators of the desirability of a project such as the Net Present Value, NPV. This teaching note will examine in detail the determination of cash flows, in particular the cash flows to debt (CFD), the cash flow to equity (CFE) and what is known as the capital cash flow, CCF. We also examine the cash flow of tax savings, TS and free cash flow (FCF).

Forecasted Financial Statements

In this section we present the two most well-known financial statements, the Income Statement and the Balance Sheet. In addition, we present the Cash Budget, which is similar to the Statement of Cash Flows[3] .

The Income Statement

The following table shows the Income Statement.

Table 1a. Income Statement

Year	0	1	2	3	4
Sales revenues		379.3	408.2	443.6	479.9
Cost of Goods Sold COGS		268.3	287.3	310.7	336.1
Gross Income		111.0	120.9	132.9	143.7
Administrative and Sales A&S expenses		75.8	81.1	87.0	92.9
Depreciation		11.3	14.2	17.9	22.7
Earnings Before Interest and Taxes EBIT		24.0	25.6	27.9	28.1
Interest payments		7.0	4.5	4.0	3.4
Return from ST investment		0.0	0.0	0.0*	0.0
Earnings Before Taxes EBT		16.9	21.1	23.9	24.7
Income Taxes		5.9	7.4	8.4	8.7
Net Income	0.0	11.0	13.7	15.6	16.1

* The exact value is 0.0032.

The Income Statement shows the operation of the firm and the performance in terms of Net Income. This statement has a critical line: the calculation of income tax. If we do not use a logical statement and we have a negative EBT, Net Income (losses) would be over stated (less negative).

The Cash Budget

First we show the cash budget, CB.

[3] See for instance http://www.iasplus.com/standard/ias07.htm, visited on February 1, 2010

Table 1b Cash Budget

Year	0	1	2	3	4
Module 1: Operating activities					
Cash inflows					
Inflows from sales	37.9	363.2	410.3	445.5	430.1
Total inflows	37.9	363.2	410.3	445.5	430.1
Cash outflows					
Payments for purchases	47.1	245.5	289.5	312.9	301.9
Administrative and selling expenses	0.0	75.8	81.1	87.0	92.9
Income Taxes	0.0	5.9	7.4	8.4	8.7
Total cash outflows	47.1	327.2	377.9	408.3	403.5
Operating Net Cash Balance	-9.1	36.0	32.3	37.2	26.6
Module 2: Investing activities					
Investment in fixed assets	45.0	11.7	15.1	18.9	22.7
Net Cash Balance NCB of investment in assets	-45.0	-11.7	-15.1	-18.9	-22.7
NCB after Capital Expenditures	-54.1	24.3	17.2	18.3	3.9
Module 3: External financing					
Inflow of loans					
Short-term Loan	22.15	0.00	0.00	0.00	0.00
Long-term loan	31.50	7.14	0.00	0.34	11.00
Payment of loans					
Principal Short-term loan		22.1	0.0	0.0	0.0
Interest Short-term loan		2.9	0.0	0.0	0.0
Principal long-term loan		3.2	3.9	3.9	3.9
Interest long-term loan		4.1	4.5	4.0	3.4
NCB of financing activities	53.6	-25.2	-8.3	-7.5	3.7
Module 4 Transactions with owners					
Equity investment	13.5	3.1	0.0	0.1	4.7
Dividends		0.0	7.7	9.6	10.9
Repurchase of Stock		0.0	0.0	0.0	0.0
Payments to owners		0.0	7.7	9.6	10.9
NCB with owners.	13.5	3.1	-7.7	-9.5	-6.2
Module 5: Discretionary transactions					
Redemption of Short-term investments.		0.00	0.00	0.06	0.00
Return from Short-term investments.		0.00	0.00	0.00*	0.00
Short-term investments.		0.00	0.06	0.00	0.00
NCB of discretionary transactions		0.0	-0.1	0.1	0.0
Year NCB	13.0	2.2	1.2	1.4	1.4
Cumulated NCB	13.0	15.2	16.3	17.7	19.2

*The exact value is 0.0032.

In this example we assume that customers have to pay to place an order with the firm and at the same time, the firm has to pay some advance payment when purchasing from the suppliers. This is listed in the Balance Sheet.

The Balance Sheet

Finally, we show the Balance Sheet.

Table 1c Balance Sheet

Year	0	1	2	3	4
Assets					
Cash	13.0	15.2	16.3	17.7	19.2
Accounts Receivable	0.0	19.0	20.4	22.2	24.0
Inventory	20.0	22.5	24.1	26.0	28.1
Advance payments paid	27.1	28.9	31.3	33.8	0.0
Short-term investments	0.0	0.0	0.1	0.0	0.0
Current assets	60.1	85.5	92.1	99.8	71.3
Net fixed assets	45.0	45.5	46.4	47.3	47.3
Total	105.07	130.94	138.48	147.05	118.62
Liabilities and equity					
Accounts Payable	0.0	27.1	28.9	31.3	33.8
Advance payments received,	37.9	40.8	44.4	48.0	0.0
Short-term debt	22.1	0.0	0.0	0.0	0.0
Current liabilities	60.1	67.9	73.3	79.3	33.8
Long-term debt	31.5	35.5	31.6	28.1	35.2
Total Liabilities	91.6	103.4	104.9	107.4	69.0
Equity investment	13.5	16.6	16.6	16.7	21.4
Retained earnings	0.0	0.0	3.3	7.4	12.1
Current year Net Income	0.0	11.0	13.7	15.6	16.1
Repurchase of equity	0.0	0.0	0.0	0.0	0.0
Liabilities and equity	105.07	130.94	138.48	147.05	118.62

These financial statements have been constructed following strictly the Double Entry Principle and without using plugs to solve the balancing problem.

Construction of Cash Flows

Modigliani and Miller, M&M (1958 and 1963) proposed a basic idea: in a perfect market with no taxes, the total value of a firm is not affected by the way total capital is divided between equity and debt. In mathematical terms,

$$V^{Un} = V^{L} = E + D \qquad (1a)$$

Where V^{Un} is the value of the firm without debt, V^{L} is the value of the firm with debt, E is the value of equity and D is debt. All of the values in equation 1a are market values. This is known as the capital structure, which is the division of the source of funds for investment between debt and equity. This means that when there is no tax, the capital structure does not affect the value of the firm. A firm that has no debt is known as an unlevered firm, and a firm that borrows debt is known as a levered firm.

For each element of the above equation a cash flow is associated with it and they maintain the same relationship as the values

$$FCF = CFD + CFE \quad (1b)$$

Where FCF is free cash flow, CFD is the cash flow to debt, CFE is the cash flow to equity.

On the other hand they stated that when there are taxes this externality generates additional value called tax savings for interest payments or tax shield. In this case the capital structure does affect the value of the firm and its mathematical expression is as follows:

$$V^{Un} + V^{TS} = V^{L} = E + D \quad (1c)$$

Where V^{TS} is the value of tax savings. Similarly we can associate cash flows to each of these elements, as follows:

$$FCF + TS = CFD + CFE \quad (1d)$$

Where TS is the tax savings. Below we will explain in detail what we mean by TS. V^{TS} is the present value of the TS at an appropriate discount rate. From these basic concepts we will derive the cash flows that will allow us to calculate the value of the firm and the PV.

Capital Cash Flow CCF

Capital providers of capital for the operation of a firm or project are twofold: the owners of the debt and shareholders. These are the stakeholders that the firm or project should pay some return.

Where, how and when does the firm pay the investors? We can answer this by examining two of the financial statements we have presented above: the income statement and cash budget. Looking at the income statement we find that after the net operating income and other income there are two items that have to do with this compensation: the financial costs (compensation to the owners of debt) and net income (compensation to owners of equity). However, this is not exactly the amount they receive due to the accrual-based principle applied in the construction of financial statements.

In the Cash Budget we list the actual movements of cash. In Module 3 appears the cash flow of financial transactions. On the other hand, in Module 4 are the transactions with shareholders.

This means that if we wish to know the actual remuneration received by capital owners (debt and equity) we should look at modules 3 and 4 from the Cash Budget, CB. Here we must clarify that when we examine the cash flows we will do it from the viewpoint of each owner of capital (debt and equity).

Cash Flow to Debt

The owners of the debt provide loans to the firm or project and in return receive the initial amount borrowed and the interest agreed upon. We determine this in Module 3 in the CB.

Table 2a. Module 3 from Cash Budget. External Financing

Year	0	1	2	3	4
Inflow of loans					
Short-term Loan	22.15	0.00	0.00	0.00	0.00
Long-term loan	31.50	7.14	0.00	0.34	11.00
Payment of loans					
Principal short-term loan		22.1	0.0	0.0	0.0
Interest short-term loan		2.9	0.0	0.0	0.0
Principal long-term loan		3.2	3.9	3.9	3.9
Interest long-term loan		4.1	4.5	4.0	3.4
NCB of financing activities	53.6	-25.2	-8.3	-7.5	3.7

As we show the cash flow from the viewpoint of the owners of the debt, we proceed to modify the above table as follows:

Table 2b. Deriving the Cash Flow to Debt: CFD

Year	0	1	2	3	4
Inflow of loans					
Minus Short-term Loan	-22.15	-0.00	-0.00	-0.00	-0.00
Minus Long-term loan	-31.50	-7.14	-0.00	-0.34	-11.00
Payment of loans					
Plus Principal Short-term loan		22.1	0.0	0.0	0.0
Plus Interest Short-term loan		2.9	0.0	0.0	0.0
Plus Principal long-term loan		3.2	3.9	3.9	3.9
Plus Interest long-term loan		4.1	4.5	4.0	3.4
Minus NCB of financing activities = CFD	-53.6	25.2	8.3	7.5	-3.7

Then, the CFD is all the funds supplied and/or received by the owners of debt to and from the firm or project (they make an investment to lend this money, so it is a negative amount) and in return they receive repayment of debt and agreed interests. The algebraic sum of these items is the CFD. Observe this is the negative of the NCB from financing activities.

Cash Flow to Equity CFE

Similarly, the CFE is determined from the CB module 4. The firm receives the investment in equity and pays dividends and repurchases of shares. Let us see this in Module 4.

Table 3a.Module 4 from Cash Budget: Transactions with owners

Year	0	1	2	3	4
Equity investment	13.5	3.1	0.0	0.1	4.7
Dividends	0.0	0.0	7.7	9.6	10.9
Repurchase of Stock	0.0	0.0	0.0	0.0	0.0
NCB with owners.	13.5	3.1	-7.7	-9.5	-6.2

As we did in Module 3, we modify the presentation of the above table as follows:

Table 3b Calculation of CFE

Year	0	1	2	3	4
Minus Equity investment	-13.5	-3.1	0.0	-0.1	-4.7
Plus Dividends	0.0	0.0	7.7	9.6	10.9
Plus Repurchase of Stock	0.0	0.0	0.0	0.0	0.0
-NCB with owners = CFE	-13.5	-3.1	7.7	9.5	6.2

Then, the CFE is all of the owners' investment contributions as inflows to the firm or project (they make an investment, so it is a negative amount) and in return receive the dividends distributed, and any repurchase of equity. The algebraic sum of these items is the CFE. Again, observe that CFE is the negative of NCB with owners.

Construction of Capital Cash Flow CCF

From CFD and CFE we can build the CCF. The capital cash flow is the essence of the approaches of Modigliani and Miller. Recently, Ruback (2000) has popularized. It is the sum of the contributions and compensation **actually** received by owners of capital (debt and equity). CCF is the sum of the CFD and the CFE and it is the right hand side of equations (1b and 1d).

$$CCF = FCF + TS = CFD + CFE \quad (2)$$

Therefore, CCF will be.

Table 4 Calculation of CCF

	Year 0	Year 1	Year 2	Year 3	Year 4
CFD	-53.6	25.2	8.3	7.5	-3.7
CFE	-13.5	-3.1	7.7	9.5	6.2
CCF	-67.1	22.1	16.0	17.0	2.5

This seems to be a paradox: the value of cash flow we are interested in is not what remains in the firm, but what goes out of the firm. It is what the firm pays the owners of capital (debt or equity). Of course, eventually, everything is paid back or reverts to the stakeholders. However, we recognize the payment at the time when it actually occurs. This is important to keep in mind because it is often thought that the cash flows we are interested in are what results from subtracting outlays from income.

For period N, the last forecasted year, we must add the market value or terminal value. (Benninga and Sarig, 1997, Copeland et al., 2000 and Weston and Copeland, 1992 call continuing value, Damodaran 1996 and Tham and Vélez Pareja 2004, call terminal value). Here we will call it terminal value. This terminal value is discussed in another work.

With the CCF and using a proper discount rate we can calculate the firm value.

Now we illustrate alternate forms. These forms are more complicated (though not more difficult) for calculating the cash flows, both the FCF and the CFE. However, before we do that we have to define what tax savings are.

Tax Savings, TS

Tax savings are a subsidy the government gives to any firm for every dollar spent and deduced from the tax return that the company files. Every expense is a source of tax savings. However, we are interested in those related items that affect the

financial aspects of the firm. There might be different sources of TS, for instance, interest expenses, adjustments to the financial statements for inflation, deduction of interest paid on book value of equity as part of the dividends, losses in exchange rate, etc. (See Vélez-Pareja and Benavides, 2009, Vélez Pareja and Tham 2003 and Tham and Vélez Pareja 2004b). The taxes that generate TS are income tax. When taxes are mentioned in this context we refer to income taxes.

The effect of taxes in the expenses of a firm that is taxed reduce the expense before tax (Ex) to

$$Ex \times (1-T) \quad (3)$$

where T is the tax rate and Ex is expense.

This means that a charge involves a tax savings of

$$Ex \times T \quad (4)$$

In the case of interest, you get a tax savings equal to

$$TS = Int \times T. \quad (5)$$

This reduces interest payments by the tax savings and, therefore, the cost of debt. As the tax savings is already included in the standard formulation of the weighted cost of capital with an adjustment factor, it should not be included in the FCF. Unlike the other items TS are not "seen" in the CB because it is considered within the taxes paid, as a lower value of those taxes.

The usual procedure is to consider (5) as a general rule. However, we examine an example and consider three cases to illustrate how to calculate the TS and test if (5) is a general rule or not.

An example illustrates this idea.

Example 1

Assume that EBIT is 500. This is shown in the next table that depicts a simplified Income Statement.

Table 5a. Simplified Income Statement, EBIT > FE

	Unlevered	Levered
EBIT	500	500
Financial expenses, FE	0	300
Earnings Before Taxes EBT	500	200
Taxes (30%)	150	60
Net Income	350	140
TS = Difference in taxes		90

The tax savings are something tangible and reflected in lower tax liability with the consequent effect on cash flow. In the example, the first idea that comes to mind is that the shareholder will receive $300 less because there was an increase in interest expense. However, when we consider the tax this assertion has no grounds. It is only reduced by $ 210 (350-140 or Ex × (1-T) = 300 (1 – 0.30) = 210), as shown in the previous table. Observe that tax savings are 90 or T × Ex (300 × 30%). This tax savings will increase CFE.

It should be noted that that formulas (3) and (4) are correct when the firm has EBIT and is subject to income taxes. More specifically, if the result of operating income plus other income is positive (earnings before interest), then it generates a tax shield for interest payments. If there is no such surplus, there are no tax savings, at least in the period we analyze. In all cases the best way to calculate the tax savings for interest payments, is to calculate the difference between taxes with and without debt.

Now consider a second case. Assume that EBIT is positive but less than the interest charges (financial expenses, FE). This is 0< EBIT+OI < FE.

Table 5b. Simplified Income Statement 0< EBIT+OI < FE

	Unlevered	Levered
EBIT	500	500
Financial expenses, FE	0	650
Earnings Before Taxes EBT	500	-150
Taxes (30%)	150	0
Net Income	350	-150
TS	0	150

Notice in this case that equations (3) and (4) do not apply. The tax savings for paying 650 of interest is not 195 (30% × 650) but 150 (500 × 30%). This means that when EBIT is positive but less than the interest payments, the tax savings are based on EBIT. This is,

$$TS=T\times EBIT \qquad (6)$$

We consider an additional case: EBIT + OI < 0.

Table 5c. Simplified Income Statement EBIT+OI < 0

	Unlevered	Levered
EBIT	-100	-100
Financial expenses, FE	0	650
Earnings Before Taxes EBT	-100	-750
Taxes (30%)	0	0
Net Income	-100	-750
TS	0	0

In this case we see that when EBIT+OI is negative, the firm earns no TS.

We can also see the tax savings as the difference between taxes with and without debt. However, if there are losses carried forward, the TS unearned in one year can be recovered in the future, when EBIT+OI>0.

We can summarize these ideas in the following table

Table 6. Summary of three cases for calculating TS

	No debt	Debt	TS, difference in taxes[4]
	EBIT + OI	EBIT + OI	
	0	FE	
Case 1 EBIT+OI >FE	EBT = EBIT + OI	EBT = EBIT + OI- FE	TS = T×FE
	Tax = T × (EBIT + OI)	Tax = T × (EBIT + OI - FE)	
Case 2 0<EBIT+OI <FE	EBT = EBIT + OI	EBT = EBIT+OI – FE < 0	TS = T × (EBIT + OI)
	Tax = T × (EBIT + OI)	Tax = 0	
Case 3 EBIT+OI < 0	EBT = EBIT + OI < 0	EBT < EBIT + OI - FE <0	TS = 0
	Tax = 0	Tax = 0	

- $$TS = \begin{cases} = T \times FE & \text{If } EBIT+OI > FE \\ = T \times (EBIT+OI) & \text{If } 0 < EBIT < FE \\ = 0 & \text{If } EBIT < 0 \end{cases} \quad (7)$$

In the first case we say that the TS is equal to the financial expense times the tax rate. In the second case we see that the TS **are not** T times the financial expenses, as predicted by eq. (4) but T times EBIT + OI. This is a very important conclusion. In the third case we say that when EBIT + OI is negative, the TS is zero.

Observe that it is not true that TS arise if the firm pays taxes. TS arise when the firm is subject to income taxes even if in a particular case the firm does not pay taxes, as in table 6, Case 2. The condition for the existence of TS is that the firm is subject of income taxes **AND** EBIT + OI is non negative.

Observing the previous cases we have a segmented function of TS depending from EBIT + OI. This is depicted in the next Exhibit.

[4] When Other Income is interest income, tax savings is not the difference in taxes. They are that difference minus the tax on interest income.

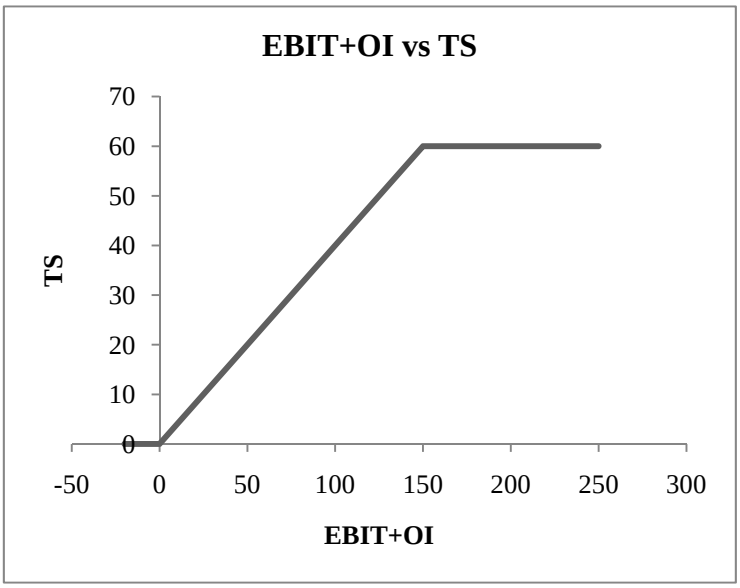

Exhibit 1. TS as a function of EBIT + OI

This segmented function is quite relevant because in reality, at least in the beginning years for new ventures or startups, EBIT+OI might be less than FE or negative. This means that in those cases we cannot assume that the TS are fully earned. It might be either zero or less than T×FE.

The segmented function for TS can be expressed as

$$TS = Maximum(T \times Minimum(EBIT+OI, FE), 0) \quad (8a)$$

In Excel notation:

$$=Max(T*Min(EBIT+OI,FE),0) \quad (8b)$$

If table 6 and Exhibit 1 show the relationship between TS and EBIT, we can conclude that TS is a function of EBIT and hence has the same risk of EBIT (or Free Cash Flow). This means that the proper discount rate for TS should be Ku, the cost of unlevered equity.

For illustrating these conditions we consider two scenarios: when taxes are paid the same year as accrued and when taxes are paid next year.

Example 2

This calculation is simplified because we know that there may be adjustments for inflation and these must be taken into account in their effects on taxes. Also, this expression is approximate because it assumes that taxes are paid the same year in which they are accrued. In reality, this happens in the next year in many cases. In some firms, most taxes are paid the same year in which it is assessed due to the withholding tax. This withholding plays the role of a payment of tax in advance. In each case we must recognize what the situation is and reflect that in the calculation of TS.

How does the (1-T) factor work? We show that with a simple example. Assume a loan of 1,000 to be repaid next year. Tax rate is 40% and taxes are paid the same year as accrued. Assume a cost of debt Kd of 23%. The Cash Flow to Loan, CFL, before and after taxes is shown in the next table.

Table 7a. Taxes paid the same year. TS fully earned

Year	0	1
Loan	1,000	
Interest		−230
Principal payment		−1,000
CFL before taxes	1,000	−1,230
Kd		23%
CFL before taxes	1,000	−1,230
Tax savings		92
CFL after taxes	1,000	−1,138
Kd after taxes		13.80%

Note that CFL is the negative of the Cash Flow to Debt, CFD (CFD would be -1,000 in time 0 and +1,300 in time 1). However, after tax CFL IS NOT After tax CFD. The TS is not something that reduces the CFD (that is what the debt holder receives), it is a reduction of what the firm pays out. The meaning of after tax IRR refers not to the after tax cost of debt (as perceived by the debt holder), but to the net cost paid by the firm.

A loan at 23% before taxes will end up as a loan at 13.8% if the corporate tax rate is 40%. If tax rate T is 40%, then TS is 92 (230×40%). In previous table taxes are paid the same year and the TS fully earned in the same year. In this particular case, after tax contractual Kd is Kd(1-T) = 23% × 60% = 13.8% which is the IRR for the after tax CFL.

Now assume that taxes are paid next year. This means that TS are effectively received when taxes are paid. In that case we have:

Table 7b. Taxes paid next year. TS fully earned

Year	0	1	2
Loan	1,000		
Interest		−230	
Principal payment		−1,000	
CFL before taxes	1,000	−1,230	
Kd	23.00%		
Tax savings			92
Net CFL after taxes	1,000	-1,230	92
Kd after taxes	15.00%		

In the previous table we can see that after tax Kd IS NOT $Kd_{t-1}(1-T)$. Postponing the TS one year increases the after tax cost of debt from 13.8% to 15%.

In both cases the TS is the same: 92, but it is effective one year later. Observe that after tax, the cost of debt Kd *is not* Kd×(1−T). The after-tax Kd is 15% and not

13.8%. Although all these details are manageable in a spreadsheet, in practice most users and recent textbooks keep doing the adjustment for taxes with the factor (1−T).

If Losses Carried Forward (LCF) are allowed, TS not earned in one period can be recovered in the future when losses are recovered.

Reality is not as simple as we have shown in the illustrative examples. Typical conditions in reality make the calculation and the "receipt" of TS a little more complex. Issues like inflation adjustment to the financial statements, losses carried forward, taxes paid in advance or delayed and exchange rate losses might make the calculation of TS difficult. Not all of them are reflected in the cost of debt after taxes, Kd×(1-T).

Free Cash Flow, FCF

A definition used for the FCF is available funds that are actually distributed to the owners of capital (shareholders and debt holders). This value can be reached in two ways: a direct way that will be discussed in this section and measures what the owners of capital (debt or equity) are actually receiving as a portion of income (operating or net). A second approach is the indirect method that requires some adjustments to the accounting figure to convert it to a cash flow. This approach will be studied in another section.

It is common knowledge that free cash flow (FCF) should not include items relating to financing the firm, either equity or debt. This is true. Why? Because the FCF is associated with the unlevered value of the firm (see above equations 1a to 1d). However, we see in those equations that the financing flows correspond in some way to the FCF; in particular, refer to equation (1d).

We can say that CCF ≡ What is paid to the owners of capital

(9)

This means that CCF consists of what the owners of capital are expecting to receive.

We said that one consequence of debt financing was that when the firm is taxed, tax savings are created (and that creates value for the firm or project) and this saving is also involved in net income. For the above argument, we must modify the previous identity as follows.

FCF ≡ What is paid to the owners of capital less the tax savings (10a)

This is,

FCF = CFD + CFE - TS (10b)

As shown, this is the easiest way to build the FCF.

Where are the CFD and the CFE? They are in the Cash Budget statement..

And how do we find the tax savings? Examining when taxes are paid in the CB and if there is enough EBIT plus Other Income in the IS to offset the financial expenses. What we need to know is whether EBIT plus OI are greater than the interest expenses or not. If not, we already know from above, how to calculate the TS.

FCF from the CB

With the direct method we look at the financial statements and in particular the cash flow to determine the CFD and the CFE as we did above. On the other hand we should analyze the financial statements to identify whether there are losses or not and when these losses are recovered. Also, we have to consider whether with net loss it was possible to earn some portion of the tax savings. With this analysis we determine the amount and the time the firm actually earns the tax savings.

Here in our example, what do the financial statements tell us about this issue? The first thing is to check whether they have earned all or part of tax savings. Where do we find this information? We find it In the income statement. Note that in all years,

interest payments (financial expenses) are less than EBIT already mentioned. This means that during all the years the firm will earn the full tax savings (T × FE).

Table 8. EBIT, Other financial income and financial expenses

	Year 1	Year 2	Year 3	Year 4
EBIT	24.0	25.6	27.9	28.1
Return from ST investment	0.0	0.0	0.0	0.0
Sum	24.0	25.6	27.9	28.1
Interest payments	7.0	4.5	4.0	3.4

Applying the previous algorithm (5a) and calculating TS as T times financial expenses, we have

Table 9. Calculation of TS

	Year 1	Year 2	Year 3	Year 4
Tax rate	35.0%	35.0%	35.0%	35.0%
Tax savings earned (Algorithm)	2.5	1.6	1.4	1.2
Tax savings accrued (T × FE)	2.5	1.6	1.4	1.2
TS not earned	0.00	0.00	0.00	0.00

In this case as Tax savings earned (Algorithm) and Tax savings accrued (T × FE) are identical we conclude that there are no TS pending or unearned. In case of a difference, we have to check when these TS can be recovered if there is a regime of losses carried forward, LCF

Table 10. Calculation of FCF from CCF

Year	0	1	2	3	4
CCF	-67.1	22.1	16.0	17.0	2.5
Minus TS		-2.5	-1.6	-1.4	-1.2
FCF	-67.1	19.7	14.5	15.6	1.3

As we see, to arrive at the FCF requires a series of steps and analysis to calculate the TS and to find the correct value. The reader should compare this procedure with the calculation of CCF which allows us to reach the value of the firm or project in a much more simple way.

Traditional Method of Calculating FCF

The traditional approach is the indirect method that requires the calculation of the firm's working capital (current assets minus current liabilities) and also the calculation of the change in working capital (CWC) from one period to another. Done this way, we can apply the following expression:

$$FCF = EBIT \times (1 - T) + Dep + Amort - CWC - Investments \quad (11)$$

Where *EBIT* is the operating income, *T* is the tax rate, *Dep* is depreciation, *amort* is amortization and *CWC* is the change in working capital. The issue here is to convert an accounting figure of profit (net income or EBIT) that contains elements of accrual-based accounting into a cash flow.

Let us examine this "formula" (9). When we calculate EBIT × (1 − T) we are recognizing the taxes with no financial effects (EBIT is by definition before taxes and interest charges hence it does not have that effect). When we add depreciation and amortization charges we are recognizing that these two items are a non-cash movement. When we subtract the CWC we are adjusting the EBIT by undoing some accrual-based accounting operations, by those items that appear in the IS as if they have been totally received in cash (in particular, sales revenues and cost of goods sold because it is common to have accounts receivable, accounts payable and inventories).

Looking in detail at the arithmetic operations regarding the CWC, and in particular on an item, will allow us to understand why it has to be subtracted (See Vélez-Pareja (2005)). In a given year t, we list $Sales_t$ and we wish to determine how much of those sales have been received in that year t. We have to take into account that not all that was invoiced and that appears as sales revenues has been received in

t; in t we have received the amount left after we subtract from the total sales the accounts receivable AR_t. This is, from the sales listed in t, $Sales_t$, the firm receives only

$$\text{CF due to sales at t} = Sales_t - AR_t \quad (12a)$$

In addition, at the beginning of year t (end of year t−1) there were some AR outstanding, that were invoiced at year t−1, this is AR_{t-1}. If those AR were received in t, then they will be part of the cash flow at t. If not, they will be listed in AR_t. Hence, the total cash flow in t due to sales in t and previous year will be

$$CF_{St} = AR_{t-1} + Sales_t - AR_t \quad (12b)$$

Grouping terms we have

$$CF_{Vt} = Sales_t + AR_{t-1} - AR_t \quad (12c)$$

Or,

$$CF_{St} = Sales_t - (AR_t - AR_{t-1}) \quad (12d)$$

This is we subtract the change in AR from t−1 to t, from $Sales_t$. We have to remember that accounts receivable are part of the working capital. With a similar reasoning we can arrive to the conclusion that we should subtract the change from t−1 to t for other items of working capital..

The conclusion is that

$$\text{Net } CF_t = EBIT_t - CWC_t \quad (102e)$$

Where Net CF is the cash flow associated to EBIT and CWC is the change in working capital.

To convert the EBIT into a cash flow we have to subtract the change in working capital.

To have consistency between the definition of FCF and the "formula" (11) we must be careful in defining the elements that enter into it. For example, when we mention the working capital we mean exactly the definition, which is the difference

between current assets and current liabilities. In this case then, current assets contains all the elements that are part of it. In particular, it includes the cash balance, accounts receivable, inventories and marketable securities. On the other hand, it contains current liabilities excluding the current portion of financial debt. This is so because debt (short-term or long-term) is included in what constitutes the CFD,. If, the working capital does not include all current assets (for example, if you leave out the items such as cash and marketable securities as non-operational), we lose consistency between the definition and formulation and there might be an over statement of cash flows.

If we calculate the cash flow using the two methods the results will be identical.

Here is an apparent paradox: if we say that the FCF should be free of the effects of financing, how come we can calculate precisely the elements from which the firm gets the funds, as we did in the first approach? The answer is easy. It's just a matter of perspective. We can see it (in the direct method) as what owners of capital actually receive or using the indirect method, what is available to effectively distribute to the owners of capital. Both approaches, therefore, should lead to the same result.

Where do we get each piece of information in order to derive the cash flows? Using the first approach (direct method), from the cash budget, the Income Statement and from the knowledge of the way taxes are paid and if EBIT is greater, equal or lower than the interest charges. In the second approach (indirect method) we take the information from the Balance Sheet and the Income Statement.

We believe that the first approach is clearer, simpler and less likely to generate errors.

Cost Allocation and Accruals

There are certain expenses that, although not part of the FCF, affect it through tax savings, such as depreciation.

Depreciation is not within the FCF because it is not a flow of cash; hence it is not a cash flow. It is an allocation of past costs: a tangible asset's cost. Depreciation is the result of spreading the cost of an asset over a useful life. It allocates the historical cost of an asset due to wear and tear, usage, time, among other factors. It is then, a noncash expense. Because depreciation is a noncash expense, it increases free cash flow (available cash) and reduces earnings.

With the concepts discussed so far it is clear that the depreciation reduces the tax base and hence taxes, so that if there is accelerated depreciation, (if we depreciate higher early in the life of the asset), then the taxes will be lower now and higher in the future. This happens if we have EBIT. If the firm does not pay taxes because there is no taxable income and losses carried forward are not allowed, this assertion is not valid. When we postpone taxes, its present value diminishes; therefore, the effect of accelerating the depreciation on a project is to enhance its NPV.

Comparison of Approaches

To get a clear view of the simplicity of the proposal (but even more on the simplicity of the proposal by working with the capital cash flow, CCF) we show step by step calculations to obtain the CFE and FCF from the income statement (traditional).

Using the indirect method, the CFE and the FCF are calculated from net income and from EBIT. We illustrate the two procedures.

From The Income Statement IS

We now proceed to do the steps to calculate the FCF from the income statement and balance sheet. The first is to calculate the working capital and its change every year.

Table 11 Working capital WC and its change

Year	0	1	2	3	4
Current Assets	60.1	85.5	92.1	99.8	107.9
Current liabilities minus financial debt	37.9	67.9	73.3	79.3	85.7
WC	22.1	17.6	18.9	20.5	22.2
Change in WC ΔWC	22.1	-4.5	1.3	1.6	1.7

In table 12 we calculate the investment in capital assets (Capex). This is not an item we find in the financial statements and it has to be derived from them. In Table 13 below, we use equation (12) for estimating the investment in capital expenditures.

$$\text{Investment in } FA_t = NFA_t + \text{Depreciation}_t - NFA_{t-1} \quad (13)$$

where FA is fixed assets, NFA is net fixed assets.

Table 12 Calculation of Investment in Assets

Year	0	1	2	3	4
Net Fixed Assets	45.0	45.5	46.4	47.3	48.5
Depreciation		11.3	14.2	17.9	22.7
Investment in assets	45.0	11.7	15.1	18.9	23.8

For instance, at year 2 investment is FA is 15.1 (46.4 + 14.2 -45.5). We have to keep in mind that the usual approaches when calculating cash flows with the indirect method, users only construct the Income Statement and the Balance Sheet and from them they derive the cash flow. This is what we do with equation (9). Also, recall that the typical approach for forecasting financial statements is to use the percent of sales approach and use plugs to solve the balancing problem.

Next we show the calculation of FCF

Table 13. Calculating FCF with the Indirect Method

Year	0	1	2	3	4
EBIT		24.0	25.6	27.9	28.1
Minus tax on EBIT		-8.4	-9.0	-9.8	-9.8
NOPLAT		15.6	16.6	18.2	18.3
plus Depreciation		11.3	14.2	17.9	22.7
Minus ΔWC	-22.1	4.5	-1.3	-1.6	-17.0
Minus investment in assets	-45.0	-11.7	-15.1	-18.9	-22.7
Interest income		0.0	0.0	0.0	0.0
Minus tax on interest income		0.0	0.0	0.0	0.0
FCF (indirect method)	-67.1	19.7	14.5	15.6	1.3
FCF (direct method)	-67.1	19.7	14.5	15.6	1.3

Observe it is identical to the FCF obtained with the direct method.

Finally, next table shows the calculation of CFE with the indirect method

Table 14. Calculating CFE with the Indirect Method

Year	0	1	2	3	4
Net Income		11.0	13.7	15.6	16.1
plus depreciation		11.3	14.2	17.9	22.7
Minus ΔWC	-22.1	4.5	-1.3	-1.6	-17.0
Minus payment (inflow) of debt (principal)	53.6	-18.2	-3.9	-3.5	7.1
Minus investment in assets	-45.0	-11.7	-15.1	-18.9	-22.7
CFE (indirect method)	-13.5	-3.1	7.7	9.5	6.2
CFE (direct method)	-13.5	-3.1	7.7	9.5	6.2

As can be seen, both approaches give the same results as should be the case.

Summary and Conclusions

We have presented the calculation of different cash flows for valuation purposes. In particular, we constructed CFD, CFE, CCF and FCF. We explained in detail the procedure to calculate the TS under different scenarios of EBIT. The conclusion of this analysis is that the standard procedure of calculating TS as the tax rate times the interest paid is only a special case. We also mentioned that there are other sources of tax savings that have to be taken into account in any analysis.

We illustrated the direct and indirect methods. We have shown that both methods arrive to identical results.

We leave to the reader the decision to choose the method more suitable for her preferences. We prefer the easiest one: use the Capital Cash Flow for valuation purposes.

Appendix

Simple example

Table A1. Input Data

Table of parameters			
Tax rate	30.0%		
Domestic inflation rate	5.0%		
	Real	**Nominal**	
Cost of debt	8.00%	13.40%	
Return on ST-investments	5.00%	5.25%	
Investment			
Investment, 2010	2,400.0		
Accounting life, years	8.0		
Economic life, years	10.0		
Debt financing			
Debt, 2010	600.0		
# of equal payments	4.00		
Equity financing			
Initial equity contribution	1,800.0		
Dividends (% of NI)	70.0%		
Revenues			
Annual revenues, 2010	500.0		
Annual increase	100.0		
COGS, % of revenues	45.0%		
Working capital			
Accounts receivable (AR)	15.0%	% of revenues	15.0%
Accounts payables (AP)	10.0%	% of COGS	10.0%
Cash Required for Operations	0.0%	% of revenues	6.0%

Assumptions
No inventories
End of year convention
Project ends at the end of 2014
The expected inflation rate is constant over the life of the project
The annual real increase in revenues is constant over the life of the project
No administrative expenses
No reinvestment
Assume no losses carried forward

No short-term loan
No terminal value calculation
For depreciation, assume straight-line

Abbreviations
Cash Required for Operations (CRO)
Cost of Goods Sold (COGS)
Earnings before Interest and Taxes (EBIT)
Earnings before Taxes (EBT)
Net Income (NI)
Short-term (ST) Investments
Net Cash Balance (NCB)
Long-term (LT) debt
Liquidation value (LV)

Table A2 Indices for inflation and revenues

	Year	2010	2011	2012	2013	2014	2015
Annual inflation rate			5.0%	5.0%	5.0%	5.0%	5.0%
Inflation index		1.000	1.050	1.103	1.158	1.216	1.276
Annual increase in revenues				100.0	100.0	100.0	100.0

Table A3 Depreciation schedule for tax purposes

	Year	2010	2011	2012	2013	2014	2015
Begin balance			2,400.0	2,100.0	1,800.0	1,500.0	1,200.0
Annual depreciation			300.0	300.0	300.0	300.0	300.0
Ending balance		2,400.0	2,100.0	1,800.0	1,500.0	1,200.0	900.0
Market value of investment							1,148.7

Table A4 Loan schedule

	Year	2010	2011	2012	2013	2014
Begin balance			600.0	477.0	337.5	179.4
Interest accrued			80.4	63.9	45.2	24.0
Payment			203.4	203.4	203.4	203.4
Ending balance		600.00	477.0	337.5	179.4	0.0

Table A5 Calculation of annual revenues and COGS

	Year	2010	2011	2012	2013	2014
Annual revenues			500.0	600.0	700.0	800.0
COGS			225.0	270.0	315.0	360.0

Table A6 Working capital

Year	2011	2012	2013	2014
Accounts receivable	75.0	90.0	105.0	120.0
Accounts payable	22.5	27.0	31.5	36.0
Cash Required for Operations	0.0	0.0	0.0	0.0

Table A7 Income statement

Year	2010	2011	2012	2013	2014
Revenues		500.0	600.0	700.0	800.0
COGS		225.0	270.0	315.0	360.0
Gross income		275.0	330.0	385.0	440.0
Depreciation		300.0	300.0	300.0	300.0
EBIT		-25.0	30.0	85.0	140.0
Interest payments		80.4	63.9	45.2	24.0
Return from ST investments		0.0	1.0	7.2	14.6
EBT	-105.4	-32.9	46.9	130.5	
Income taxes	0.0	0.0	14.1	39.2	
Net Income (NI)		-105.4	-32.9	32.8	91.4
Dividends	0.0	0.0	23.0	64.0	
Retained earnings		-105.4	-32.9	9.9	27.4
Cum. retained earnings		-105.4	-138.3	-128.5	-101.1

Table A8 Cash budget statement

Year	2010	2011	2012	2013	2014
Module 1: Operating activities					
Revenues (Cash)		425.0	585.0	685.0	785.0
Total cash inflow		425.0	585.0	685.0	785.0
Purchases (Cash)		202.5	265.5	310.5	355.5
Income taxes		0.0	0.0	14.1	39.2
Total cash outflow		202.5	265.5	324.6	394.7
Operating Net Cash Balance		222.5	319.5	360.4	390.3
Module 2: Investing activities					
Investment	2,400.0				
NCB after capital expend.	-2,400.0	222.5	319.5	360.4	390.3
Module 3: External financing					
Loan inflow	600.0				
Loan repayment		-203.4	-203.4	-203.4	-203.4
NCB after financing activities	-1,800.0	19.1	116.1	157.0	186.9
Module 4: Transactions with owners					
Initial equity contribution	1,800.0				
Dividends		0.0	0.0	-23.0	-64.0
NCB after transactions with owners	0.0	19.1	116.1	134.0	123.0
Module 5: Discretionary transactions					
Redemption of short-term investments		0.0	19.1	136.2	277.4
Return from short-term investments		0.0	1.0	7.2	14.6
Short-term investments	0.0	19.1	136.2	277.4	414.9
NCB after discretionary transactions		0.0	0.0	0.0	0.0
Cumulative NCB		0.0	0.0	0.0	0.0

Table A9 Balance sheet

Year	2010	2011	2012	2013	2014
Assets					
Cash		0.0	0.0	0.0	0.0
Accounts receivable		75.0	90.0	105.0	120.0
Short-term investments		19.1	136.2	277.4	414.9
Current assets		94.1	226.2	382.4	534.9
Net fixed assets	2,400.0	2,100.0	1,800.0	1,500.0	1,200.0
Total assets	2,400.0	2,194.1	2,026.2	1,882.4	1,734.9
Liabilities & Equity					
Accounts payable		22.5	27.0	31.5	36.0
Long-term debt	600.0	477.0	337.5	179.4	0.0
Total liabilities	600.0	499.5	364.5	210.9	36.0
Initial equity investment	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0
Retained earnings		-105.4	-138.3	-128.5	-101.1
Total liabilities & equity	2,400.0	2,194.1	2,026.2	1,882.4	1,734.9

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Discussion Questions on Simple Numerical Example

The following questions are based on the simple financial model that is in Appendix.

Conceptual Questions

1. In Table 2, with respect to the end of 2015, the book value of the investment is US $900,000. However, the market value of the investment is US $1,148,700. Which of these two values is the correct one to include

in the cash flow statement for the project? Briefly explain your reasoning. If both are incorrect, then what is the correct answer? Briefly explain your reasoning.

2. In the income statement, note the following two situations: For 2011, the EBIT is negative, and in 2012, the sum of the EBIT and the return from short-term investments is less than interest payments. Briefly explain the calculations of the tax savings for these two years.
3. What is the Capital Cash Flow (CCF)? Briefly explain. Briefly explain how one would derive the capital cash flow (CCF) from the cash budget statement.
4. What is the Free Cash Flow (CCF)? Briefly explain. Briefly explain whether it is possible to derive the free cash flow (FCF) from the cash budget statement. If yes, explain how. If no, explain what additional information is required, and from where do we obtain this information?