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WACC or APV?

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Abstract

Miller and Modigliani's seminal papers (1958, 1963) gave rise to two alternative methodologies for project and firm valuations: the Weighted Average Cost of Capital (WACC) and Adjusted Present Value (APV). As is often the case of many larger firms in industrialized economies, whenever a target debt ratio is set up for the long term, WACC might be a good approximation. However, APV has certain advantages making it more convenient for smaller companies with unstable debt ratios, in countries with complex tax legislation and in emerging markets where high economic uncertainty makes the leveraging decision much more opportunistic.

KEYWORDS: WACC, APV, valuation

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WACC OR APV?

There are basically two methodologies for project and firm valuations: the Weighted Average Cost of Capital *WACC* (and derived methods) and Adjusted Present Value (*APV*)[1].

For practical purposes, as is often the case of many larger firms in industrialized economies, whenever a target debt ratio is set up for the long term, *WACC* and its associated methods might be an acceptable approximation.

However, the situation is different in a considerable number of instances:

a) For smaller firms with unstable debt ratios and non-existent or negligible long-term debt;

b) Wherever tax codes include significant taxes beyond the typical corporate tax rates on profits;

c) In emerging markets where scarce financial market development hampers significant levels of long-term debt and high economic uncertainty makes the leveraging decision much more opportunistic

For the sake of simplicity and for the rest of this paper those companies under the aforementioned conditions will be named as Non-Standard Firms (*NSFs*).

This paper asserts that *APV* has a number of advantages making it often more convenient than *WACC*-derived methods for *NSFs*..

1) Background

According to Miller & Modigliani (1958, 1963), hereinafter *MM*, the after tax cost of capital *WACC* of a firm is given by the following formula:

$$WACC = \frac{D}{V} \cdot \left(1 - T_C\right) \cdot r_D + \frac{E}{V} \cdot r_E \qquad (1)$$

The next relationship also holds[2]:

$$WACC = \left(1 - \frac{DT_C}{V}\right) \cdot r_A \qquad (2)$$

Where,

r_A is the asset discount rate after taxes

D is the market value of debt

T_C is the corporate tax rate

V is the market value of the firm

r_D is the discount rate on debt

E is the market value of equity

r_E is the discount rate on equity

Reordering terms the following expression is found for the return on equity with taxes:

$$r_E = r_A + \frac{D}{E} \cdot \left[\left(r_A - r_D \right) \cdot \left(1 - T_C \right) \right] \tag{3}$$

There is also the following equivalent formula:

$$V_L = V_U + DT_C \tag{4}$$

Where V_U is the value of the unleveraged firm after taxes.

This last formula shows that the value of the firm rises with debt by an amount equal to DT_C. This last quantity is known as the debt tax shield. The tax shield materializes through a cash flow increase for fund providers. Notice that *WACC* seeks to capture the impact of these incremental cash flows by diminishing the discount rate applicable to unleveraged free cash flows.

MM's conclusions are supported on the following assumptions:

a) No Transaction Costs

This supposition ensures for everyone to have the same access to financial markets. The lack of transaction costs also implies that costs of financial distress are inexistent.

b) Perfectly Competitive Financial Markets

With this condition nobody has advantages in the financial markets. If this were not the case, leverage preferences could differ among market participants and debt levels would not be immaterial.

c) No Agency Costs

This implies that the manager's sole objective is to maximize shareholders' wealth. Thus, the financial mix does not have any connection with the particular interests of administrators or any impact on firm value.

d) No Personal Taxes

Individuals do not pay taxes[3].

e) All Free Cash Flows are Perpetuities

This assumption is built-in only to simplify the formulas and is not really necessary for proving *MM*'s claims about the impact of leverage on firm value.

f) Constant Corporate Tax Rate

This condition reduces the effect of taxes to the case where the tax code only includes corporate income taxes.

Actually, the term DT_C in the preceding formulas is a simplification since it only takes into account the corporate tax effects on interest payments and assumes just one marginal tax rate. Strictly the actual tax rates applicable to each and every cash flow along the horizon must be considered. Therefore, in a more general way, the value of the tax shield (*TS*) is better expressed as *PV(TS)*.

If, in addition, the costs of financial distress (*CFD*) are included, formula (4) must be re-written as:

$$V_L = V_U + PV\left(TS\right) - PV\left(CFD\right) \tag{5}$$

The costs of financial distress emerge through a decrease in expected free cash flows for all fund providers. This results in a reduction in the value of the firm. Information on the costs of financial distress is gathered mainly from bond rating reports which are not readily available for most *NSFs*[4].

For simplicity, the impact of the costs of financial distress will be ignored for the rest of this paper. Hence, the value of the leveraged firm (or its *APV*) will be given by:

$$V_L = APV = V_U + PV\left(TS\right) \tag{6}$$

MM's work gave rise to three approaches for firm and project valuation: *WACC*, Flow to Equity (*FTE*) and Adjusted Present Value (*APV*). Subsequently, Ruback[5] proposed a fourth method: Capital Cash Flows (*CCF*).

Following, the adequacy of these methods for the case of *NSFs* will be discussed. The argumentation will focus on a simple practical example.

2) Valuation Methods

A base case will be set up on which the different valuation approaches will be performed.

2.1) Base Case

The term "financial balance sheet" is defined as the firm's balance sheet in market value terms. Assuming that all cash flows are non-growing perpetuities, the financial balance sheet of a leveraged firm can be expressed as[6]:

Assets	**Liabilities**
Tangible Assets	Debt
Debt Tax Shield (DT_C)	Equity
Total Value	Total Value

Imagine a firm with a constant operational cash flow before taxes of $20 Million (a non-growing perpetuity). If the yearly tax rate remains constant at 50% and the non-leveraged discount rate after taxes (r_A) is 12% the operational cash flow after taxes is $10 Million and its present value $83.34 Million. This is the value of the firm´s tangible assets.

Say that the company has a non-growing financial debt amounting to $50 Million and costing 4% yearly[7].

The financial balance sheet of the firm will be:

Assets	**Liabilities**
Tangible Assets: +$83.34 Million	Debt: $50 Million
Debt Tax Shield: +$50 Million x 0.5 = $25 Million	Equity: $58.34 Million
Total Value: $108.34 Million	Total Value: $108.34 Million

2.2) WACC Valuation

WACC is the most widely used method for project and firm valuation. Through this method value is computed by discounting after tax unleveraged free cash flows at the Weighted Average Cost of Capital (*WACC*).

First the discount rate on equity r_E must be estimated. The practical way to do it is by estimating the beta of the equity and then determining r_E through the *CAPM*. Given that in this example market information is lacking, formula (3) will be used instead:

$$r_E = r_A + \frac{D}{E}\left[\left(r_A - r_D\right)\left(1 - T_C\right)\right] = 12\% + \frac{50}{58.34}\left[\left(12\% - 4\%\right)\left(1 - 0.5\right)\right] = 15.43\% \qquad (7)$$

The *WACC* rate is computed through formula (1):

$$WACC = \frac{D}{V}\left(1 - T_C\right)\cdot r_D + \frac{E}{V}\cdot r_E = \frac{50}{108.34}\left(1 - 0.5\right)4\% + \frac{58.34}{108.34} = 9.23\% \qquad (8)$$

Observe that the same result is obtained by using formula (2):

$$WACC = r_A \cdot \left(1 - \frac{DT_C}{V}\right) = 0.12 \cdot \left(1 - \frac{\$50 Million \cdot 0.5}{\$108.34 Million}\right) = 9.23\% \qquad (9)$$

The value of the firm is attained by computing the present value of the $10 Million perpetuity at the *WACC* rate:

$$PV = \frac{\$10 Million}{0.0923} = \$108.34 Million \qquad (10)$$

2.3) FTE Valuation

FTE is also a widely used methodology. Under *FTE*, first total value to equityholders (*E*) is computed by discounting after tax cash flows to equityholders at the equity discount rate r_E. Firm value is found by adding the value of the debt *D*.

From (8) the equity discount rate is already known to be 15.43%. The cash flow to equityholders will be the after tax value of the difference between before tax yearly unleveraged earnings ($20 Million) and yearly interest payments (50 Million x 4%):

$$FTE = \left[20Million - 50Million \cdot 4\%\right]\left(1 - 0.5\right) = \$9Million \tag{11}$$

The value of equity is the present value of the $9 Million perpetuity at the r_E rate.

The value of the firm will be:

$$PV = E + D = \frac{9Million}{0.1543} + 50Million = 58.34Million + 50Million = \$108.34Million \tag{12}$$

Which is identical to the result obtained through *WACC*.

2.4) CCF Valuation

Capital Cash Flows (*CCF*) is a newer method[8]. The cash flow to be discounted (*CCF*) is the overall after tax cash flow received by both debtholders and equityholders[9]. Value is obtained by discounting *CCF* at the before tax *WACC* rate as follows:

The discount rate is:

$$r_{CCF} = \left(\frac{D}{V}\right) \cdot r_D + \left(\frac{E}{V}\right) \cdot r_E = \left(\frac{50Million}{108.34Million}\right) \cdot 4\% + \left(\frac{58.34Million}{108.34Million}\right).15.43\% = 10.15\% \tag{13}$$

The cash flow to be discounted (*CCF*) is:

$$CCF = D \cdot r_D + E \cdot r_E = 50Million \cdot 4\% + 58.34Million \cdot 15.43\% = \$11Million \tag{14}$$

And firm value will be the present value of an \$11 Million perpetuity at the r_{CFF} rate:

$$PV = \frac{\$11 Million}{0.1015} = \$108.34 Million \tag{15}$$

This is exactly the same result obtained through both the *WACC* and the *FTE* valuations.

Notice that the discount rates for the previous three valuation methods require:

a) All cash flows to be perpetuities

b) A constant and unique corporate tax rate

c) A constant *D/V* ratio, meaning that the level of debt evolves according to firm value over time

Since the three methods share the same restrictions it can be concluded that *FTE* and *CCF* are really *WACC*-derived valuation methods.

Rigorously, the three methods should be invalidated whenever these restrictions do not hold (which happens to be the case in most real life situations). However, this inconvenient can be ameliorated by recalculating the discount rates according to every period's capital structure. Also, an equivalent T_C reflecting the combined effect of all taxes could be estimated.

2.5) APV Valuation

Together with *WACC*, *APV* is the most widely used method for project and firm valuations. Value is obtained according to formula (7)

$$V_L = APV = V_U + PV(TS) = 83.34 Million + 50 Million \cdot 0.5 = \$108.34 Million \tag{16}$$

Once more the same result obtained with the other methods.

If cash flows were not perpetuities and the firm wished to keep a constant debt ratio, the level of debt must be adjusted every period to reflect the changing present values of both tangible assets and the tax shield.

It is important to realize that whenever cash flows are not perpetuities, *APV* has important key differences with the *WACC*-derived valuation models:

a) The discount rate is unleveraged reflecting the expected return demanded by investors from the type of business being analyzed, independently of the way free cash flows evolve over time. This permits valuation of free cash flows that are not perpetuities

b) The firm as a whole is valued without consideration to its leverage over time leaving the level of debt as an independent variable with no relation whatsoever with the value of the firm. So, no fixed debt ratio is necessary.

c) The present value of the debt tax shield is computed by discounting actual period-by-period tax savings. Each period's taxes are computed according to the particular tax code applicable without having to assume a unique and constant corporate tax rate.

3) Method Comparison

It was seen above that the shortcomings associated with the *WACC*-derived methods can be ameliorated if the discount rates are recalculated according to the capital structure of every period and an equivalent T_C is adapted to reflect the combined effect of all corporate taxes. In this manner, the *WACC/FTE/CCF* results will tend to resemble those achieved through *APV*.

It was also stated that if cash flows are not perpetuities and the firm wishes to keep a constant debt ratio, *APV* will yield results akin to those of *WACC/FTE/CCF* as long as the level of debt is adjusted over time in line with the changing present values of both tangible assets and the debt tax shield. In this way, the *APV* results will tend to be like those attained through *WACC/FTE/CCF*.

Observe that a time frame (be a month, a semester or a year) must always be defined to make either of these adjustments. The shorter the period the closer the results will be between the *WACC*-derived methods and *APV*. Nonetheless, being the periods discrete the outcomes from the two approaches will always differ and the adjustments to either method might be quite cumbersome and time consuming.

At this point it can be stated that:

a) Whenever the level of debt can be anticipated along the horizon, *APV* will be the simpler method: The present value of the debt tax shield is added to the firm's unleveraged value and, being tax savings directly associated with the systematic risk of the debt, they will be discounted at the discount rate of the debt r_D.

b) When the firm seeks to maintain a stable debt ratio, the level of debt evolves with the value of the firm. Hence, tax savings depend on both the changing value of the firm and the discount rate of the debt. In this instance, the appropriate discount rate is not clear cut, nevertheless it has been proved that *WACC* automatically solves this problem[10]. Hence, *WACC* will be the preferable method.

It is obvious that neither of these two extreme cases faithfully reflect the day-to-day reality of most firms. Having say that, case 2, where a target debt ratio is set up for the long term, might be an acceptable approximation for many larger corporations in advanced and stable countries. On the other hand, case 1, where the level of debt is independent from firm value, is closer to *NSFs* where leverage depends more on financial market conditions and other factors.

3.1) On the Practical Impact of the Debt Tax Shield

Before continuing some comments are necessary about the final impact of the debt tax shield.

The debt tax shield is relevant only if corporate profits materialize[11]. But corporate profits not only arise from day-to-day operational results but are also affected by the so called "Non-Debt-Tax-Shields" (*NDTS*). *NDTS* stem from items such as depreciation and amortization, and research and development expenditures that are regularly expensed from taxable income. The larger these deductions, the lower the taxable income and the less significant the debt tax shield will be. This means less sizeable tax benefits of debt for capital intensive and research dependent firms with considerable *NDTS* [12].

In many countries, the fact that corporate taxes do not depend only on profits also make the tax benefits of leverage less predictable. The inflation adjustment tax existing in some Latin American nations offers an extreme example where it is possible for the debt tax shield to decrease (instead of increase) with leverage.

According to this tax, balance sheet accounts are classified either as "monetary" or "non-monetary". High rotation items like accounts receivable and accounts payable are considered monetary. More stable items such as fixed assets, inventories and equity are considered non-monetary.

The non-monetary items must be inflation adjusted whereas the monetary ones need not. Firms pay a tax on the "profits" due to a favorable impact of inflation on their balance sheets. The tax is computed on the difference between the adjusted items in the asset and liability sides. Let us illustrate with the following example[13]:

	Assets	Liabilities
Monetary	$200 Million	$500 Million
Non-Monetary	$800 Million	$500 Million (Equity)
Totals	$1000 Million	$1000 Million

For an inflation index of 20%, the adjustment is:

$$Adjustment = (\$800 \cdot 20\%) - (\$500 \cdot 20\%) = +\$60 Million \quad (17)$$

This means that taxes will be paid on an inflationary "profit" of $60 Million. Notice that the larger the equity (and the lower the debt) the smaller the inflationary tax. Hence, the direction of this tax incentive is opposite to the traditional tax on profits.

In practical terms, the widespread custom for *NSFs* is to set up a mixed debt policy. A minimum (low) debt ratio is established that should remain constant for the long term and at the same time a management determined second tier to be modified opportunistically is acknowledged. Hence, debt is partially dependent on firm value and partially management determined[14].

This brings us to conclude that *APV* looks better suited for *NSFs* than the *WACC*-derived methods. However, at first glance the practical application of *APV* is hampered by the fact that the discount rate for the debt tax shield is not clearly defined[15]. Fortunately, a recent paper[16] offers a solution to the debt tax shield problem. The author asserts that:

> *"…a consistent way to estimate the value of the tax savings is not by thinking of them as the present value of a set of cash flows, but as the difference between the present values of two different sets of cash flows: flows to the unlevered firm and flows to the levered firm".*

Therefore, the problem stemming from the correct discount rate applicable to the tax savings seems to be resolved: The present value of the debt tax shield is computed by subtracting the present value of two cash flow streams both tied to shareholder returns. The first stream corresponds to the taxes that the firm would have paid if it lacked any leverage. Being these taxes directly related to the firms'unleveraged profits the applicable discount rate must be the unlevered discount rate (r_A) which in this instance is equivalent to the equity discount rate (r_E).

The second stream corresponds to the taxes paid by the leveraged firm. These taxes are tied to period-by-period leveraged profits and therefore their discount rate is the period-by-period equity discount rate (r_E). This rate must be computed in line with the firm's leverage at each point in time. The present value of the debt tax shield results from subtracting the second from the first stream. Let us illustrate with our base case example:

If there were no debt operational cash flows and taxes would be:

Tax Stream Without Leverage	
Operational Cash Flow Before Taxes	\$20 Million
Taxes (50%)	\$10 Million

The unlevered discount rate (r_A) and the discount rate on equity (r_E) after taxes would be both 12%. Hence, the present value of the unlevered tax stream will be:

$$PV\left(Unlev.Taxes\right)=\frac{10}{0.12}=\$83.33Million \tag{18}$$

With \$50 Million leverage at a 4% yearly cost the tax stream will be:

Tax Stream With Leverage	
Operational Cash Flow Before Taxes and Interest	\$20 Million
Interest Payments (50 Million x 4%)	\$2 Million
Operational Cash Flow After Interest	\$18 Million
Taxes (50%)	\$9 Million

The levered discount rate on equity as computed in (7) is 15.43%. Thus, the present value of the levered tax stream is:

$$PV\left(Lev.Taxes\right)=\frac{9}{0.1543}=\$58.33Million \tag{19}$$

The present value of the tax shield is:

$$PV\left(Tax\ Shield\right)=83.33-58.33=\$25Million \tag{20}$$

This is the same figure obtained in the base case example. It was to be expected given that the base case is based on a non-growing perpetuity.

Thus, the way is cleared for *APV* as the proper valuation method when constant leverage ratios and simple tax codes are not realistic assumptions . The valuation is decomposed as follows: First, the value of the unleveraged firm must be calculated, and then the present value of the debt tax shield (as the difference of two cash streams) is added up[17].

Before concluding a word must be said about the terminal value.

In many valuations it is customary to assume a constant debt ratio perpetuity at the end of the horizon. It was explained above why *WACC* (and its derived methods) are the most suitable for this kind of situation. Therefore, there is no doubt the *WACC* is the recommended method for finding the present value of the perpetuity.

Summarizing, for many smaller companies everywhere and in emerging markets it is recommended to use *APV* within the horizon when leverage is unstable and *WACC* related methods for the perpetuity when the debt ratio is fixed.

4) Conclusions

There are basically two alternative methodologies for project and firm valuations: on the one hand the *WACC*-derived methods, including *WACC* proper, Flow-to-Equity (*FTE*) and Capital Cash Flows (*CCF*); and on the other hand Adjusted Present Value (*APV*).

The two methodologies yield the same results as long as cash flows are perpetuities, there is a unique and constant corporate tax rate, and leverage as a proportion of the market value of the firm remains constant. When these conditions are not met the two methodologies can be adjusted to yield approximately analogous outcomes.

For practical purposes, whenever a target debt ratio is set up for the long term, *WACC* and its associated methods might be an acceptable approximation. This is often the case of many larger corporations in advanced and stable countries.

However, the situation is often different for smaller firms everywhere, and in many countries where: a) high economic uncertainty press firms to build in

considerable financial flexibility and be prepared to quickly adjust the amount and profile of their debts in reaction to political and macroeconomic developments and; b) legislation often includes taxes such as those on inflationary "earnings" or asset value, to the extent that the common corporate tax rate might not necessarily be the more relevant levy.

APV has a number of advantages making it more convenient than *WACC*-derived methods in many instances. In particular:

a) No fixed debt ratio is necessary. The firm as a whole is valued without consideration to its leverage over time leaving the level of debt as an independent variable with no relation whatsoever with the value of the firm.

b) The present value of the debt tax shield is obtained by discounting actual period-by-period tax savings. Each period's taxes are computed according to the particular tax legislation applicable without having to assume a unique and constant corporate tax rate.

However, *WACC* still remains the more convenient procedure for discounting the perpetuity that is usually assumed at the end of the horizon, the reason being that *WACC* automatically corrects for the discount rate applicable to the tax shield.

Notes

[1] Modigliani F., Miller M. H. 1958, 1963.
[2] Haley C. W., Schall L. D. 1973
[3] Miller (1977) shows how MM's conclusions change in the presence of personal taxes.

4 The value of the firm might also be affected by other variables such as subsidies that might lower the cost of debt or improve the firm's financial results, costs associated with issuing new securities, etc. If these other effects are factored in we come to the concept of Adjusted Present Value (*APV*) in its more complete form expressed as (where *SE* stands for "Special Effects" encompassing the diverse factors mentioned above):

$$APV = V_U + PV(TS) + PV(SE) - PV(CFD) \quad .$$

[5] Ruback R. S. 2002.
[6] The example could also be developed with growing perpetuities.
[7] For simplicity it is assumed that the cost of serving the debt equals the discount rate of the debt $r_{D.}$
[8] Ruback R.S. 2002.
[9] CCF also corresponds to the unleveraged after tax cash flow plus the debt tax shield.

[10] Inselbag I., Kaufold H. 1997.

[11] The case of those companies having a net operating loss that can offset earnings into the future displacing the tax shield to future periods is ignored in this paper.

[12] Grinblatt M., Titman S. 1998.

[13] The example is taken from Sabal J. 2002.

[14] The focus is on local firms. Subsidiaries of multinational corporations determine leverage with an overall global perspective taking into account differential taxes, availability of local credit and exchange risks.

[15] There has been a long academic dispute as to the right discount rate for tax savings since it has not been at all clear what is the risk associated with this cash stream (Myers S. C. 1974, Harris R. S. & Pringle J. J. 1985).

[16] Fernandez P. 2004.

[17] The impact of special effects (and eventually of the costs of financial distress) might also be factored.

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