Investment appraisal: A critical review of the adjusted present value (APV) method from a South African perspective

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Abstract

Since first developed by S C Myers, the adjusted present value (APV) approach has gained wide recognition as an acceptable method of discounting cash flows. Although a number of assumptions have to be made, there is merit in using the APV method as an alternative to the NPV method of project appraisal. The purpose of this article is to evaluate the appropriateness of the APV method for investment appraisal purposes in the South African context. The major advantage of the APV method is that it separates the NPV rendered by the project if it were all-equity financed, from the side-effects of financing. This allows the advantage of project-specific financing to be taken into account in a very direct way when a project is evaluated, which is especially helpful when the weight or cost of financing differs from the rest of the company.

Within the South African context, and specifically against the background of South African taxation legislation, certain principles underlying APV is questionable. The major point of critique is that the existence of the tax shield under South African taxation legislation is not proven. The second point of critique is that the different formulae used to determine the K_u, the cost of equity in an ungeared project, only render the same answer when the cost of debt is equal to the risk-free rate. In this regard a suggestion is made to adjust K_u for the premium on the risk-free rate in the case where the cost of debt exceeds the risk-free rate.

Key words

Adjusted present value (APV)
Net present value (NPV)

1 Introduction

Corporate investment appraisal is set in the context of the company's capital budgeting process and more widely, in its overall aims, culture and environment. Capital budgeting involves the selection of appropriate investment projects as well as decisions on the source and scale of how these projects will be financed (Samuels, Wilkes & Brayshaw 1995:73).

The most important investment appraisal techniques are the accounting rate of return (accounting profit as a percentage of initial investment), the payback method (period of time before initial investment is recouped in cash), internal rate of return, net present value method (Correia, Flynn, Uliana & Wormald 1993:343-350), and, more recently, the adjusted present value method (Brealey & Meyers 1996:525). The major disadvantage of the former two is that it fails to take the time value of money into account. These two methods are therefore only useful as a broad indicator of profitability (Correia *et al* 1993:349).

The internal rate of return (IRR) and net present value (NPV) methods are very similar. In the case of the former, the internal rate of return of a number of cash flows spanning a number of years are determined. This rate of return is then compared to the company's weighted average cost of capital to determine the feasibility of the project (Correia *et al* 1993:345). The net present value method involves discounting the cash flows at the company's weighted average cost of capital. A positive net present value indicates that the project earns more than the company's cost of capital and that it therefore should be accepted.

Pike (1996:82) has shown that there was a large increase in the use of discounted cash flow techniques by large firms in the United Kingdom during the period 1975 to 1992, while the use of the accounting rate of return remained fairly constant. Pike's research indicates an increase in the use of the Internal rate of return from 44% to 81% of the companies, while the use of the Net present value increased from 32% of the companies to 74% in the same period. The use of the average rate of return remained constant at about 50%.

Since it was first developed by S C Myers (1974:1-24), the adjusted present value (APV) approach has gained wide recognition as an acceptable method of discounting cash flows (Brigham & Gapenski 1996:280).

The model is called the adjusted present value model (APV) as the project (or company) valued will first be valued as if it were all-equity financed, and then this value is adjusted to allow for tax relief on debt capital and other possible advantages or side-effects of financing. In other words, the project's direct contribution is adjusted for the project's side effects on other investment and financing options (Myers 1974:4). The evident advantage over the other discounting methods is that it combines investment and financing decisions and allows the financing effects specific to a particular project to be incorporated into the analysis of that project (Brigham & Gapenski 1996:281).

The purpose of this article is to evaluate the appropriateness of the APV method for investment appraisal purposes in the South African context.

The article is arranged as follows: After the introduction, an exposition of the APV approach is presented. The APV method is then evaluated. Two issues are raised: (1) the formulae used to determine the value of an ungeared project can only be reconciled if the cost of debt is equal to the risk-free rate, and (2) the validity of the tax shield under current South African taxation legislation is discussed.

Research entailed a study of relevant sources on the topic of adjusted present value and capital structure.

The article concludes that, against the background of South African taxation legislation, certain principles underlying APV is questionable. The major finding is that the article doubts the existence of a tax shield under South African taxation legislation.

A list of frequently used symbols and abbreviations is included as Appendix A.

2 An exposition of the APV approach

2.1 Background

The APV approach separates the net present value of a project into two components:

- the NPV that the project would produce if it were all-equity financed, also called the base-case NPV (Lumby 1991:414); and
- the present value (PV) of financing-related cash flows, of which the PV of tax savings as a result of using debt, is the most important.

The adjusted present value is the sum of these two components. Therefore, for the purpose of this article, the APV can be expressed as follows:

APV = base-case NPV + PV of the tax shield, or:
$V_{gp} = V_{up}$ + PV (tax shield)

where:
V_{gp} = Value of a geared project
V_{up} = Value of an ungeared project

This formula was deduced from the Modigliani and Miller formula which accounts for the value of a geared company after taking taxes into account. The similarity to the Modigliani and Miller proposition I is evident:

$V_g = V_u$ + PV of the expected tax shield (Modigliani & Miller 1963:436)

where:

V_g = Value of geared company
V_u = value of ungeared company

The application of the APV method is best explained by means of an example:

Example 1

The following applies to Johnson Limited: The cost of debt (assumed to be risk-free) is 10%, the market return is 15%, and the corporate rate of taxation is 35%. The company has a beta of 1,2 and its target debt:equity ratio is 1:4.

The first step is to determine the required return on shareholders' equity:

$$\begin{aligned} K_e &= R_f + \beta(R_m - R_f) \\ &= 10\% + 1{,}2(5\%) \\ &= 16\% \end{aligned}$$

The weighted average cost of capital can be calculated as follows:

$$\begin{aligned} K_o &= 0{,}8\ (16\%) + 0{,}2\ (1 - t)\ K_d \\ &= 14{,}1\% \end{aligned}$$

The company is considering project AB requiring an outlay of R1 000 000, which is expected to produce an after tax cash flow of R282 000 in perpetuity (R433 846 per annum, before taxation). The acceptance of the project would not involve any change in risk.

2.2 Financing rules

The first aspect that needs to be clarified is how the project above should be financed if the company remains at its current target debt:equity ratio of 1:4.

Brealey & Myers (1996:529) suggest that there are two common financing rules and that the value of the tax shield depends on the rule followed by the company. The rules are:

- Financing rule 1: Debt fixed. A fraction of the initial project value is borrowed and debt repayments made on a predetermined schedule. The debt:equity ratio is therefore based on the initial outlay of the project and does not take the NPV of the project into account.
- Financing rule 2: Debt rebalanced. Debt is adjusted in each future period to reflect a constant fraction of the future project value, taking into account the repayment of debt as well as the increase in equity due to the NPV of the project.

In practice financing rule 1 would apply to a situation where a fixed amount of debt is used to finance a project, while financing rule 2 would be appropriate for a situation where a target debt:equity ratio has to be maintained.

With reference to Example 1 above, a number of writers seem to suggest that the project should simply be financed with R200 000 of debt and R800 000 of equity (cf. Correia *et al* 1993:621; Van Horne 1992:220; Samuels *et al* 1995:646). That would be in accordance to financing rule 1 above.

However, Lumby (1991:411) suggests that this does not appear to bring the project's NPV that accrues to equity shareholders into account. Lumby argues that although the initial capital outlay is R1 000 000, the annual net cash inflows will have a present value of R282 000/0,141 = R2 000 000. Based on financing rule 2, this increase in company value should be split in the ratio 1:4. Therefore, as a result of the market value of the project, debt should increase by R400 000 and the market value of equity should rise by R1 600 000. R400 000 of new debt should be raised to finance the project, and the balance required for the initial outlay, R600 000, should come from the equity shareholders.

2.3 The cost of equity in an ungeared project

When using the APV method to determine the value of Project AB in Example 1 above, the project's net cash flow is determined assuming that it is all equity financed, and then adding the benefits of the new debt capital.

It is therefore necessary to determine what the discount rate would be if the project was equity financed only.

Two formulae are widely used for adjusting the shareholders' required return (K_e) of a geared firm or project to the required return (K_u) of an ungeared firm or project:

The first formula is the Modigliani & Miller proposition 2 with taxes:

$K_e = K_u + (1 - t)(K_u - K_d)(V_d/V_e)$ (Modigliani & Miller 1963:439)

which can be rearranged as follows:

$$K_u = \frac{(V_e \times K_e) + (V_d \times K_d(1-t))}{V_e + V_d \times (1-t)}$$

In the second formula the capital asset pricing model ($K_u = R_f + B_a(R_m - R_f)$) is used, and $ß_a$ of the ungeared firm or project is determined as follows:

$$ß_a = ß_e \frac{V_e}{V_e + V_d(1-t)} + ß_d \frac{V_d(1-t)}{V_e + V_d(1-t)}$$

(Samuels *et al* 1995:283; Lumby 1991:417)

As the beta of debt is usually assumed to be zero (Samuels *et al* 1995:283; Lumby 1991:416), the second term disappears, leaving:

$$\beta_a = \beta_e \frac{V_e}{V_e + V_d(1 - t)}$$

$$= \frac{\beta_e}{(1 + V_d/V_e(1 - t))}$$

Using these two formulae to calculate K_u leads to the same answer:

$$K_u = \frac{(V_e \times K_e) + (V_d \times K_d(1 - t))}{V_e + V_d \times (1 - t)}$$

$$= (4 \times 16 + 1 \times 10 \times 0{,}65)/(4 + 1 \times 0{,}65)$$
$$= 15{,}1613\%$$

or:

$$\beta_a = \beta_e/(1 + (1 - t)V_d/V_e)$$
$$= 1{,}2/(1 + 0{,}65 \times 1/4)$$
$$= 1{,}0323$$

$$K_u = R_f + \beta_a(R_m - R_f)$$
$$= 10 + 1{,}0323(5)$$
$$= 15{,}1613\%$$

Therefore V_{up} = R282 000/15,1613% = R1 860 000

2.4 The present value of the tax shield

The present value of the tax shield in Example 1 can be determined by discounting the annual interest saving by the cost of debt, or, more directly, by multiplying the amount of debt by the rate of taxation.

0,1 x R400 000 x 0,35/0,1 = R140 000

The value of the geared project is calculated as follows:

$$
\begin{aligned}
V_{gp} &= V_{up} + PV(\text{tax shield}) \\
&= R1\ 860\ 000 + R140\ 000 \\
&= R2\ 000\ 000
\end{aligned}
$$

As the value of the project is R1 000 000 more than the initial outlay, it should be accepted.

Using the weighted average cost of capital, results in the same answer: R282 000/0,141 = R2 000 000

Assume that instead of using R400 000 worth of debt, the directors decide to finance this project with R600 000 of debt, in other words, the project bears a gearing ratio different from that of the company as a whole. The APV method will then be a useful method to determine the value of the project. The advantage that the company accrues from using the *extra* debt of R200 000, is given by the present value of the tax relief: R200 000 x 35% = R70 000.

The total value of the geared project will be:

R1 860 000 + R600 000 x 35% = R2 070 000.

2.5 Debt capacity created

Lumby (1991:420) points out that the value of the tax shield should be based on the theoretical amount of debt that a project's debt capacity would allow it to raise and not on the actual amount of debt used. Lumby shows that the value of a project's debt capacity lies in the project's ability to act as security for a loan, and the consequent tax relief available from such a loan. In practice some projects may be undertaken where the actual amount of debt finance effectively undergears the project, leaving spare debt capacity. Alternatively, a project might be financed by more debt capital than the project itself can support, which means that the project is overgeared because of unused debt capacity elsewhere in the company. In order to avoid the influence of this cross-subsidisation, Lumby advocates that the theoretical amount of debt financing that a project allows is used to base the value of the tax shield on.

The logic behind the APV method is this: different risk cash flows should be evaluated separately using discount rates which specifically reflect the systematic risk levels involved. For this reason, the technique is sometimes referred to as the Valuation of Components Rule (Lumby 1991:422).

3 Evaluation of the APV method

The major advantage of the APV approach is that it allows the financing effects specific to a particular project to be incorporated into the analysis of that project (Brigham & Gapenski 1996:281). The APV approach therefore is appropriate for projects where (1) the debt used to support the project can be specifically identified, (2) where the project will be financed with a debt/equity mix which differs from the company's target ratio, and (3) where the use of a differential debt/equity mix on one project does not alter the firm's optimal debt/equity mix used to finance the firm's other projects (Brigham & Gapenski 1996:281). Although other methods such as the NPV also recognise the taxation benefits of debt, it assumes that all projects are financed with the same debt/equity mix, whereas the APV method provides a convenient way to recognise differential debt-carrying capacities of different assets.

Lumby (1991:415) shows that the different methods of investment appraisal lead to the same solution as long as the company's existing gearing ratio is maintained. However, as soon as the project's gearing ratio is different from that of the company as a whole, the APV method is the only method that is capable of taking the effect into account.

A major disadvantage of the APV is that it is difficult to determine the cost of equity for an ungeared project in a risk class equal to that of each project under consideration (Brigham & Gapenski 1996:281), and also the amount and cost of debt that will be used to finance each project. These specifications may possibly be determined for large stand-alone projects, but are not feasible for the large majority of capital projects.

Another argument against the APV method is that it is usually necessary to use different costs of capital for different projects as these projects usually do not bear the same risk. Since this adjustment is made anyway, a further adjustment can be made to allow for the greater debt-carrying capacity of a specific project, which will result in a lower effective cost of capital (Brigham & Gapenski 1996:281).

Brealey & Myers (1996:527) also point out that a tax shield cannot be used unless a company is profitable and therefore paying taxes, and not many companies can be sure that future profits will be sufficient to allow for the benefit of the tax shield. A project's debt capacity depends on its ability to generate enough income to pay interest. When profits exceed expectations, the firm can borrow more. If the project fails, it will not support any debt. The future amount of interest saving is tied to the value of the project. The present value of the tax shield is therefore only an estimate.

4 Two additional points of critique against the APV method

4.1 The formulae used to determine the value of an ungeared project can only be reconciled if the cost of debt is equal to the risk-free rate

4.1.1 Background

As shown above, there are basically two formulae that may be used to calculate K_u in an all equity project.

The first is the Modigliani & Miller proposition 2 with taxes:

$$K_e = K_u + (1 - t)(K_u - K_d)(V_d/V_e) \qquad \text{(Modigliani \& Miller 1963:439)}$$

and the second is to ungear beta first, and then to use the Capital asset pricing model:

$$\beta_a = \beta_e \frac{V_e}{V_e + V_d(1 - t)} + \beta_d \frac{V_d(1 - t)}{V_e + V_d(1 - t)}$$

(Lumby 1991:417)

The beta of debt is usually assumed to be nil (Hamada in Lumby 1991:428; CIMA:177; Samuels *et al* 1995:283), leaving

$$\beta_a = \frac{\beta_e}{(1 + D/V(1 - t))}$$

A comparison of the formulae reveals the following:

$$K_e = K_u + (1 - t)(K_u - K_d)(V_d/V_e)$$

$$\therefore \quad K_u = K_e - (1 - t)(K_u - K_d)(V_d/V_e) \ldots\ldots [1]$$

$$\beta_a = \frac{\beta_e}{(1 + V_d/V_e(1 - t))} \ldots\ldots [2]$$

Applying the Capital Asset Pricing Model:

$$K_e = R_f + \beta_e(R_m - R_f)$$

$$\therefore \quad \beta_e = (K_e - R_f)/(R_m - R_f)$$

Replace in formula [2] above:

$$\beta_a = \frac{(K_e - R_f)}{(R_m - R_f)(1 + V_d/V_e(1 - t))}$$

Replace in the Capital Asset Pricing Model:

$$K_u = R_f + \beta_a(R_m - R_f)$$

$$\therefore \quad K_u = R_f + \frac{(K_e - R_f)(R_m - R_f)}{(R_m - R_f)(1 + V_d/V_e(1 - t))}$$

$$\therefore \quad K_u = R_f + \frac{(K_e - R_f)}{(1 + V_d/V_e(1 - t))}$$

$$\therefore \quad K_u\,(1 + (1 - t)(V_d/V_e)) = R_f((1 + V_d/V_e(1 - t)) + K_e - R_f$$

$$\therefore \quad K_u + K_u(V_d/V_e)(1 - t) = R_f + R_f(V_d/V_e(1 - t)) + K_e - R_f$$

$\therefore \quad K_u = K_e - K_u(V_d/V_e)(1 - t) + R_f(V_d/V_e(1 - t))$

$\therefore \quad K_u = K_e - (K_u - R_f)(V_d/V_e)(1 - t)$ .... [3]

Let [1] = [3]

Therefore $K_d = R_f$

The formula

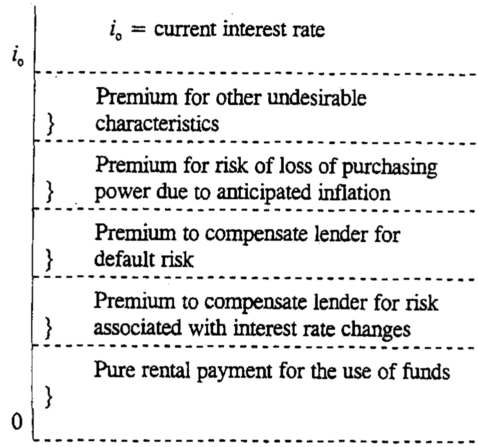
$$\beta_a = \beta_e/(1 + (1 - t)(V_d/V_e))$$

above can only be used when the cost of debt is equal to the risk free rate, and this poses a problem: there is a possibility that when used in practice, the actual cost of debt may be used in the formula $K_u = K_e - (1 - t)(K_u - K_d)(V_d/V_e)$, rendering a different answer than when the CAPM, assuming $K_d = R_f$, is used.

4.1.2 The difference between the cost of debt and the risk-free rate

In practice the cost of debt will always be considerably more than the risk-free rate. Even in a perfect capital market where there are no costs associated with financial distress (Brigham & Gapenski 1996:4), the lenders of money may still require a premium to compensate them for risks such as a change in interest rate or an increase in inflation. Interest rates are influenced by a number of factors such as the length to maturity of a loan, the risk of default and the funds available for lending.

Black & Daniel (1988:102) divide the rate of interest into a pure rental payment for the use of money (risk-free interest rate) plus various premiums that compensate the savers for risks associated with their particular claim. This can be illustrated as follows:



The pure rental payment for the use of money is the risk-free rate. This rate is the same for all claims, but the risk premiums will vary with the characteristics of the claim (Black & Daniel 1988:102).

The fact that the cost of debt in the real world will always be higher than the risk-free rate does not necessarily render these formulae useless. In order to ensure the correct application of these formulae, and especially the formula where the CAPM is used after beta has been ungeared, we need to consider the (so-called) beta of debt:

$$\beta_a = \beta_e \frac{V_e}{V_e + V_d(1 - t)} + \beta_d \frac{V_d(1 - t)}{V_e + V_d(1 - t)}$$

Example 2

The same information applies as in Example 1 above, except that K_d is not assumed to be same as the risk-free interest rate, therefore :

R_f = 10%
K_d = 13%
t = 35%
K_e = 16%
R_m = 15%
β = 1,2

Target debt:equity ratio: 1:4

$$\begin{aligned} K_e &= R_f + \beta(R_m - R_f) \\ &= 10 + 1{,}2(5) \\ &= 16\% \end{aligned}$$

The two formulae reconciled above lead to the same answer, as long as an adjustment for the cost of debt is made.

Let us first consider the Modigliani & Miller proposition 2 with taxes:

$$K_u = K_e - (1 - t)(K_u - K_d)(V_d/V_e)$$
$$\therefore \quad K_u = 16 - 0{,}65(Ku - 13)(1/4)$$
$$\therefore \quad K_u = 15{,}58\%$$

The second formula used requires the theoretical beta of debt to be calculated. The beta of debt is then inserted into the formula to obtain β_a.

The beta can be calculated as follows:

$$\beta_d = (K_d - R_f)/(R_m - R_f)$$

In the above example, β_d would amount to 3/5 = 0,6. Inserted into the formula, β_a would be calculated as follows:

$$\beta_a = \beta_e \frac{V_e}{V_e + V_d(1 - t)} + \beta_d \frac{V_d(1 - t)}{V_e + V_d(1 - t)}$$

$$\begin{aligned} &= 1{,}2(4)/4{,}65 + 0{,}6(0{,}65)/4{,}65 \\ &= 1{,}1161 \end{aligned}$$

Applying the CAPM:

$$\begin{aligned} K_u &= R_f + \beta_a(R_m - R_f) \\ &= 10 + 1{,}1161(5) \\ &= 15{,}58\% \end{aligned}$$

The problem behind this second formula is that the beta of debt is deduced from the cost of debt, while it seems that a number of writers doubt the existence of such a beta (Lumby 1991:428; CIMA:177; Samuels *et al* 1995:283).

4.1.4 A suggested alternative - the delta factor

An alternative formula is therefore suggested:

$$K_u = R_f + \beta_a(R_m - R_f) + \delta_d$$

where:

$$\beta_a = \beta_e \frac{V_e}{V_e + V_d(1 - t)}$$

and:

$$\delta_d = \frac{(K_d - R_f)(V_d(1 - t))}{V_e + V_d(1 - t)}$$

The delta factor (δ) gives an indication of the total premium that the providers of debt require as compensation for possible risks taken such as risks associated with interest rate charges, the possibility of default, an inflation premium and any other possible risks.

Applied to the above example, K_u can be calculated to be the same as in the case of Modigliani and Miller proposition 2 with taxes, as follows:

$$\beta_a = \beta_e \frac{V_e}{V_e + V_d(1 - t)}$$

$$= 1{,}2(4)/4{,}65$$

$$= 1{,}0323$$

and:

$$\delta_d = \frac{(K_d - R_f)(V_d(1 - t))}{V_e + V_d(1 - t)}$$

$$= 3(0{,}65)/4{,}65$$

$$= 0{,}4194$$

$$K_u = R_f + \beta_a(R_m - R_f) + \delta_d$$

$$= 10 + 1{,}0323(5) + 0{,}4194$$

$$= 15{,}58\%$$

4.3 The validity of the tax shield under South African taxation legislation

In respect of the validity of the so-called tax shield, a distinction should be made between a taxation system where capital gains and dividends are taxed, for example the United States of America, and a system where these two items are tax exempt, such as the taxation system in South Africa.

This distinction is made because the theory of the existence of a tax shield was evidently developed for a taxation system where capital gains and dividends are taxed in the same manner as ordinary company profits or interest received. Although several adjustments were later made to allow for differences in personal and corporate taxation rates, and for capital gains not yet realised (*cf.* Brealey & Myers 1996:479-484; Samuels *et al* 1995:656-658), the Modigliani and Miller theory of debt in a world with taxes, requires only that debt and equity be taxed at the same rate (Brealey & Myers 1996:480).

Under the US taxation system the taxation rate paid on interest and dividends received is equal (Brealey & Myers 1996:479). On the other hand, interest paid is a tax deductible expense, dividends paid are not (Brealey & Myers 1996:475). This taxation system (where dividends and interest are equally taxed) results in a saving for the providers of capital *at the cost* of the Receiver of Revenue when debt is included in the capital structure.

According to Brealey & Myers (1996:476) and Samuels *et al* (1995:653) the Receiver of Revenue is effectively subsidising the interest payment. "*In effect, the government pays 35% of the interest expense*" (Brealey & Myers 1996:475).

Under South African taxation legislation, where interest but not dividends received by an investor is taxed in the hands of the investor, debt indeed becomes a cheaper form of finance than it would have been had it not been tax deductible. But for all intents and purposes the basic Modigliani & Miller propositions in a world without tax hold. This can best be illustrated by an example.

Example 3

A comparison of how the $/R 1 000 000 earnings before interest and taxes in our example of project AB above will be divided among bondholders, stockholders and the Receiver of Revenue under respectively United States of America and South African taxation systems, is shown below:

We assume that the geared projects include debt of $/R1 000 000 in their capital structures, and cost of debt is 10%. We also assume that all income is paid out as dividends and corporate and personal tax rates amount to 35%.

	USA		SOUTH AFRICA	
	Ungeared $	**Geared $**	**Ungeared R**	**Geared R**
EBIT	1 000 000	1 000 000	1 000 000	1 000 000
Interest @ 10%	-	(100 000)	-	(100 000)
EBT	1 000 000	900 000	1 000 000	900 000
Corp Taxation @ 35%	(350 000)	(315 000)	(350 000)	(315 000)
	650 000	585 000	650 000	585 000
Stockholders:				
Dividends received	650 000	585 000	650 000	585 000
Personal tax @ 35%	(227 500)	(204 750)	-	-
Net	422 500	380 250	650 000	585 000
Bondholders:				
Interest received	-	100 000	-	100 000
Taxation		(35 000)		(35 000)
		65 000		65 000
Summary:				
Receiver	577 500	554 750	350 000	350 000
Stockholder	422 500	380 250	650 000	585 000
Bondholder	-	65 000	-	65 000
	1 000 000	1 000 000	1 000 000	1 000 000

Table 1

It is clear that the Receiver of Revenue receives a smaller share of the income in the case of the geared company under the USA tax system. The difference - $22 750 - capitalised at the cost of debt is the present value of the tax shield ($22 750/0,1 = $227 500).

The theory of the tax shield therefore appears to be correct - ultimately, there is a saving for the providers of capital when a company uses gearing, and this saving must go to the stockholders. But this only appears to apply to a taxation system where dividends and interest received are taxed equally.

We can see from Table 1 above that under South African taxation legislation, the bond and stockholders receive no benefit due to the gearing. The Receiver of Revenue does not subsidise any of the interest paid. The fact that interest is tax deductible, merely makes it a cheaper form of finance than it would have been had it not been tax deductible.

From Example 3 above it can be deduced that under South African taxation legislation, the same principles in a Modigliani & Miller world *without* taxes still apply: Gearing has no effect on the value of a project (or company). This can be illustrated by another example of arbitrage.

Example 4

In Example 3 above, let us assume that the value of the ungeared South African company (CD Limited) is R4 000 000. (We would like to suggest that the value of geared company (AB Limited) will be R4 000 000 in total as well). As the geared company is financed with R1 000 000 of debt, the value of the geared equity (V_e) should be R3 000 000.

Johnson Limited, who holds a 10% share in AB Limited, receives 10% of R585 000, that is R58 500, as a dividend. Under South African taxation legislation, none of this is taxable. In our arbitrage model, Johnson Limited should earn the same if it sells its interest, borrows additionally to maintain its financial risk, and purchases an interest in the ungeared company, CD Limited. How much can it sell its interest in AB Limited for?

Arbitrage and market forces require Johnson Limited to end up with earnings of R58 500 after it has sold its interest in AB Limited and purchased an interest in CD Limited. Regardless of the amount that Johnson Limited sells its interest in AB Limited for, it will borrow R100 000 to maintain its financial risk. At an interest rate of 10% an amount of R10 000 interest will be payable, which amounts to R6 500 after taxation. Johnson therefore has to receive R65 000 of dividends from CD Limited to be in the same position as before - R65 000 - R6 500 = R58 500.

In order to receive R650 000 of dividends, he would have to purchase a 10% interest in CD Limited at a cost of R400 000. Of this amount, R100 000 is borrowed, which means that Johnson Limited must receive R300 000 for its 10% interest in the geared company AB Limited. This brings the market value of the equity (V_e) of AB Limited to R3 000 000.

Brealey & Myers (1996:475) state that the government pays part of the interest bill - this is correct, but in South Africa the Receiver of Revenue recoups it when interest is taxed, but dividends not.

5 Conclusion

"Any economic model is a simplified statement of reality. We need to simplify in order to interpret what is going on around us. But we also need to know how much faith we can place in our model." (Brealey & Myers 1996:183)

This is certainly applicable to the APV method of project evaluation. Although a number of assumptions have to be made, there is merit in using the APV method as an alternative to the NPV method of project appraisal. The major advantage of the APV method is that it separates the NPV rendered by the project were it all-equity financed, from the side-effects of financing. This allows the advantage of project-specific financing to be taken into account in a very direct way when a project is evaluated, which is especially helpful when the weight or cost of financing differs from the rest of the company.

The purpose of this article was to evaluate the appropriateness of the APV method for investment appraisal purposes in the South African context.

Within the South African context, and specifically against the background of South African taxation legislation, certain principles underlying APV is questionable. The major point of critique is that the existence of the tax shield under South African taxation legislation is not proven. The second point of critique is that the different formulae used to determine the K_u, the cost of equity in an ungeared project, only render the same answer when the cost of debt is equal to the risk-free rate. In this regard a suggestion is made to adjust K_u for the premium on the risk-free rate in the case where the cost of debt exceeds the risk-free rate.

The consequence of this research is that care should be taken when the Adjusted Present Value method is applied within the South African context, as it may lead to incorrect decisions.

Appendix A

Frequently used symbols

APV	Adjusted present value
β	Beta coefficient, a measure of market risk
β_a	Beta of an ungeared project (or firm), beta of an asset
β_d	Beta of debt
β_e	Beta of a geared project (or firm)
CAPM	Capital asset pricing model
cf	compare
δ	Delta coefficient, a measure of the premium required by providers of debt capital as compensation for risks carried
EBIT	Earnings before interest and taxation
EBT	Earnings before taxation
EAT	Earnings after taxation
K_d	Cost of debt
K_e	Cost of geared equity
K_o	Weighted average cost of capital
K_u	Cost of ungeared equity
NPV	Net present value
PV	Present value
R_f	Risk-free rate of return
R_m	Market rate of return
STC	Secondary tax on companies
t	Taxation rate
V_d	Market value of debt
V_e	Market value of geared equity
V_g	Market value of geared company
V_{gp}	Market value of geared project
V_u	Market value of ungeared company
V_{up}	Market value of ungeared project

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