Tax Complexity and the Cost of Debt

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Summary

Now that debt has replaced equity as the preferred source of finance for many UK companies, the correct calculation of the cost of debt assumes even greater importance than it has done formerly. While financial management textbooks are in agreement on how to calculate the pre-tax cost of debt, there is much less agreement on how to calculate the after tax cost of debt. The different approaches taken by different authors leave students and practitioners confused and unsure as to how they should proceed. This article explores the calculation of the after tax cost of debt in order to help both students and practitioners to understand the interaction of tax and debt in the current UK environment and to be aware of the limitations of the various simplifications which are made, explicitly or implicitly, in the textbooks.

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Introduction

When a company wishes to raise long term debt capital, it is important to be able to calculate the cost of that debt, both to select the particular issue with the lowest cost and to calculate the cost of capital of the company. The assumptions used in making the calculations will obviously affect the figure obtained for the cost of capital. While there is agreement on the method for calculating the pre-tax cost of debt capital, textbooks calculate the after tax cost of debt using a number of different simplifications. Students who have followed a taxation course and practitioners familiar with the complexity of the tax treatment [1] of debt in the UK might reasonably be suspicious of the use of such simplifications and, as a consequence, may lack confidence in the result produced. To take into account all the differences due to taxation is certainly complicated but, until we have explored the full picture, we cannot be sure that the simplifications made by authors and the results obtained by using their methods are valid. We will look first at the calculation of the pre-tax cost of debt and will then outline some of the different approaches suggested for calculating the after tax cost of debt. We will then explore the steps necessary to calculate a more accurate cost of debt capital and finally compare the results of using this more sophisticated approach with those produced using some of the more simple approaches.

The Cost of Debt

To permit the effects of taxation to be seen clearly, we assume throughout this article that there are no issue costs. We use the following notation:

[1] As at 31st May 2001

Let

V_t = Value of the bond at time t
I = Annual interest on the bond (the coupon rate x the nominal or par value of the bond)
R = Redemption value of bond
N = Number of years to redemption at time of issue
n = Number of years from time t to redemption
m = Number of interest payments in the year
r_t = redemption yield at time t (annual rate)

Assuming there is an efficient market in the bond then the value of the bond at any time will equal the present value of the cash flows from the bond. If it is assumed that the next interest payment is due in exactly 1/mth of a year, then:

$$\begin{aligned} V_t &= \sum_{j=1}^{mn} \frac{I/m}{(1+r_{mt})^j} + \frac{R}{(1+r_t)^n} \\ &= \frac{I}{mr_{mt}}\left(1 - \frac{1}{(1+r_{mt})^{mn}}\right) + \frac{R}{(1+r_t)^n} \qquad \text{Equation (1) a} \\ &\textit{where} \\ r_{mt} &= (1+r_t)^{1/m} - 1 \end{aligned}$$

If interest is paid annually then m is 1 and equation (1) a simplifies to

$$V_t = \sum_{j=1}^{n} \frac{I}{(1+r_t)^j} + \frac{R}{(1+r_t)^n} = \frac{I}{r_t}\left(1 - \frac{1}{(1+r_t)^n}\right) + \frac{R}{(1+r_t)^n} \qquad \text{Equation (1) b}$$

The internal rate of return (IRR) of these cash flows (r_t) is the pre-tax redemption yield of the bond at time t (see for example Samuels et al (1995), page 438; Pike & Neale (1999), page 570; Watson & Head (1998), page 201).

If the bond is irredeemable (i.e. $n=\infty$) the equation becomes

$$V_t = \frac{I}{r_t} \quad so \quad r_t = \frac{I}{V_t} \qquad \text{Equation (1) c}$$

All the financial textbooks we have examined agree with these pre-tax equations (see for example Samuels et al (1995), page 438; Pike & Neale (1999), page 570; Arnold (1998), page 711) but differences occur when the effect of taxation is considered.

The simplest approach adopted is to calculate the after tax cost of debt by multiplying the pre-tax cost of debt by ($1-t_c$) where t_c is the marginal rate of corporation tax (Arnold (1998), page 712):

$$r_{AT} = (1 - t_c) r_0 \qquad \text{Equation (2)}$$

Other textbooks give this equation but qualify it by saying that account should be taken of the way interest payments and principal repayments are treated for taxation purposes (Watson & Head (1998), page 201).

A slightly more sophisticated approach recognises that the redemption value is not treated in the same way as the interest for tax purposes (Samuels et al (1995), page 445):

$$V_0 = \frac{I}{m}(1 - t_c)\sum_{j=1}^{mN} \frac{1}{(1 + r_{mAT})^j} + \frac{R}{(1 + r_{AT})^N} \qquad \text{Equation (3)}$$

Neither of these simplifications are correct, except in a very limited case, so let us explore a more accurate approach to the calculation of the after tax cost of debt.

First it is necessary to decide whether to consider the position of the issuer or the investor. This did not matter when we looked at the pre-tax case since the cash flows would just be equal although of opposite sign but this is not necessarily true in the after tax case. If the issuer is a company and the investor an individual then the tax treatment, and hence the cash flows, for each will be different. Let us look at each in turn.

Issuer's Perspective

The most likely scenario is that the issuer is a taxable company, which is making taxable profits. If the issuer is not making taxable profits then the relevant cash flows will be those of equation (1) a. Despite what many textbooks imply, the tax shield (i.e. the reduction in the corporation tax for the company due to the debt issue and subsequent payment of interest) is not exactly the interest charge multiplied by the marginal corporation tax rate (It_c) for each year the debt is outstanding. The tax treatment follows the accounting treatment i.e. the finance charge relating to the borrowing in the profit and loss account, which, since FRS4 (1993), is calculated by the effective rate method (Lewis & Pendrill (2000), page 121). At issue the liability is recorded in the balance sheet at the present value of the cash flows discounted at the market rate of interest (i.e. the pre-tax cost of debt as calculated in (1) a above). The charge to the profit and loss account for the year is the present value of the cash flows at the start of the year multiplied by the pre-tax cost of the debt. This means that the charge to the profit and loss account increases throughout the life of the loan provided the redemption price exceeds the issue proceeds. Since the tax shield is the profit and loss charge multiplied by the marginal corporation tax rate, this also increases as the years go by.

Using our notation above (please see over)

Once the debt has been issued the tax obligations are fixed; a change in the market price of the debt will not affect them.

The gross interest and the cash effect of the redemption of the bond are the same as the pre-tax case. To find the exact after tax cost of debt it is necessary to know the timing of the tax payments, both the corporation tax and any income tax deducted from the interest at source i.e. before payment is made to the investor. This is difficult at present since the rules concerning payment of corporation tax have recently been changed. Once the transitional period is over, companies with large "profits"[2] will pay their corporation tax by four equal instalments. The first instalment will be paid on the 14th day of the seventh month of the accounting period, the other three at quarterly intervals from that date. A further complication is that depending on the tax position of the investor, the interest is paid gross or net. Until 1 April 2001, the interest had to be paid net of income tax at the rate of 20%. It is now possible for interest to be paid gross if the recipient is liable to corporation tax.

If the interest is paid net, the income tax must be paid to the Inland Revenue 14 days after the end of the calendar quarter in which the interest is paid. This will complicate any attempt to calculate an exact cost of debt substantially. If we ignore the difference in the timing of the interest and the associated income tax payment the cash flows to the issuer in the net interest position will be the same as that of the gross interest case.

The exact cost of debt will still be very difficult to calculate. The interest payments must be discounted from the date they are paid i.e. m payments per year. The corporation tax effect must be

[2] "Profits" here are the adjusted profits for taxation purposes. Large profits are those above £1.5 million for a single company.

discounted from the date of payment of the corporation tax, i.e. four times a year.

If we assume that the bond is issued on the first day of the accounting period, using half monthly discounting, the after tax cost of debt r_{AT} would satisfy the following equation:

$$V_0 = \frac{I}{m}\sum_{j=1}^{mN}\frac{1}{(1+r_{mAT})^j} - \frac{V_0 r_0 t_c}{4}\sum_{j=1}^{4}\frac{1}{(1+r_{24AT})^{7+6j}} - \frac{t_c(V_0 r_0 - I)}{4}\sum_{k=1}^{N-1}(1+r_0)^k\sum_{j=1}^{4}\frac{1}{(1+r_{24AT})^{24k+7+6j}}$$
$$-\frac{It_c}{4}\sum_{j=1}^{4(N-1)}\frac{1}{(1+r_{24AT})^{31+6j}} + \frac{R}{(1+r_{AT})^N}$$

where

$$r_{kAT} = (1+r_{AT})^{1/k} - 1 \quad \text{for all } k > 0$$

Equation (4) a

If interest payments are made annually, m=1, and we assume all tax is paid in one lump sum at the time of the interest payment, this equation becomes:

$$V_0 = I\sum_{j=1}^{N}\frac{1}{(1+r_{AT})^j} - \frac{V_0 r_0 t_c}{(1+r_{AT})} - (V_0 r_0 - I)t_c\sum_{j=2}^{N}\frac{(1+r_0)^{j-1}}{(1+r_{AT})^j} - It_c\sum_{j=2}^{N}\frac{1}{(1+r_{AT})^j} + \frac{R}{(1+r_{AT})^N}$$
$$= \frac{(1-t_c)I}{r_{AT}}\left(1 - \frac{1}{(1+r_{AT})^N}\right) - \frac{(V_0 r_0 - I)t_c}{(1+r_{AT})}\sum_{j=0}^{N-1}\frac{(1+r_0)^j}{(1+r_{AT})^j} + \frac{R}{(1+r_{AT})^N}$$

Therefore

$$V_0 = \frac{(1-t_c)I}{r_{AT}}\left(1 - \frac{1}{(1+r_{AT})^N}\right) - \frac{(V_0 r_0 - I)t_c}{(r_0 - r_{AT})}\left(\frac{(1+r_0)^N}{(1+r_{AT})^N} - 1\right) + \frac{R}{(1+r_{AT})^N}$$

Equation (4) b

It can be shown that $r_{AT} = r_0(1-t_c)$, where r_0 is the pre-tax cost of debt at issue, solves this equation. So, with the frequently used assumptions of annual interest payments and the tax effects occurring at the same time, the "multiply by (1 – tax rate) rule", frequently denigrated by lecturers is, in actual fact, correct! However, where these assumptions do not hold, the calculations become extremely complex and this rule does not give the correct answer.

The above equations give the cost of debt at issue. However, the financial manager needs to know the cost of debt at any time t during the life of the bond. It is the opportunity cost that matters to the financial manager. So, if at time t the price of the bond in the market is V_t and the bond has n years to maturity, it is often said that the relevant cost of debt is that of a bond with interest I, redemption R, issued at V_t with n years to run. The return on such a bond would satisfy the above equation (4) b with V_0 replaced by V_t and N replaced by n.

Investor's Perspective

It is most likely that the investor will be a company in which case the cash flows of the investor will be similar but of opposite sign to those of the issuer. In the event that the investor is an individual[3], the tax regime will be different. We shall deal with each in turn.

For the company investor the only difference from the cash flows made above for the issuer will be the dates of tax payment. The dates for tax payments in the investor company may well have been different from that of the issuer company since the

[3] Very few individuals seem to be drawn to invest in specific company bonds. Individuals wanting to invest in bonds seem to do so through an investment vehicle. Occasionally they may receive bonds in exchange for equity in the take-over of their owner-managed business but this is rarely traded debt.

accounting periods may have been different. Until 1 April 2001 interest was received net of a 20% tax deduction. After 1 April 2001, the recipient company can receive interest gross, without the deduction of tax, provided the paying company is satisfied that the recipient is eligible to receive the interest in this way.

For the individual investor, the interest received will be chargeable to income tax. In fact, the interest would be received net of tax at the rate of 20% and a basic rate taxpayer would not have to pay any more tax on the interest. Higher rate taxpayers would have to pay a further amount of income tax at the rate of 20% on the gross interest. The date on which any additional tax due would have to be paid would depend on the particular circumstances of the individual. The regulations are complicated and involve payments on account on 31st January in the fiscal year that the interest is paid and 31st July after the end of the fiscal year, any balance being paid by the following 31st January. There may also be tax to be paid on the difference between the price of the bond and the redemption payment.

A gain of more than ½ % of the redemption price per year is considered to be a "deep gain" and is subject to income tax in the year of redemption. If the gain is smaller then it comes under the capital gains tax legislation and since the bond, if denominated in sterling, would be a qualifying corporate bond, such a gain would be exempt from capital gains tax. If the amount paid for the bond is greater than the sum at which it is redeemed, the loss can be set against income tax.

Trying to calculate the exact cost of debt under these circumstances is again very difficult. The simplest case would be that of a basic rate tax payer, who at time *t* buys a qualifying bond at a discount that does not constitute a deep discount. Assuming the first interest payment to be due in exactly 1/mth of a year:

$$V_t = \frac{I}{m}(1-t_{pi})\sum_{j=1}^{mn}\frac{1}{(1+r_{mtpAT})^j} + \frac{R}{(1+r_{tpAT})^n}$$

where

t_{pi} = the tax rate for deductions at source

r_{ipAT} = the after tax return on the bond for the individual investor

$r_{mipAT} = (1+r_{ipAT})^{1/m} - 1$

Equation (5)

If the bond is classified as a deep discount bond then the difference between the redemption value and the purchase price (R-V_t) will be taxed at the investor's marginal tax rate. The tax will probably be paid on 31st January following the end of the tax year in which the investor received the money. Equation (5) would then have an additional term for the tax cash flow.

$$\frac{-t_p(R-V_t)}{(1+r_{12ipAT})^{12n+q}}$$

where

t_p = investor's marginal income tax rate $= t_{pi}$ in this case

$r_{12ipAT} = (1+r_{ipAT})^{1/12} - 1$

q = number of months after redemption payment until tax paid

Equation (6)

If the price paid for the bond (V_t) is larger than the redemption value then a loss will be made and will be set against income tax, so the additional term will be exactly the same as in (6).

A more likely scenario is that the investor is a higher rate taxpayer and will have to pay additional tax on the interest at a rate equal to the difference between the higher rate and the rate withheld on the interest i.e. $I(t_h - t_{pi})$ per annum. The time of payment of this additional tax will depend on the tax position of the holder and the length of time the bond is held. If the bond is held for some time then payments on account will probably be required as explained above. Assuming the bond is purchased on the first day of the fiscal year payments on account are required after the first year, Equation (5) would have to be modified by adding the following term to the right hand side:

$$-\frac{I}{2}(t_h - t_{pi})\left(\frac{2}{(1+r_{12pAT})^{22}} + \sum_{1}^{n-1}\frac{1}{(1+r_{12pAT})^{12j+10}} + \sum_{2}^{n}\frac{1}{(1+r_{12pAT})^{12j+4}}\right)$$

Equation (7)

The return for a non-tax paying investor will be very similar to the pre-tax case but it may take some time for the investor to get the repayment of the tax deducted at source[4]. There may be circumstances when the non-tax payer can receive the interest gross in which case there will be no delay, (although non-tax payers are unlikely to invest in such bonds).

[4] A non-tax payer can reclaim tax paid at source on bond interest but cannot reclaim the tax paid on dividends.

Examples

How significant are the differences in the after tax cost of debt using these approaches? In the following table we have calculated the annual cost of debt, assuming three different models, for one debt issue.

The debt, which has a price of £90, has a 10% coupon rate and is purchased exactly 1/m th year before interest is to be paid and will be redeemed in precisely n years at £100. The corporation tax rate is assumed to be 30%.

Years to maturity	**2**	**5**	**10**	**From equation**
With annual interest, i.e. m=1				
Pre-tax (r_o)	16.25	12.83	11.75	1b
After tax:				
$r_{at} = (1-t_c)r_o$	11.37	8.98	8.23	2
Adjusted	12.99	9.61	8.53	3
More accurate cost to issuer	11.37	8.98	8.23	4b

With semi-annual interest, i.e. m=2

Years to maturity	**2**	**5**	**10**	**From equation**
Pre-tax (r_o)	16.68	13.17	12.07	1a
After tax:				
$r_{at} = (1-t_c)r_o$	11.68	9.22	8.45	2
Adjusted	13.24	9.79	8.69	3
More accurate cost to issuer	11.49	9.06	8.26	4a

While the differences between the after tax cost produced by the simple methods and the more accurate method are small, it is possible that they may be significant in some circumstances.

Implications for Teaching

As we have mentioned earlier, there does not seem to be a consistent approach by authors to the adjustment made for taxation in the cost of debt. This article has addressed questions raised by students 'What's the real position given the differences in the textbooks?' 'Why do the textbooks differ?'

Students from their taxation courses will be aware of the significant changes to the timing of payment of Corporation Tax for large companies introduced by the Finance Act 1998. These timing changes have an impact on the cost of debt after tax. (Likewise they will want to know what impact the abolition of payment of Advance Corporation Tax on dividend payments has on the cost of finance.) Students should be warned in finance courses about the dangers of assuming that approximations will always be satisfactory when some circumstances might make them misleading.

Implications for Practitioners

With the removal of the repayable tax credit for institutions, companies are looking to increase their level of debt as this may be a cheaper way of obtaining finance. Dr Bill Robinson of PricewaterhouseCoopers in a news release of 8 June 2000, states that

"Bonds have already replaced equities as the preferred source of finance for UK companies and the trend toward bond finance is accelerating as the European bond market takes off following the creation of the Euro."

The tax treatment of interest payments as opposed to dividends is often quoted as the major source of advantage for debt finance. It is important to know what is the precise position with regard to taxation to ensure this is indeed true.

Conclusions

The oft quoted after-tax cost of debt formula:

$$r_{AT} = (1 - t_c) r_0 \qquad \text{Equation (2)}$$

is not strictly correct, though, perhaps surprisingly, it does give the correct answer if interest payments are annual and the tax effects of interest occur immediately. In practice, interest is often paid more frequently than annually and, as we have explained, the tax effects are unlikely to occur immediately. Hence the simple formula is unlikely to give the correct after tax cost of debt.

The other commonly used formula

$$V_0 = \frac{I}{m}(1 - t_c)\sum_{j=1}^{mN} \frac{1}{(1 + r_{mAT})^j} + \frac{R}{(1 + r_{AT})^N} \qquad \text{Equation (3)}$$

which recognises that, for tax purposes, the redemption value has to be treated differently from interest, is also not correct.

Fortunately, for most purposes, it does not matter that the cost of debt used in the calculation is only an approximation. However, if the more complex calculations are avoided, it is important for both students and practitioners to appreciate that they are working with an approximation and to treat that approximation with due respect.

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