Weighted Average Cost of Capital

(Relevant to PBE Paper III – Financial Management)

Simon S P Lee, The Chinese University of Hong Kong

The weighted average cost of capital (WACC) is a common topic in the financial management examination. This rate, also called the discount rate, is used in evaluating whether a project is feasible or not in the net present value (NPV) analysis, or in assessing the value of an asset. Previous examinations have revealed that many students fail to understand how to calculate or understand WACC.

WACC is calculated as follows:

WACC = E/V x Re + D/V x Rd x (1-tax rate)

WACC is the proportional average of each category of capital inside a firm – common shares, preferred shares, bonds and any other long-term debt –

where:
Re = cost of equity
Rd = cost of debt
E = market value of the firm's equity
D = market value of the firm's debt
V = E + D = firm value
E/V = percentage of financing that is equity
D/V = percentage of financing that is debt

WACC is simply a replica of the basic accounting equation: Asset = Debt + Equity. WACC focuses on the items on the right hand side of this equation.

(Most companies do not have preferred shares. For simplicity, we only use common shares and bonds in our illustrations.)

A firm derives its assets by either raising debt or equity (or both). There are costs associated with raising capital and WACC is an average figure used to indicate the cost of financing a company's asset base.

In determining WACC, the firm's equity value, debt value and hence firm value needs to be derived. This part is definitely not too difficult. You also need to find the cost of the equity and the cost of the debt.

Basically there are two approaches in finding the cost of equity: the dividend growth approach and the capital asset pricing model (CAPM) approach.

Using the dividend approach,

$$Po = D_1 / (Re - g)$$

where
P_0 is the current stock price or price of the stock in period 0.
D_1 is the dividend in period 1
R_e is the cost of equity
g is the dividend growth rate

$$R_e = D_1 / P_0 + g$$

This approach only applies to dividend-paying stock as we need to determine the dividend growth rate.

The other approach is the CAPM, which was developed by Sharpe, a Nobel Prize winner in economics in 1990.

$$R_e = R_f + ßex\ (R_m - R_f)$$

Using CAPM, the risk free rate (Rf) and market return (Rm) have to be found, as does the stock's beta. There are many arguments about how best to determine the risk free rate, market return and the beta. However, CAPM is relatively more commonly used than the dividend growth model since most stocks do not have a stable dividend history.

When calculating the cost of debt, we do not use the coupon rate of the bond as reference. Rather, we use the yield rate. For example, if a bond has coupon rate of 3% and a market price of 103, this implies that the actual yield is less than 3%.

Let me use an example to illustrate.

On the equity side, a company has 50 million shares with market price of $80 per share. The beta of the stock is 1.15 and market risk premium is 9%. The risk-free rate is 5%.

On the debt side, the company has $1 billion outstanding debt (face value). The current price of the debt is 110 and the coupon rate is 9%: the company pays semi-annual coupons with 15 years to maturity. Assume the tax rate is 15%.

To find the cost of equity,

$$R_e = 5 + 1.15(9) = 15.35\%$$

Remember the market risk premium is R_m-R_f. Since this is given, we need not deduct 5% from 9%.

To find cost of debt, we turn to the bond pricing equation and find r.

$$P = C \times [1 - 1/(1 + r)^t]/r + F \times 1/(1 + r)^t$$

We may assume the face value of individual bond = $1,000. Since C = $45 (remember it's a **semi-annual** payment), t = 30, P = $1,100, F=$1,000, we find that r = 3.9268%. (You may need to use a computer or estimation method to find r.)

Since the cost of debt is given on an annual basis, R_d = 2 x 3.9268% = 7.854%. In calculating WACC, we use the after-tax cost of debt. (This is because interest payments are eligible for tax deductions.) If the interest rate is 7.854%, taking into account the tax deduction, the actual interest rate must be lower. Thus the after tax cost of debt is 7.854% x (1-15%) = 6.6759%.

A useful way of checking your answer is to remember that, for most companies, the cost of debt (before tax) is usually lower than the cost of equity. If you calculate Re to be less than R_d, you have probably made a mistake.

We have the cost of debt and cost of equity; now we need to find the firm's value. The values are as follows:

Equity market value E = 50 million ($80) = $4 billion
Debt market value D = $1 billion (1+110%) = $1.1 billion
Firm market value V = E + D = $5.1 billion

Weight of E = E/V = $4 /$5.1 = 0.7843
Weight of D = D/V = $1.1 /$ 5.1 = 0.2157

So, what is the WACC?

WACC = 0.7843(15.35%) + 0.2157(6.6759%) = 13.48%

This rate is used in the evaluation of a project NPV or in determining the value of an asset. Why is WACC important? For a project to be feasible, not just profitable, it must generate a return higher than the cost of raising debt (R_d) and the cost of raising equity (R_e).

Students must bear in mind that WACC is affected not only by Re and R_d, but it also varies with capital structure. Since R_d is usually lower than R_e, then the higher the debt level, the lower the WACC. This partly explains why firms usually prefer issuing debt first before they raise more equity.

As part of their risk management processes, some companies add a risk factor, say 1.5%, to the WACC in order to include a risk cushion in their project evaluation. The logic behind this is simple as the process of finding WACC involves a large degree of estimation: you need to estimate the risk free rate, the beta and the market return.

So next time you tackle a WACC question, remember this process. In real life the process is similar, just more complicated as a company may have different debts with different interest rates.