The weighted average cost of capital

Jean-Charles Bagneris

v2018.09.2

Abstract

We define the cost of the companies resources. We then explain how to estimate it for investment purposes in the most common cases of debt and equity resources.

Keywords: WACC, investment, resources, cost of capital

Contents

Learning Objectives

By the end of this module, students should be able to:

- Define the concept of cost of capital
- List the different capital sources companies use for financing investment
- Estimate the cost of each capital source
- Calculate the weighted average cost of capital for investment purposes

1 The concept of cost of capital

1.1 Financial resources are costly

The adage known as “There ain’t no such thing as free lunch”[1] has a meaning in many different contexts. In the field of finance, it means that there is no such thing as free financial (monetary) resource.

This is especially true for corporations, which invest resources provided by their shareholders and various money lenders, all of them expecting some return on the money they provided. Actually, by simply looking at a company’s balance sheet, you can see at a glance both the origin of the resources the company invested (on the liabilities side), and their destination, which assets these resources were invested in, on the assets side.

A corollary of the adage is that to be profitable, *any investment should return at least enough money to cover the cost of the invested financial resources*.

Obviously, to apply this piece of wisdom we need a way to measure the cost of a company resources, also known as “cost of capital”.

In the following, we will assume that we calculate the cost of capital for investment purposes. This is important as, for example, this tells us that we are not interested in the historical cost of capital (the cost of the resources that were invested in the past), but rather in the *marginal* cost of capital, the cost of the next resources we will have to find in order to finance the investments projects we are currently considering.

Note: What if the company has cash available?

Some might argue that if the company has cash available, this resource comes for free. They would forget that if there is cash available, it is an asset in the balance sheet (on the left side). Consequently, as any asset, this cash was “financed” by the resources on the other side, and certainly did not come for free. The only difference with what we said above is that, because this cash is already available, its cost is probably not the marginal cost but rather the historical cost of capital, as it was financed by resources outstanding.

Note that for investment purposes, that does not change much: what is relevant is the opportunity cost of the resources, as we will see below when estimating the cost of capital in practice.

[1] Which even has an entry in wikipedia, see https://en.wikipedia.org/w/index.php?title=There_ain%27t_no_such_thing_as_a_free_lunch&oldid=834265546

1.2 The different kinds of financial resources

Let us now turn to the question of the financial resources a company might use. Again, remember that we assume that the context is investment decision, thus we implicitely mean “the financial resources a company might use *for investment purposes*”. By looking again at the (right side of the) balance sheet, you might realize that actually, financial resources only have two possible origins: shareholders equity or “liabilities”, that is, debt of some kind.

This might sound surprising, but it is actually possible to associate any kind of financial resource to one of two categories only: equity or debt. As we focus on the cost of the resources here, think about the ways a financial resource “provider” might get compensated:

- the compensation might be independent of the investment project (or the company) future performance: the typical case is interest payments, which depend on a rate applied to the amount of resources provided, and for how long it was provided,
- or it might depend on the performance of the investment projet (or the company): a good example is dividend payments to the shareholders.

In the first case, we have something wich looks like debt – at least for what it costs to the company, which is all we need here.

In the second case, the resource provider is a *residual claimant*, that is, her compensation is linked to what is remaining (“residual”) as a profit once everything else has been paid (including the compensation on the various debts of the company, by the way). On the costs side for the company, this looks like equity, and again, we do not need to investigate further in the context of this document, as we only care about the cost of the resources.

Thus, to estimate the global cost of the financial resources of the company, we have to identify the cost of equity and the cost of debt.

2 The cost of the different kinds of resources

We now turn to the estimation of the cost of the different categories of resources.

Remember that we explained that we are interested in the *marginal* cost of the resources, and that the resources we are considering are those which are suitable for investment purposes, namely, debt and equity.

Before going into the details of debt and equity costs, please notice that the cost of a given financial resource for a company is the same thing as the return (before tax) it pays to the resource provider. When you pay interests to a bank, this is part of the cost of your debt, and it is part of the bank’s profit. When companies pay dividends to shareholders, this is part of their return on the company’s shares of stocks, and this is indeed part of the cost of the company’s equity.

We will illustrate the different steps of the cost and resources and WACC calculation with the following example.

Important: The example below is meant as an illustration only. The data has been simplified, and by the time you read it, it will probably be outdated. You should not use it for any real trading or investing activity.

Example: The Kraft Heinz Company (KHC)

The Kraft Heinz Company is a USA based company operating in the food processing sector, with around 39,000 full time employees. The shares of stock are listed on the Nasdaq.

In the end of 2017, the company had 1.219 billion outstanding shares which close price was $77. The market value of its debt was estimated to $33 billion ("fair value of debt, estimate based on quoted market price for similar instruments").

The unlevered beta of the food processing sector is 0.56, the market risk premium 5.08% and the risk free rate (long term treasury bond rate) 2.41%.

It is estimated that KHC would have to pay 3.9% (before tax) as an interest rate on new debt.

Finally, the US federal statutory tax rate for the company is 35%.

Data sources:

- Yahoo Finance[a]
- Kraft Heinz Company investor relations website[b]
- Damodaran Online Data page[c]

[a] https://finance.yahoo.com/quote/KHC
[b] http://ir.kraftheainzcompany.com
[c] http://pages.stern.nyu.edu/~adamodar/

2.1 The cost of debt

The cost of debt as a market price

As you probably know, the cost of debt is a percentage rate, known as interest rate, which is contractually defined between the lender and the borrower *ex-ante*, that is, before the money is actually lended.

The interest rate is a market price: either the corporation borrows directly from the financial market, or it goes through a bank. The banks in turn finance themselves on the financial market, and compete to attract the customers, thus the rates they apply are market prices as well – they only add their margin to it.

This means that the cost of debt is not really calculated or estimated: it is merely *observed* on the market – knowing at which rate you could borrow tomorrow probably only takes a few phone calls.

How does the bank or the financial market determine at which rate they are willing to lend money to a given corporation? It mainly depends on two factors: the credit risk (see the chapter "Fundamentals of risk and return in finance"[2]), the probability that the corporation will pay interest and repay on due time, and the basis level of interest rates. The duration of the loan might have an influence, too: it is usually (but not always) more expensive to borrow money for longer periods of time.

If the corporation has outstanding debt which is publicly traded on a financial market (that is, bonds), the current yield to maturity (YTM) of these bonds is a good basis for the cost of debt. The return that investors expect from the corporation's debt on the market should not be too far from what they would expect from additional debt from the same company, provided the risk and duration are similar. It should be

[2] https://files.bagneris.net/

noted, though, that whenever the company borrows more debt, it increases its financial risk (the risk that it fails to pay on time): if the amount of the new debt is significant, it might raise the cost of all its debts.

The influence of the corporate taxes

The story of the cost of debt does not stop with the observation of the interest rate the company would have to pay to borrow additional resources. In most countries, the interests paid on the debt are considered by the tax authority as expenses that lower the corporate tax basis (the earnings before tax or EBT): interest payments are tax deductible.

This means that whenever a corporation pays interest, it lowers its tax payments (provided it pays taxes, of course). This is known as the interest tax shield. It follows that the interest rate is note the final cost of debt for the company, because it is *before tax*. The real cost of debt for the company is the *after tax* cost. If the company pays taxes, and its marginal corporate tax rate is τ, then the after tax cost of debt k_D is defined as:

$$k_D = i \times (1 - \tau) \tag{1}$$

Where i is the before tax cost of debt, the marginal interest rate the company would have to pay for the next debt resources it gets.

Example: Tax shield example

To illustrate how the tax shield affects the real rate paid on the company's debt, consider the ND and D companies. They are absolutely identical, except for their financing. The ND company has no debt at all, and the D company has 400 worth of debt in its financing, on which it pays 6.25% as an interest rate. The EBIT for both companies is 250, and their tax rate is 40%. Let us calculate the after tax profit for each company:

Company	ND	D
EBITDA	250	250
Interests	0	25
EBT	250	225
Taxes@40%	100	90
Net profit	150	135

The interests for company D are of course 400 $\times$ 6.25 / 100 = 25.

Now, as the debt is the only difference between the two companies, the lower net profit for D is only related to the cost of debt. Thus, the cost of debt in percentage is simply the difference between the two companies' net profits, divided by the amount of D's debt:

$$\frac{150 - 135}{400} = 3.75\%$$

This is indeed the after tax cost of debt, which we might calculate using equation 1 above:

$$k_D = 6.25\% \times (1 - 40\%) = 3.75\%$$

We can now use equation 1 to calculate the after tax cost of debt for the Kraft Heinz Company.

Example: KHC - After tax cost of debt

The cost of debt before tax for KHC is 3.9% per year, from the data in the previous section. In addition, its tax rate is 35%. We thus get:

$$k_D = 3.9\% \times (1 - 35\%) = 2.54\%$$

2.2 The cost of equity

The cost of equity as a market price

As the cost of debt, the cost of equity is actually a market price. Why is it so?

If a corporation is public, this is rather obvious. The company shares (representing its equity) are freely traded on a stock market. The return expected on the company stocks (which is the same as the cost of its equity) is linked to the stock market price. If the shareholders are unhappy with the return they get, they might sell the company's stocks to invest in another one. The sell pressure on the market will push the stocks price down, and the return will mechanically increase. The stocks price is a market price, thus the stocks return (which again, is the cost of the equity) is a market price as well.

If the corporation is private, one might think that it is different, as it seems the shareholders might "decide" the level of returns they expect from their share of the company. If we assume that the economy is competitive, this is not true: the shareholders returns come from the company profits. In a competition framework, this profits in turn depends on market prices. If the company wants to raise its profit by increasing its prices, a competitor might sell at a lower price, reducing the company's market share – and its profits. If the company choses to lower its costs, again a competitor might pay lower wages, or a better price for raw materials. Finally, the profit level for a given activity is some kind of equilibrium price[3].

The cost of equity as the price of risk

As the cost of equity is the return expected by the shareholders on their stocks, estimating the cost of equity uses the risk-return relationship in finance. What follows assumes that you heard about it, and about the capital asset pricing model (see again the chapter "Fundamentals of risk and return in finance"[4] for a gentle introduction to the CAPM).

The classical way to estimate the cost of equity of a given company is then to use the CAPM, which implies that one knows the company's beta.

Betas are typically estimated either with statistical methods from the series of historical stock returns, or by adapting known betas (e.g. for the sector, or a competitor) to the specificities of the company.

One of the most common adaptation used to find the company's beta is to get an unlevered beta suitable for its activity risk, and adjust if for its financial risk, approached with the financial leverage:

$$\beta_L = \beta_{UL} \times (1 + (D/E) \times (1 - \tau)) \quad (2)$$

[3] Note that this nice reasoning collapses if the assumption of fair competition does not hold: for example if a company is in a monopolistic position, or if competitors have (secret) agreements on prices.

[4] https://files.bagneris.net/

with:

β_L the beta adjusted for the company leverage
β_{UL} the unlevered beta
D the company debt market value
E the company equity market value
τ the company's marginal tax rate

Once the beta for the company's equity is known, we simply apply the CAPM formula to get the expected return on its stock, which is our estimation for its cost of equity k_E:

$$k_E = r_f + \beta_i \times \left[E(r_M) - r_f\right] \tag{3}$$

with:

r_f the risk free rate
β_i the beta of company i equity
$E(r_M) - r_f$ the market risk premium

Example: KHC - Cost of equity

In order to find KHC's cost of equity, we first need to find its beta, as we only know the unlevered beta for the food processing sector, which is 0.56.

To apply equation 2 above, we need the debt and equity market value, and the company's tax rate. The debt market value and the tax rate were given and are D = \$33 billion and τ=35% respectively.

To get the market value of the equity, also called "market capitalization", we just have to multiply the outstanding number of stocks by the stock price in the end of 2017, E = 1.219 $\times$ \$77 = \$93.86 billion.

Finally we get:

$$\beta_L = 0.56 \times (1 + (33/93.86) \times (1 - 35\%)) = 0.688$$

Note that the Yahoo finance website reported a 0.76 beta in April 2018, but the stock price at that time was substantially lower at \$60, which was mechanically increasing the leverage (the market value of equity was lower).

We can now use the beta in the CAPM model in order to find the cost of equity for KHC. Again, the risk premium is estimated to 5.08% in late 2017 - early 2018, and the risk free rate is 2.41%.

$$k_E = 2.41\% + 0.688 \times 5.08\% = 5.91\%$$

The cost of equity and the dividend payments

For dividends paying companies, there is a relationship between the expected return on the shares of stocks (the cost of equity), the stock price, and the future payments expected on the stocks – the dividends. The stock price should be the discounted value of all the future dividends on the stock, using the cost of equity as a discount rate.

A well-known model derived from this relationship links the next dividend to be paid D_1 (the subscript 1 meaning “in 1 period in the future”), the dividends expected growth rate g, the current stock price P_0 and the expected return on the stocks, that is, the cost of equity k_E. This model is called the Gordon-Shapiro model (more about this model in the chapter “Stocks valuation”[5]):

$$P_0 = \frac{D_1}{k_E - g} \tag{4}$$

It might be tempting to reverse the equation above to find the cost of equity from the stock price, the dividend payments and their growth rate. Beware that there are strong assumptions underlying the model: the dividends growth is supposed to be sustainable forever. In addition, if the stock price exhibits a high volatility (it is not very stable), the results might be very different depending on which stock price you chose (opening or close, today or yesterday, last known or average, if average, how many periods, etc.).

It is nonetheless interesting to see if the Gordon model is consistent with the CAPM for a given company – but remember, the company has to be a dividend-paying one, with a more or less regular dividend stream.

Example: KHC - Dividend payments

The KHC company pays dividends on a quarterly basis, and regularly. We might then try to get information from the comparison of the CAPM results, and the Gordon model application.

The dividend for 2018, as reported by Yahoo finance, is $2.50. We used $77 as the stock price for the market value of the equity estimation, and we found a cost of equity of 5.91%. This would yield an expected annual growth of the dividends such as:

$$g = k_E - \frac{D_1}{P_0} = 5.91\% - \frac{2.50}{77} = 2.66\%$$

Given our cost of equity calculation and the expected dividend for 2018, we can see that if the agents on the market are rational, the $77 stock price means that they expect the dividend to grow by 2.66% per year forever.

Again, note that we used the last closed price of 2017, which might or might not be a good estimate at that time.

3 Weighting and the capital structure

Once the cost of the two families of resources, debt and equity, has been estimated, it is time to aggregate these costs to find the overall cost of the company resources, the WACC.

The aggregation is done through a very simple weighted average, as the name WACC implies. The weights are of course the relative weights of debt and equity in the company financing – its resources.

As simple as this might sound, there are a few points which should be taken with caution and need further explanation.

[5] https://files.bagneris.net/

3.1 Finding the weights to use

The weights used in the weighted average of the costs of debt and equity are generally the relative **market values** of those resources in the company's capital structure.

That means that one should never ever use book values (from the balance sheet) to estimate the weights. Book values come from bookkeeping and are often past values (i.e. values that were estimated at the time the operation was recorded in the books). But the WACC is calculated for investment decision purposes, that is, to be used in a decision to be taken today about the next investment projects: we should use "current" values of debt and equity. The most "current" values are those provided by the market.

The only possible exception to the above rule is the case in which the company is about to change its capital structure for a new "target" one. If the change is reasonably sure, then use the target structure in the calculation: the investment project will produce cash flows under the new structure. Note that if the capital structure changes, so will the leverage and the financial risk, and you probably have to correct the beta for the change, and calculate a new cost of equity (once again, you should probably read the chapter on "Risk and return in finance"[6] before this one).

What to do if market values are not available? It might be the case that the company has bank loans (those are not publicly traded, thus don't have any market value) in its structure, or even the company is not listed: it is a private one, and there is no such thing as a market value of the equity. When this is the case, we have to use data from similar listed company to estimate the current values of debt and equity.

Example: KHC - Debt value

For example, in the KHC data above, the debt market value is actually an estimation, the "fair value of debt, based on quoted market price for similar instruments".

Note also that the market value of debt changes mechanically with the yield to maturity, which in turn depends on the debt risk level, its maturity and the interests rate level on the market. It is usually not difficult to discount the (known) cash flows of a given loan (interest payments and repayments) in order to get an estimate of its market value.

Finally, beware that debt ratio and financial leverage are two different ratios. The debt ratio is the ratio of the market value of the debt D to the market value of the total resources, debt plus equity. The leverage is the ratio of the market value of the debt D to the market value of the equity E. Of course, it is easy to get one from the other one. We use the following notations:

D Debt market value
E Equity market value
L Leverage $= \frac{D}{E}$
W_D Weight of debt, or debt ratio $= \frac{D}{(D+E)}$
W_E Weight of equity, or equity ratio $= \frac{E}{(D+E)}$

Then we have:

$$W_D = \frac{L}{1+L} \tag{5}$$

[6] https://files.bagneris.net/

and:

$$L = \frac{W_D}{1 - W_D} \tag{6}$$

Example: Debt ratio from leverage

If the leverage of a company is 25%, then, from equation 5 above, its debt ratio is:

$$W_D = \frac{0.25}{1.25} = 0.20 = 20\%$$

An easy way to do the calculation without even remembering the calculation is to write:

$$L = \frac{D}{E} = \frac{25}{100}$$

Thus, when the market value of the debt D is 25, the market value of the equity E is 100. Then, as we only care about *relative* values here, we can write:

$$W_D = \frac{D}{(D+E)} = \frac{25}{(25+100)} = 0.20$$

Of course, one can use the same trick to get the leverage from the debt ratio.

3.2 Weighted average calculation

Finally, the WACC calculation is given by:

$$WACC = (W_D \times k_D) + (W_E \times k_E) = \left(\frac{D}{(D+E)} \times k_D\right) + \left(\frac{E}{(D+E)} \times k_E\right) \tag{7}$$

Example: KHC - WACC calculation

We already calculated the costs of debt and equity for KHC, and got k_D = 2.54% and k_E = 5.91%.

We know that the debt market value is D = 33 billion.

We can calculate the equity market value (the market capitalization):

$$E = 1.219 \times 77 = 93.86 \text{ billion}$$

We now apply equation 7 above:

$$WACC = \left(\frac{33}{(33+93.86)} \times 2.54\%\right) + \left(\frac{93.86}{(33+93.86)} \times 5.91\%\right) = 5.03\%$$

4 Estimating the cost of capital in practice

Here we address some common questions that might arise when trying to estimate the cost of capital in practice.

4.1 Specific financing opportunities

You probably noticed that the techniques detailed in the sections above assume that we calculate a global and unique cost of capital for a given company.

But what if a given investment projects entails a specific financing opportunity?

> **Example: Special financing opportunities**
>
> Some assets necessary for the investment project, like a machine, or computers, might be acquired through special financing such as a lease opportunity.
>
> Another common case is the availability of some financing at a reduced cost, or even regional/state grants or subsidies because we invest in a particular industry, considered as a high priority one.

In that kind of case, we still stick to the global WACC model. The idea is that the company can raise additional resources on the “global money market” at a given cost, and that it should compare and assess the various projects it has available with a unique discount rate.

The correct way to take into account projects specificities, including financial ones, is through the estimation of the (differential) cash flows the project will generate if undertaken. The cash flow estimation goes beyond the purpose of this document (see any chapter about investment decision in a finance textbook for more about that), but the idea is that if a given financing opportunity, specific to a given projects, saves a given amount of interest payments every year, this should be taken into account in the said project cash flows.

4.2 Opportunity cost

Another topic is the one of available resources: if the company has cash available for investment, does it change anything in the calculation?

The answer is no, as we already stated in the first section. But why? Because of what is called the *opportunity cost*.

When a decision (such as the investment decision) should be taken involving a choice between mutually exclusive alternatives, chosing one rather than the other one entails a cost, which is the forgone output of the abandoned option. If the cash at hand is used for a given project, then it is no longer available for other projects, which, on average, should have paid a return at least equivalent to the WACC of the company (otherwise those projects would not be profitable and, as such, dropped out): thus, the opportunity cost of the available cash is the WACC.

4.3 Issuing costs

The question of the issuing costs is a bit tricky. Should the issuing costs be taken into account globally or in a given project cash flows, that is, added to the necessary investment?

It is theoretically better to take into account the issuing costs in the marginal cost of the resources, including those into the WACC: any *new* resource will entail issuing costs, be it a new loan, a bonds or a stocks issue.

Unfortunately, this is not always possible: again, a given project might entail its own financing, with specific issuing costs, for example depending on the size of the financing – an important part of issuing costs is typically fixed. Then it is probably better to add the issuing costs to the investment expenses on a per project basis.

Summary

- All financial resources come at a cost. The cost of capital is the global cost of the company financial resources.
- The cost of capital is usually estimated for investment purposes: this means that we are interested in the *marginal* cost of the financial resources.
- The financial resources a company might use for investment are either debt, or equity.
- The cost of debt is the *after tax* cost of getting new debt from a bank or the financial market:

$$k_D = i \times (1 - \tau)$$

- The cost of equity is best approached by the risk-return relationship: the riskier it is to hold the stocks of a given company, the higher the expected return on these stocks, and the company cost of equity
- The above is formalized by the Capital Assets Pricing Model (CAPM), in which the risk is measured by the beta coefficient:

$$k_E = r_f + \beta \times (E(r_M) - r_f)$$

- The WACC is then calculated as a weighted average of the cost of debt k_D and the cost of equity k_E.
- The weights are given by the relative **market** values of debt and equity, or the target capital structure, if any.
- Projects specificities such as special financing opportunities or issuing costs should be taken into account in the project cash flows.

Exercises

Provide all answers with 2 decimal places, except the betas which should have 4 decimal places. Remember to round the final result only: you should never round any intermediary result.

1. A company's marginal tax rate is 40%. The company has a debt ratio of 23% and could borrow more debt at a 6.93% rate. Its beta is 1.6, the risk free rate is 2.03% and the market risk premium 5.34%. What is the company's WACC?

2. The CFO of the NewWorld company wants to calculate its WACC. NewWorld is not listed on any financial market, but a competitor with similar activity and size has a 1.45 beta and 34% leverage. NewWorld has 46% debt in its resources, and the main bank of the company told the CFO that it could borrow more at a 6.24% rate.

   Assume that the marginal corporate tax rate is 30% for NewWorld and its competitor, that the risk free rate is 2.09% and the equity risk premium 5.62%.

   - What is the unlevered beta of NewWorld and its competitor?
   - What is the leverage of NewWorld?
   - Calculate the cost of equity of NewWorld.
   - Finally, what is the WACC of NewWorld?

3. A company issued 4 years ago $400 million worths of bonds with a 6.5% coupon rate. The bonds will be repaid at par in 6 years from now, and their current YTM is 6.8%. They are the only debt of the company. Regarding the equity, there are 20 million outstanding share of stocks, which last known price is $34.2. The unlevered beta for the company's industry is 1.34, the risk free rate 1.94% and the market risk premium 6.02%. Finally, the marginal tax rate for the company is 25%. What is its WACC?

Exercises answers

1. A company's marginal tax rate is 40%. The company has a debt ratio of 23% and could borrow more debt at a 6.93% rate. Its beta is 1.6, the risk free rate is 2.03% and the market risk premium 5.34%. What is the company's WACC?

   Given the information we have, we need to calculate the after tax cost of debt k_D, the cost of equity k_E and finally the weighted average of those, which yields the WACC.

   Given the tax rate of 40%, the after tax cost of debt is:

   $$k_D = 6.93\% \times (1 - 40\%) = 4.16\%$$

   For the cost of equity, we use the CAPM and the provided beta:

   $$k_E = 2.03\% + 1.6 \times 5.34\% = 10.57\%$$

   Finally, as there is 23% of debt, there is 100% - 23% = 77% of equity and the WACC is:

   $$WACC = (23\% \times 4.16\%) + (77\% \times 10.57\%) = 9.10\%$$

2. The CFO of the NewWorld company wants to calculate its WACC. NewWorld is not listed on any financial market, but a competitor with similar activity and size has a 1.45 beta and 34% leverage. NewWorld has 46% debt in its resources, and the main bank of the company told the CFO that it could borrow more at a 6.24% rate.

   Assume that the marginal corporate tax rate is 30% for NewWorld and its competitor, that the risk free rate is 2.09% and the equity risk premium 5.62%.

   - What is the unlevered beta of NewWorld and its competitor?

     We calculate the unlevered beta from the competitor's data. As the two companies have roughly the same activity and size, they have the same activity risk, hence the same unlevered beta:

     $$\beta_{UL} = \frac{1.45}{(1 + 34\% \times (1 - 30\%))} = 1.1712$$

   - What is the leverage of NewWorld?

     As NewWorld has a 46% debt ratio, equation 6 yields:

     $$D/E = \frac{46}{(100 - 46)} = 85.19\%$$

   - Calculate the cost of equity of NewWorld.

     First we calculate the beta of NewWorld from the unlevered beta and its leverage:

     $$\beta = 1.1712 \times (1 + 85.19\% \times (1 - 30\%)) = 1.8697$$

     Then we use the CAPM to calculate the cost of equity, using the provided risk free rate and risk premium:

     $$k_E = 2.09\% + 1.8967 \times 5.62\% = 12.60\%$$

- Finally, what is the WACC of NewWorld?

  We just calculated the cost of equity k_E, we also need the after tax cost of debt k_D:

  $$k_D = 6.24\% \times (1 - 30\%) = 4.37\%$$

  Then we can aggregate the cost of debt and the cost of equity in the WACC:

  $$WACC = (46\% \times 4.37\%) + ((1 - 46\%) \times 12.60\%) = 8.81\%$$

3. A company issued 4 years ago $400 million worths of bonds with a 6.5% coupon rate. The bonds will be repaid at par in 6 years from now, and their current YTM is 6.8%. They are the only debt of the company. Regarding the equity, there are 20 million outstanding share of stocks, which last known price is $34.2. The unlevered beta for the company's industry is 1.34, the risk free rate 1.94% and the market risk premium 6.02%. Finally, the marginal tax rate for the company is 25%. What is its WACC?

   As usual, we need the cost of debt k_D, the cost of equity k_E and the weights. Here, the weights are not given, which means we have to calculate the market value of the debt D and the equity E.

   The market value of the debt is the market value of the $400 million worth of bonds. Let us first calculate this, as usual by discounting the bonds cash flows at the YTM. The cash flows are the total interests (coupons) paid in the end of each year during the 6 remaining years, and the repayment of all the bonds at par in the end of year 6:

   $$D = (400 \times 6.5\%) \times \frac{(1 - 1.068^{-6})}{0.068} + \frac{400}{(1.068)^6} = 394.24$$

   Regarding the market value of equity, we simply have to multiply the number of outstanding stocks by their last known price:

   $$E = 20 \times 34.2 = 684.00$$

   With the market value of debt and equity, we have the financial leverage D/E and can use it to find the company's beta from the unlevered one:

   $$\beta = 1.34 \times \left(1 + \frac{394.24}{684} \times (1 - 25\%)\right) = 1.9193$$

   We then use the CAPM with the beta to find the cost of equity:

   $$k_E = 1.94\% + 1.9193 \times 6.02\% = 13.49\%$$

   For the after tax cost of debt, we use the bonds YTM as a basis:

   $$k_D = 6.8\% \times (1 - 25\%) = 5.10\%$$

   Finally, we assemble everything to find the WACC:

   $$WACC = \frac{394.24}{(394.24 + 684)} \times 5.10\% + \frac{684}{(394.24 + 684)} \times 13.49\% = 10.42\%$$
