Chapter 33
CAPITAL STRUCTURE AND THE THEORY OF PERFECT CAPITAL MARKETS

Does paradise exist in the world of finance?

While accounting looks at a company by examining its past and in focusing on its costs, finance is mainly a projection of the company into the future. Finance reflects not only risk but also – and above all – the value that results from the perception of risk and future returns.

In finance, everything is about the future – return, risk and value.

From now on, we will speak constantly of **value**. As we saw previously, by value we mean **the present value of future cash flows discounted at the rate of return required by investors**:

- equity (E) will be replaced by the **value of equity** (V_E);
- net debt (D) will be replaced by the value of net debt (V_D);
- capital employed (CE) will be replaced by enterprise value (EV), or firm value.

We will speak in terms of a financial assessment of the company (rather than the accounting assessment provided by the balance sheet). Our financial assessment will include only the market values of assets and liabilities:

ENTERPRISE VALUE or FIRM VALUE (EV)	VALUE OF NET DEBT (V_D)
	EQUITY VALUE (V_E)

As operating assets are financed by equity and net debt (which are accounting concepts), logically, a company's enterprise value will consist of the market value of net debt and the market value of equity (which are financial concepts). This chapter therefore reasons in terms of:

Enterprise value = Value of net debt + Equity value

Important: Enterprise value is sometimes confused with equity value. Equity value is the enterprise value remaining for shareholders after creditors have been paid. To avoid confusion, remember that **enterprise value is the sum of equity value and net debt value.**

> In this book we refer to the market value of operating assets (industrial and commercial) as "enterprise value", which is the sum of the market value of equity (i.e. the company's market capitalisation if it is publicly traded) and the market value of net debt. Enterprise value and firm value are synonymous.

Similarly, we will reason not in terms of return on equity, but rather required rate of return, which was discussed in depth in Chapter 22. In other words, the accounting notions of **ROCE (return on capital employed), ROE (return on equity) and i (cost of debt)**, which are based on past observations, will give way to **WACC or k (required rate of return on capital employed), k_E (required rate of return on equity)** and k_D **(required rate of return of net debt)**, which are the returns required by those investors who are financing the company.

    The question that lies at the heart of this chapter is whether there is an optimal capital structure, one in which the combination of net debt and equity maximises enterprise value. In other words, is there a capital structure in which the weighted average cost of capital (as defined below) is the lowest possible?

    Note that we consider the weighted average cost of capital (or cost of capital), denoted k, to be the rate of return required by all the company's investors either to buy or to hold its securities. **It is the company's cost of financing and the minimum return its investments must generate in the medium term. If not, the company is heading for ruin**.

    k_D is the rate of return required by lenders of a given company, k_E is the cost of equity required by the company's shareholders, and k is the weighted average rate of the two types of financing, equity and net debt (from now on referred to simply as debt). The weighting reflects the breakdown of equity and debt in enterprise value.

    With V_D, the market value of net debt, and V_E the market value of equity, we get:

$$k = k_D \times \left(\frac{V_D}{V_D + V_E} \right) + k_{CP} \times \left(\frac{V_E}{V_D + V_E} \right)$$

or, since the enterprise value is equal to that of net debt plus equity ($V = V_E + V_D$):

$$k = k_D \times \left(\frac{V_D}{V} \right) + k_E \times \left(\frac{V_E}{V} \right)$$

If, for example, the rate of return required by the company's creditors is 5% and that required by shareholders 10% and the value of debt is equal to that of equity, the return required by all of the company's sources of funding will be 7.5%. Its weighted average cost of capital is thus 7.5%.

COST OF CAPITAL OF MAJOR EUROPEAN COMPANIES
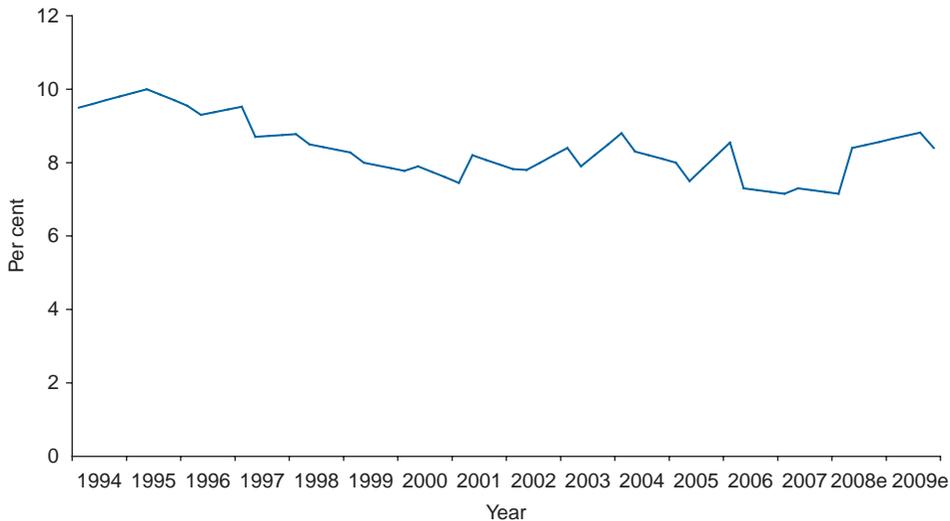
Example: Recent developments in the cost of capital of the largest listed European groups.

Source: Exane BNP Paribas

To simplify our calculations and demonstrations in this chapter, we shall assume infinite durations for all debt and investments. This enables us to apply perpetual bond analytics and, more importantly, to assume that the company's capital structure remains unchanged during the life of the project; income being distributed in full.

The assumption of an infinite horizon is just a convention designed to simplify our calculations and demonstrations, but they remain accurate within a limited time horizon (say, for simplicity, 15–20 years!).

We shall start by assuming a tax-free environment, both for the company and the investor, in which neither income nor capital gains are taxed. In other words, heaven! Concretely, the optimal capital structure is one that minimises k, i.e. that maximises the enterprise value (V). Remember that the enterprise value results from discounting free cash flow at rate k. However, free cash flow is not related to the type of financing. The demonstrations below endeavour to measure and explain changes in k according to the company's capital structure.

Section 33.1
THE EVIDENCE FROM THE REAL WORLD

According to conventional wisdom, there is an optimal capital structure that maximises enterprise value by the judicious use of debt and the leverage it offers. This enables the company to minimise its weighted average cost of capital – that is, the cost of financing.

Why do we say that? Because there is enough evidence showing that the leverage of companies is not highly volatile. If the leverage doesn't change so often it means that companies are generally satisfied with the level of debt they have in their capital structure.

We know that *ex ante* debt is always cheaper than equity ($k_D < k_E$) because it is less risky. Consequently, a moderate increase in debt will help reduce k, since a more expensive resource – equity – is being replaced by a cheaper one – debt. This is the practical application of the preceding formula and the use of leverage.

However, any increase in debt also increases the risk for the shareholder. Markets then demand a higher k_E the more debt we add in the capital structure. The increase in the expected rate of return on equity cancels out part (or all, if the firm becomes highly leveraged!) of the decrease in cost arising on the recourse to debt. More specifically, the traditional theory claims that a certain level of debt gives rise to a very real risk of bankruptcy. Rather than remaining constant, shareholders' perception of risk evolves in stages.

The risk accruing to shareholders increases in step with that of debt, prompting the market to demand a higher return on equity. This process continues until it has cancelled out the positive impact of the debt financing.

At this level of financial leverage, the company has achieved the optimal capital structure ensuring the lowest weighted average cost of capital and thus the highest enterprise value. Should the company continue to take on debt, the resulting gains would no longer offset the higher return required by the market.

Moreover, the cost of debt increases after a certain level because it becomes more risky. At this point, not only has the company's cost of equity increased, but also of that of its debt.

In short, the evidence from the "real world" shows that an optimal capital structure can be achieved with some – but not too much – leverage.

REAL WORLD APPROACH TO OPTIMAL CAPITAL STRUCTURE

According to the traditional approach, an optimal capital structure can be achieved where the weighted average cost of capital is minimal.
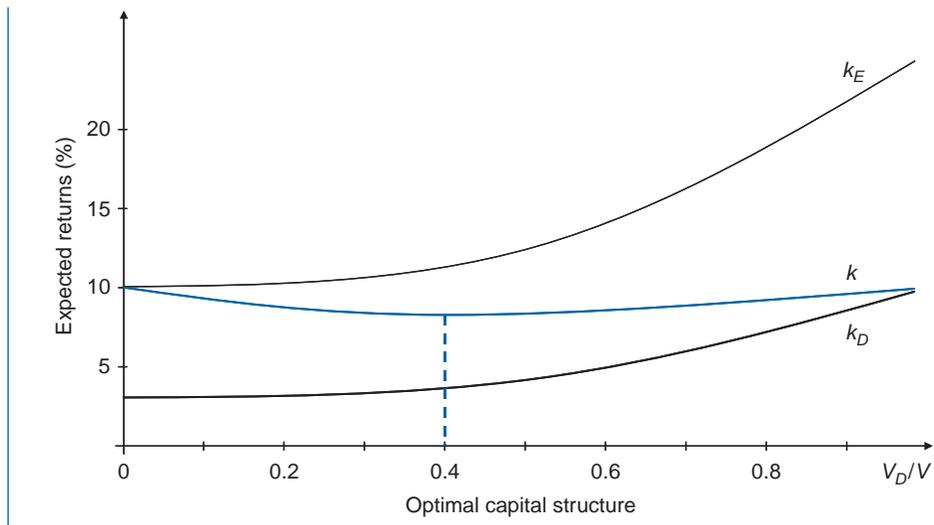
In this example, the debt-to-equity ratio that minimises k is 0.4. The optimal capital structure is thus achieved with 40% debt financing and 60% equity financing.

The evidence from the capital structure can be explained with a theoretical model. This is a success. Why? Because if we have a model that explains the determinants of an optimal capital structure policy we can:

- *explain* and interpret the behaviour of companies;
- *predict* where companies should position themselves and *suggest* these positions and an appropriate "convergence path".

The common name of the model we are talking about is the (static) "**tradeoff model**". It simply states that the optimal capital structure of a company is where benefits and costs of debt are best balanced.

This "thriller solution" – a startlingly simple conclusion – has been the result of a long evolution of financial theory, a story that started out with Franco Modigliani and Merton Miller in 1958 with a totally different result compared with the "real world" wisdom.

Section 33.2
THE CAPITAL STRUCTURE POLICY IN PERFECT FINANCIAL MARKETS

The perfect markets theory of capital structure contradicts the "real world" approach. It states that, barring any distortions, there is *no one* optimal capital structure.

We shall demonstrate this proposition by means of an example given by Franco Modigliani and Merton Miller (MM), who showed that, in a perfect market and without taxes, the traditional approach is incorrect. **If there is no optimal capital structure, the overall cost of equity (k or WACC) remains the same regardless of the firm's debt policy**.

The main assumptions behind the theorem are:

1   companies can issue only two types of securities: risk-free debt and equity;
2   financial markets are frictionless;
3   there is no corporate and personal taxation;
4   there are no transaction costs;
5   firms cannot go bankrupt;
6   *insiders* and *outsiders* have the same set of information;

According to MM, investors can take on debt just like companies. So in a perfect market, they have no reason to pay companies to do something they can handle themselves at no cost.

Imagine two companies that are completely identical except for their capital structure. The value of their respective debt and equity differs, but the sum of both, i.e. the enterprise value of each company, is the same. If the reverse were true, equilibrium would be restored by arbitrage.

We shall demonstrate this using the examples of companies X and Y, which are identical except that X is unlevered and Y carries debt of 80,000 at 5%. If the traditional approach were correct, Y's weighted average cost of capital would be lower than that of X and its enterprise value higher:

	Company *X*	Company *Y*
Operating profit: *OP*	20,000	20,000
Interest expense (at 5%): *IE*	0	4,000
Net profit: *NP*	20,000	16,000
Dividend : $DIV = NP$[1]	20,000	16,000
Cost of equity: k_E	10%	12%
Equity: $V_{CP} = DIV/k_E$[2]	200,000	133,333
Debt: $V_D = IFi/k_D$[2]	0	80,000
Enterprise value: $V = V_E + V_D$	200,000	213,333
Weighted average cost of capital: $k = OP/V$[2]	10%	9.4%
Gearing : V_D/V_E	0%	60%

1 To simplify calculations, the payout ratio is 100%.

2 To simplify calculations, we adopt an infinite horizon.

Y's cost of capital is higher than that of *X* since *Y*'s shareholders bear both the operating risk and that of the capital structure (debt), whereas *X*'s shareholders incur only operating risk.

Modigliani and Miller demonstrated that *Y*'s shareholders can achieve a higher return on their investment by buying shares of *X*, at no greater risk.

Thus, if a shareholder holding 1% of *Y* shares (equal to 1333) wants to obtain a better return on investment, he must:

- sell his *Y* shares . . .
- . . . **replicate** *Y*'s debt/equity structure in proportion to his 1% stake, that is, borrow $1333 \times 60\% = 800$ at 5% . . .
- . . . invest all this ($800 + 1333 = 2133$) in *X* shares.

The shareholder's risk exposure is the same as before the operation: he is still exposed to operating risk, which is the same on *X* and *Y*, as well as to financial risk, since his exposure to *Y*'s debt has been transferred to his personal borrowing. However, the personal wealth invested by our shareholder is still the same (1333).

Formerly, the investor received annual dividends of 160 from company *Y* (12% × 1333 or 1% of 16,000). Now, his net income on the same investment will be:

Dividends (company *X*)	$2133 \times 10\% = 213$
− Interest expense	$800 \times 5\% \ \ = 40$
= Net income	$= 173$

He is now earning 173 every year instead of the former 160, *on the same personal amount invested and with the same level of risk*.

Y's shareholders will thus sell their Y shares to invest in X shares, reducing the value of Y's equity and increasing that of X. This arbitrage will cease as soon as the enterprise values of the two companies come into line again.

Thus, barring any distortions, the enterprise value of a company must be independent of its financing policy.

Investing in a leveraged company is neither more expensive nor cheaper than in a company without debt; in other words, the investor should not pay twice, once when buying shares at enterprise value and again to reimburse the debt. The value of the debt is deducted from the price paid for the equity.

While obvious, this principle is frequently forgotten. And yet it should be easy to remember: the value of an asset, be it a factory, a painting, a subsidiary or a house, is the same regardless of whether it was financed by debt, equity or a combination of the two. As Merton Miller explained when receiving the Nobel prize for economics, "it is the size of the pizza that matters, not how many slices it is cut up into."

Or, to restate this: the weighted average cost of capital does not depend on the sources of financing. True, it is the weighted average of the rates of return required by the various providers of funds, but this average is independent of its different components, which adjust to any changes in the financial structure.

Let's see a more practical implication. Suppose a company with an invested capital (working capital and fixed assets) of €500,000. The investments can generate a constant (and perpetual) operating income of €120,000. Suppose also that:

- the annual depreciation equals the new investments of each period;
- the annual variation of working capital is approximately zero;
- the payout ratio is 100%.

Let us limit the analysis to a range of leverage values between 0 and 25%. The cost of debt is 8%.

The following table shows the effects of debt on net income and on total cash flows (dividends + interest expenses), *when there is no taxation and no other distortions*:

$V_D/(V_D + V_E)$ **market values**	**0%**	**5%**	**10%**	**15%**	**20%**	**25%**
Operating income	120,000	120,000	120,000	120,000	120,000	120,000
Interest expenses	0	(4,000)	(8,000)	(12,000)	(16,000)	(20,000)
Operating Income before taxes	**120,000**	**116,000**	**112,000**	**108,000**	**104,000**	**100,000**
Tax rate	0%					
Taxes	0	0	0	0	0	0
Net income	**120,000**	**116,000**	**112,000**	**108,000**	**104,000**	**100,000**
Dividends	120,000	116,000	112,000	108,000	104,000	100,000
Total cash flows	**120,000**	**120,000**	**120,000**	**120,000**	**120,000**	**120,000**

The total cash flows remains constant, regardless of the level of debt. In a *perfect* MM world, if we increase the proportion of debt in the capital structure the only effect we obtain is a redistribution of the slices of the "pizza" from shareholders to creditors. The total value of the "pizza" doesn't change. That is:

$$V_L = V_U$$

This is the **first proposition** of the MM theorem in absence of taxation. It simply states that, *in perfect financial markets*, the value of a levered company is exactly the same as an unlevered company.

The absence of any effect produced by changing leverage on total cash flows implies that the weighted average cost of capital (k) doesn't change, whatever the leverage.

How is it possible to obtain a constant k if k_D is constant too (due to the absence of financial distress costs) and thus if we increase the leverage we would expect a continuously decreasing k? The answer must be searched in the **second proposition** of MM (with no taxes) according to which the cost of equity must be computed as follows[3]:

$$k_E = k_{EU} + (k_{EU} - k_D) \times \frac{V_D}{V_E}$$

The above equation is the equation of a line with an intercept equal to k_{EU} – cost of equity of a company all-equity financed – and an angular coefficient ($k_{EU} - k_D$). Since k_{EU} is influenced by the operating risk of the company – a kind of risk basically uninfluenced by the capital structure policy – the positive inclination of the line reflects the fact that, by incrementing the debt/equity ratio, the shareholder is charged with an increasing financial risk in exchange of which he will ask for a higher remuneration.

The following picture illustrates this circumstance. As it can be seen, the cost of debt is represented by a horizontal line, since there are no financial distress costs. Since k is also uninfluenced by the degree of leverage, it results that the cost of equity line must have the values shown in the picture so that k can remain unchanged.

3 *This result is not magic! It can be obtained by assuming that $k = k_{EU}$, i.e.:*
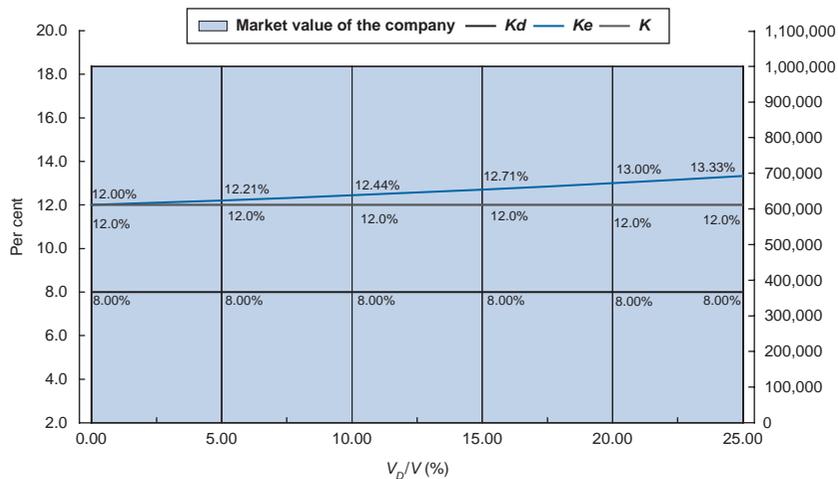
$$k_D \times \frac{V_D}{V_D + V_E} + k_E$$

$$\times \frac{V_E}{V_D + V_E} = k_{EU}$$

If we multiply both sides by

$$\frac{V_D + V_E}{V_E}$$

and we rearrange terms, we obtain exactly the second proposition.

MM WITH NO TAXES AND OTHER DISTORTIONS

In a perfect market, the rise in expected returns related to leverage is cancelled out by the rise in risk, so that the share's value remains the same.

When debt increases, so does the risk to shareholders, and the cost of equity. As a result, total shareholder wealth does not change.

Summary

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Is there such a thing as an optimal capital structure, i.e. a way of splitting the financing of operating assets between debt and equity which would enhance the value of the operating assets and minimise the company's cost of capital? This is the central question that this chapter attempts to answer.

The real world camp says yes, but without being able to prove it, or to set an ideal level of net debt and equity.

Modigliani and Miller said no in 1958, and showed how, if it were so, there would be arbitrages that re-established the balance.

For an investor with a perfectly diversified portfolio, and in a tax-free universe, there is no optimal capital structure. The following rules can be formed on the basis of the above:

- for any given investment policy and if no taxes are levied, value cannot be instantly created by the choice of a "good" capital structure;

- whether a given company is sold and the deal is paid in shares only, or whether the deal is paid in a whole range of different securities (shares, debt, hybrid shares), this will not change the value of its operating assets (excluding tax);

- in a world without taxes, the expected leverage effect is an illusion. The cost of capital (excluding tax) is linked to the company's assets and is independent from the method of financing.

But a world without taxes is a utopia, which is why the next chapter brings tax and other "distortions" into the equation.

Questions

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quiz

1/Why is the cost of equity for a company with no debt equal to the average weighted cost of capital?

2/What is the cost of capital equal to?

3/What are the two risks for a shareholder of an indebted company?

4/Of the following decisions, which is the most important: An investment decision? A financing decision? Why?

5/Explain what impact an increase in debt will have on the β of shares.

6/What are Modigliani and Miller's theories based on?

7/The fact that shareholders' expected returns rise with the level of debt does not run contrary to the approach taken by Modigliani and Miller. Why?

8/Is the cost of capital an accounting or financial concept?

9/Why can it be dangerous to use a spreadsheet to create simulations of the cost of capital?

10/Can a company create value by going into debt?

11/What is the cost of net debt of a company that has no more shareholders' equity equal to? And the cost of capital?

12/What are we forgetting when we say that by increasing return on equity, the leverage effect of debt cannot increase value?

13/True or false? "By reducing financial leverage, we reduce the cost of debt and the cost of equity, and accordingly, the weighted average cost of capital?" Why?

14/True or false? "The more debt we incur, the higher the interest rate we are charged. Our shareholders also require a higher return. Additionally, if we want a low cost of capital, we have to have a low level of debt." Why?

EXERCISES

1/ Sixty per cent of company A's needs are equity-financed at a cost of 9%, and 40% are debt-financed at 5%. Excluding tax, what is the weighted average cost of capital of this company?

2/ In a tax-free world, two companies B and C are similar in every respect, except their capital structures. B has no debts while C has debts of 24,000 at 5%. The companies have been valued as follows:

	Company B	Company C
Operating income	10,000	10,000
Financial expense	0	1,200
Net income	10,000	8,800
k_{SE}	8%	11%
V_{SE}	125,000	80,000
V_D	0	24,000
V	125,000	104,000
k	8%	9.62%
$V_D/(V_E + V_D)$	0%	23%
Payout	100%	100%

You own 1% of company *B*'s shares. How much will you receive every year? Show how you can increase this amount without altering the amount of your investment or increasing the level of risk.

When will arbitrage cease? What will the P/E be for companies *B* and *C*?

3/ A company with no debts has a weighted average cost of capital of 8%.

(a) What is the cost of equity for this company?
(b) It decides to borrow 33.5% of the value of its operating assets at a rate of 5%, in order to finance a capital reduction of 33.5%. What is the cost of equity now?
(c) If the market risk premium is 4% and the β of the company's shares before it goes into debt was 1.2, what is the new β of shares after the capital reduction?
(d) What is the β of the debt, if the β of the capital employed is equal to the average β of the capital employed and the debt weighted by the relative share of debt and equity in financing the capital employed.

$$\left(\beta = \beta_E \times \frac{V_E}{V_E + V_D} + \beta_D \times \frac{V_D}{V_D + V_E} \right)$$

4/ Deutsche Telekom and France Telecom have a similar economic risk. The beta of France Telecom shares is 1.4 and 1.1 for Deutsche Telekom. If the no-risk cash rate is 3.5% and the risk premium is 6%, what are the shareholders' required returns? If the net debt/shareholders' equity ratio is 1.5 in value for France Telecom, what is it for Deutsche Telekom which has debts of 4% compared with 4.5% for France Telecom (imagine that this is a tax-free world)?

ANSWERS

Questions

1/ *Because shareholders' equity alone bears the risk of capital employed.*
2/ *To the average weighted by the values of the cost of equity and the cost of net debt.*
3/ *The risk of capital employed and the risk of capital structure.*
4/ *Investment, because it is easier to create value by making a good investment, and we learnt in this chapter that there is no such thing as good financing.*
5/ *Debt capital, by increasing the risk of shares, increases the β.*
6/ *Arbitrage.*
7/ *Because the risk also increases.*
8/ *Financial, because only market values (rates and values) come into the calculation of the cost of capital.*
9/ *Because by modifying the relative weights of debt/shareholders' equity, we often forget that the cost of shareholders' equity and debt depends on this relative weight, and that they are not constant, no matter what the capital structure.*
10/ *No, this would be too good to be true and all companies would have huge debts.*
11/ *To the cost of shareholders' equity of a debt-free company in the same sector. Ditto.*
12/ *The risk of shareholders' equity increases and accordingly the returns required by shareholders increases at the same time.*
13/ *False, by reducing leverage, an "expensive" resource (shareholders' equity, the cost of which is reduced) is replaced with a "cheap" resource (debt, the cost of which is reduced). In sum, the weighted average cost of capital remains constant.*

14/*False, the company is replacing an "expensive" resource (shareholders' equity) with a "cheap" resource (debt) even though the cost will rise. In sum, the weighted average cost of capital remains constant.*

Exercises

1/*k = 7.4%.*

2/*A shareholder of 1% of company B will receive the following sum every year: 1% × 125,000 × 8% = 100. He sells his shares in company B and buys shares in company C. However, because the company is indebted, as a shareholder he carries a higher risk than before. If he wants to keep the same level of risk, he must put an equivalent amount into the debt underlying the shares he has bought in company C. Accordingly, if n is the percentage of 1250 paid for the shares in company C, n × 23.1% = 1 − n. The solution to this equation is n = 1/(1+23.1%) = 81%. Or, for assets totalling 1250: 19% is lent at 5% and 81% is invested in company C shares. Which is an income of 19% × 1250 × 5% + 81% × 1250 × 11% = 123, more than the initial income of 100. Arbitrage will cease when the value of the capital employed of companies' B and C is equal, for example 111,400, which gives an equity value for company C of 114,000 − 24,000 = 90,000 and a P/E of 10.2 for company C and 11.4 for company B.*

3/*(a) k_E = 8%. (b) k_E = 9.5%. (c) β = 1.57. (d) β_D = 0.45.*

4/*DT : k_E = 10.1%; FT: k_E = 11.9%; V_D/V_E = 0.45.*

BIBLIOGRAPHY

A classic example of a real world point of view:

B. Graham, L. Dodd, *Security Analysis*, 3th edn, McGraw Hill, 1951.

To read the seminal article by Modigliani and Miller:

F. Modigliani, M. Miller, The cost of capital, corporation finance and the theory of investment, *American Economic Review*, **47**, 261–297, June 1958.

F. Modigliani M. Miller, Corporate income taxes and the cost of capital, *American Economic Review*, June 1963, 433–443.

M. Miller, Debt and taxes, *Journal of Finance*, 261–275, May 1977.

For a general overview on capital structure that is still interesting to read:

J. Stiglitz, On the irrelevance of corporate financial policy, *American Economic Review*, **47**, 851–866, December 1974.