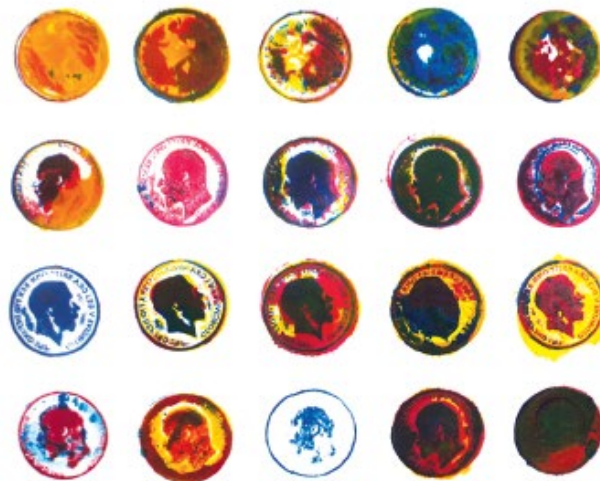


**Corporate Finance: Key Concepts & Principles
Questions and Exercises**

Corporate Finance

Key Concepts & Principles

Ewoud Jansen



VU University Press

©Ewoud Jansen

Chapter 1

(for all exercises in this chapter we use a discount rate of 4%)

Exercise 1.1

- A. What is the present value of an amount of €800 to be received 6 years from today?
- B. What is the future value of €800, 7 years from today?
- C. What is the present value of a €800 a year, 10 year annuity?
- D. What is the future value of a €800 a year, 10 year annuity?
- E. What is the present value of a perpetual cash flow of €800 per year?

Exercise 1.2

John's wants to start saving for his daughter's college education, who just turned 10 years old today. When Sarah goes to college, he wants to be able to withdraw €12,000 a year for 4 years from his account. The first withdrawal will be 8 years from today, when his daughter turns 18. John will make annual 8 deposits into his account, the first one today, and the last one when Sarah turns 17 (so one year before she goes to college).

How high should the annual deposit be so that John has enough to pay for Sarah's education?

Solutions Chapter 1

Solutions 1.1

- A. $€800 / 1.04^6 = €632.25$
- B. $€800 * 1.047 = 1,052.75$
- C. $€800 * (1 - 1 / 1.0410) / 0.04 = €6,488.72$
- D. $€800 * (1.0410 - 1) / 0.04 = €9,604.89$
- E. $€800 / 0.04 = €20,000$

Solutions 1.2

We first determine how much the account should hold to be able to make the 4 withdrawals. We can do this by calculating the present value of the 4 withdrawals of €12,000.

$PV = €12,000 * (1 - 1 / 1.04^4) / 0.04 = €43,558.74$. This is the amount the account should hold 1 year before the first withdrawal. It should therefore be equal to the future value of the 8 deposits.

$$\text{Annual Deposit} * (1.04^8 - 1) / 0.04 = €43,558.74$$

$$\text{Annual Deposit} * 9.214 = €43,558.74$$

$$\text{Annual Deposit} = €43,558.74 / 9.214 = €4,727.34$$

Chapter 2 (for all exercises in this chapter we assume cash flows are perpetual)

Exercise 2.1

A company generates a pre interest perpetual cash flow of \$30,000. It's debt is \$100,000 with a 6% interest rate. The weighted average cost of capital (WACC) is 10%. Equity is divided in 10,000 common shares.

- A. What is the total firm value?
- B. What is the market value of equity?
- C. What is the required rate on equity?

Exercise 2.2

Guadeloupe Mountain Company (GMC) earns a perpetual cash flow for its stockholders of \$405,000 per year. Its debt is \$3,000,000 with a 6% coupon. The debt accounts for 40% of total firm value. The number of shares on the market is 100,000.

- A. What is the required rate on equity?
- B. What is the weighted average cost of capital (WACC)?
- C. What is the market price per share.

Assume that GMC wants to raise \$2,000,000 in new equity by issuing new shares at a price of \$40 per share and uses the proceeds from the share issue to redeem debt by the same amount.

- D. Motivate and calculate what this means for the required rate on equity and the Wacc.

Exercise 2.3

Consider the following data:

- A company with a perpetual cash flow (before interest) of \$600;
- The total company value is \$7,000. Total debt is \$4,000;
- The required rate of shareholders is 12%.

Required

- A. The Wacc.
- B. The (market) value of equity.
- C. The interest rate on debt.

Now in addition assume a 20% tax rate.

- D. Determine the effect on total firm value, value of equity and the WACC.

Solutions Chapter 2

Solutions 2.1

- A. $\$30,000 / 0.1 = \$300,000$
- B. $\$300,000 - \$100,000 = \$200,000$
- C. Cash flow to shareholders = $\$30,000 - 6\% * \$100,000 = \$24,000$
RS = $\$24,000 / \$200,000 = 12\%$

Solutions 2.2

- A. Total firm value = $\$3,000,000 / 0.4 = \$7,500,000$
- Value equity = $\$7,500,000 - \$3,000,000 = \$4,500,000$
 $R_s = \$405,000 / \$4,500,000 = 9\%$
- B. B. Total cash flow = $\$405,000 + (6\% * \$3,000,000) = \$585,000$
WACC = $\$585,000 / \$7,500,000 = 7.8\%$
- Or: WACC = $(4,500 / 7,500) * 9\% + (3,000 / 7,500) * 6\% = 7.8\%$
- C. $\$4,500,000 / 100,000 = \45
- D. RS goes down due lower risk, WACC is not affected by level of debt financing and therefore stays the same
- Equity becomes $\$4,500,000 + \$2,000,000 = \$6,500,000$
Debt becomes $\$3,00,000 - \$2,00,000 = \$1,000,000$
Cash flow to shareholders = $\$585,000 - 6\% * \$1,000,000 = \$525,000$
 $R_s = \$525,000 / \$6,500,000 = 8.08\%$
WACC = $(6,500 / 7,500) * 8.08\% + (1,000 / 7,500) * 6\% = 7.8\%$
Or: WACC = $\$585,000 / \$7,500,000 = 7.8\%$

Solutions 2.3

- A. WACC = $\$600 / \$7,000 = 8.57\%$
- B. Value equity = $\$7,000 - \$4,000 = \$3,000$
- C. Cash flow to shareholders = $12\% * \$3,000 = \360
Annual Interest = $\$600 - \$360 = \$240$. Interest percentage = $\$240 / \$4,000 = 6\%$
- WACC = $(3/7) * 12\% + (4/7) * 6\% = 8.57\%$
- D. Without taxation total firm value is \$7,000, regardless of financial structure. With 20% tax, the value of an all equity firm becomes. $(1 - 0.2) * \$7,000 = \$5,600$.
The value of a levered firm must be higher due to the tax shield of interest payments.
- Without debt, annual tax payment is $\$600 * 0.2 = \120

Using debt gives \$240 in tax deductible interest payment. Annual tax payment = $(\$600 - \$240) * 0.2 = \$72$

PV of tax savings = $(\$120 - \$72)/0.06 = \$800$

Firm Value = $\$5,600 + \$800 = \$6,400$

Or: Firm Value = $\$5,600 + \$4,000 * 0.2 = \$6,400$

Value equity = $\$6,400 - \$4,000 = \$2,400$

Since R_s and the interest rate are not affected we can now calculate the WACC:

WACC = $(2.4/6.4)*12\% + (4/6.4)*6%*0.8 = 7.5\%$

Alternative approach

The after tax cash flow to shareholders becomes: $(\$600 - \$240) * (1 - 0.8) = \$288$. Knowing R_s remains 12%, we can determine value of equity:

Value equity = $\$288/0.12 = \$2,400$

Firm value = $\$2,400 + \$4,000 = \$6,400$

Chapter 3

Exercise 3.1

Sally is currently driving a car that runs on regular gas. Since she has landed a new job with a much longer commute, she thinks of buying a diesel fueled car. She wants to know whether the purchase of another car makes sense on a net present value (NPV) basis and uses a 5 year time frame for her analysis. To make a decision, she has collected the following information.

The car she now drives was bought new for €25,000. It can be sold right now for €10,000. If she uses it another 5 years, it can then be sold for €4,000.

Her car averages 15 kilometers per liter of gas. A liter of regular gas costs €1.60. Fixed costs like road tax and insurance are €200 per month.

The new car she considers buying is a second hand model and would cost €15,000. After 5 years it could be scrapped for €6,000. It averages 20 kilometers per liter of diesel. A liter of diesel costs €1.20. Fixed costs like road tax and insurance are €300 per month.

Sally figures she'll drive 30,000 kilometers per year in the new job. This used to be 20,000 kilometers. She works with a cost of capital of 7%.

Required:

- A. The relevant annual cash flows associated with the investment.
- B. The NPV of the investment and a decision whether or not to buy the car.
- C. We assumed a scrap value of the old car at the end of the 5th year of €4,000. At what scrap value would the decision in question B become the opposite?

Exercise 3.2

A restaurant has been suffering from a declining number of guests and average sales per guest. It has space for 50 guests per night but lately only 45% of that capacity is occupied. A guest spends \$64 on average. Three years ago these numbers were 60% and \$70 respectively. The restaurant is open 50 weeks a year and 6 nights a week. The margin (after deducting variable costs) on sales is 60%.

The worsening performance may partly be attributable to the poor economic climate in general. But a survey among the public has revealed that the ambiance and interior design of the place is perceived as outdated and that the waiters are not very attentive. As a result of these outcomes, management has decided it's time to do something.

They will modernize the interior, buy new furniture and upgrade the kitchen. This involves an investment of \$250,000. Also the staff will receive a training in the art of hospitality. This is another \$20,000 investment. The benefits of the investment will last 5 years and the scrap value is zero. Old tables and chairs with an original cost of \$25,000 will be thrown away.

As a result of the changes, the occupation rate is expected to increase to 55%. Average spending per guest will become \$68. Due to better management of kitchen staff, there is less waste of ingredients leading to a better margin of 65%.

The weighted average cost of capital is 15%.

- A. Determine the incremental cash flow that the investment generates

- B. Calculate the payback period.
- C. Calculate the Accounting Rate of Return.
- D. Calculate the NPV of this investment.
- E. Keeping all other data the same, at what level of (new) occupation rate (OR) will the NPV become zero?
- F. Keeping all other data the same, at what level of average spending per guest (ASG) will the NPV become zero?

Exercise 3.3

Good Old Travel Partner (GOTP), a travel agency, considers to make a change in their sales approach. So far they have resisted offering online services and booking options, relying on their approach of face to face contact and personal service. While this has worked well even with the initial rise of the Internet, in the last years, sales (at customer prices) have dropped and stabilized at €1,100,000 per year, down from a high in 2005 of €2,500,000. Even some of their older and loyal customers confessed having switched to online booking sites. GOTP therefore wants to supplement their physical shop with a state of the art website.

The initial development and design of the website will cost €15,000. Hosting costs are €250 per year.

As stated above, currently GOTP sells €1,100,000 worth of tickets, hotel reservations and other services to their customers. The average margin for GOTP is 20%. With the website in place, sales through the office will drop even further and become €800,000 a year. The margin will remain 20%. The website is expected to generate €500,000 in sales a year. However, since price competition on the web is more fierce and more focused on budget options, the (average) margin for GOTP is only 15%.

Since traffic at the shop will become smaller, an employee with an annual salary of €50,000 can be let go. She will receive €25,000 as compensation. Instead, a new specialized web-manager must be hired who earns €57,000 a year.

For accounting purposes, assume that the initial investment and severance payment are depreciated in a straight line to zero.

The owners of GOTP want to know if this makes for a sensible investment. The time frame for analyzing this investment is 10 years. The weighted average cost of capital is 12%.

- A. Determine the change in the annual cash flow as a result from this investment.
- B. How long is the pay-back period?
- C. Calculate the Average Accounting Rate of Return.
- D. Is the investment acceptable using based on the Net Present Value (NPV) approach?

The analysis above ignored income tax. Let's assume profits are taxed at 20%.

- E. How high will the (incremental) annual income tax payment be?
- F. Determine the NPV, taking income tax into account.

Solutions Chapter 3

Solutions 3.1

- A. Gas: $30,000/15 = 2,000$ liters = €3,200
 Diesel: $30,000/30 = 1,500$ liters = €1,800
 Annual Savings on Fuel = €1,400

Insurance becomes €100 more per month so \$1,200 per year.

The expected scrap value of the new car is €6,000. The scrap value of the old car would have been €4,000 so the difference is €2,000. All told the cash flows are (€):

	0	1	2	3	4	5
Sell old	10,000					
Buy new	(15,000)					
Scrap Value						2,000
Savings		1,400	1,400	1,400	1,400	1,400
Insurance		(1,200)	(1,200)	(1,200)	(1,200)	(1,200)
	(5,000)	200	200	200	200	2,200

- B. $NPV = (1 - 1/1.07^5)/0.07 * €200 + €2,000/1.07^5 - €5,000 = (€2,754)$
 The NPV is below zero so it's not a good idea.
- C. The NPV must increase by €2,754. This requires an increase in the difference in scrap value of $€2,754 * 1.07^5 = €3,863$. This happens when the scrap value of the new car drops to $€4,000 - €3,863 = €137$ (a lower year 5 scrap value of the old car means keeping it is less attractive and hence the investment becomes more attractive).

Solutions 3.2

- A. New cash flow: $50 \text{ guests} * 50 \text{ weeks} * 6 \text{ nights} * \$68 * 0.65 * 0.55 = \$364,650$
 Old cash flow: $50 \text{ guests} * 50 \text{ weeks} * 6 \text{ nights} * \$64 * 0.6 * 0.45 = \underline{\$259,200}$
 Incremental cash flow = \$105,450
- B. Payback $\$270,000/\$105,450 = 2.56$ years
- C. Total (incremental) profit = $5 * \$105,450 - \$270,000 = \$257,250$
 Average Annual Profit = $\$257,250/5 = \$51,450$
 Average Investment = $(\$270,000 + 0)/2 = \$135,000$
 AAR = $\$51,450/\$135,000 = 38.1\%$
- D. $NPV = \$105,450 * (1 - 1/1.15^5)/0.15 - \$270,000 = \$83,485$
- E. The PV of the new cash flow must go down by \$83,485
 $\Delta \text{ new CF} * (1 - 1/1.15^5)/0.15 = \$83,485$
 $\Delta \text{ new CF} * 3.352 = \$83,485$
 $\Delta \text{ new CF} * 3.352 = \$83,485/3.352 = \$24,905$

So when the new cash flow is lower by \$24,905, the NPV will become exactly 0.

So new cash flow must become $\$364,650 - \$24,905 = \$339,745$

We now set the outcome of the new cash flow calculation equal to \$339,745 and solve for OR.

$$50 \text{ guests} * 50 \text{ weeks} * 6 \text{ nights} * \$68 * 0.65 * \text{OR} = \$339,745$$
$$\text{OR} = \$339,745 / (50 \text{ guests} * 50 \text{ weeks} * 6 \text{ nights} * \$68 * 0.65) = 0.5124 \text{ (51.24\%)}$$

- F. We already know what the new cash flow should be to have an NPV of zero. We again set the outcome of the new cash flow calculation equal to \$339,745 but now solve for ASG.

$$50 \text{ guests} * 50 \text{ weeks} * 6 \text{ nights} * \text{ASG} * 0.65 * 0.55 = \$339,745$$
$$\text{ASG} = \$339,745 / (50 \text{ guests} * 50 \text{ weeks} * 6 \text{ nights} * 0.65 * 0.55) = \$63.36$$

In questions E and F we have performed a form of sensitivity analysis. Our initial NPV calculation was based on a 55% occupation rate. We now know that to maintain a positive NPV, it can go as low as 51.24% (keeping all else the same). The average spending per guest must be at least \$63.36 to have a positive NPV. This is actually lower than the current average check of \$64 but not an immediate problem as long as occupation rate and margin improve as planned.

Solutions 3.3

- A. *Margin change*

$\text{€}800,000 * 0.20 + \text{€}500,000 * 0.15 - \text{€}1,100,000 * 0.2 =$	€15,000
Extra Salary	(€7,000)
Hosting	(€250)
Incremental Annual Cash Flow	€7,750
Investment = €15,000 + €25,000 =	€40,000

- B. Pay back = $\text{€}40,000 / \text{€}7,750 = 5.16$ years

- C. Average annual profit = $(10 * \text{€}7,750 - \text{€}40,000) / 10 = \text{€}3,750$
Average Investment = $(\text{€}40,000 + 0) / 2 = \text{€}20,000$
AAR = $\text{€}3,750 / \text{€}20,000 = 18.75\%$

- D. NPV:

$$(1 - 1 / (1.12)^{10}) / 0.12 = 5.65$$
$$5.65 * \text{€}7,750 - \text{€}40,000 = \text{€}3,789$$

- E. Incremental income tax = $\text{€}3,750 * 0.2 = \text{€}750$ per year
Incremental cash flow after tax = $\text{€}7,750 - \text{€}750 = \text{€}7,000$.

- F. NPV = $5.65 * \text{€}7,000 - \text{€}40,000 = (\text{€}450)$

Chapter 4

Exercise 4.1

Van Horn Inc's capital structure consists of equity only. Its 100,000 shares have a market value of €50 each. The weighted average cost of capital is 8%. It wants to raise new equity of €1,000,000 by issuing 25,000 new shares. The new funds will be invested in expansion of distribution channels. We assume % returns are earned by generating perpetual cash flows.

A. Determine the annual cash flow Van Horn currently earns for its investors.

The outcome of the new investment is of course uncertain. Van Horn's management has developed 3 scenarios regarding the success.

1. New investment earns 8% (equal to WACC)
2. New investment earns 6%
3. New investment earns 11%

B. Determine the total net wealth effect under each scenario.

C. Calculate the post issue price per share under each scenario.

D. Assuming all new shares are bought by new investors, show how the total net wealth effect will be divided between current – and new shareholders.

E. Assume now the shares will be issued via a rights issue. Calculate the value of a right under each scenario and also show the total net wealth effect for existing shareholders.

Solutions 4.1

A. Total value is $100,000 * €50 = €5,000,000$. Cash flow = $8\% * €5,000,000 = €400,000$

B. 1. Incremental cash flow = $8\% * €1,000,000 = €80,000$
Total cash flow = $€480,000$. Total value = $€480,000 / 0.08 = €6,000,000$.
Net wealth effect = $€6,000,000 - €5,000,000 - €1,000,000 = €0$

Alternatively: to meet WACC, incremental cash flow must be $1,000,000 * 8\% = €80,000$. This is equal to the actual incremental cash flow. No net wealth effect since new investment earns exactly the WACC.

2. Incremental cash flow = $6\% * €1,000,000 = €60,000$
Total cash flow = $€460,000$. Total value = $€460,000 / 0.08 = €5,750,000$.
Net wealth effect = $€5,750,000 - €5,000,000 - €1,000,000 = (€250,000)$

Alternatively: to meet WACC, incremental cash flow must be $€1,000,000 * 8\% = €80,000$. Actual incremental cash flow $€20,000$ too low. Net wealth effect = $(€20,000) / 0.08 = (€250,000)$. Negative wealth effect since new investment earns less than the WACC.

3. Incremental cash flow = $11\% * €1,000,000 = €110,000$
Total cash flow = $€510,000$. Total value = $€510,000 / 0.08 = €6,375,000$.
Net wealth effect = $€6,375,000 - €5,000,000 - €1,000,000 = €375,000$

Alternatively: to meet WACC, incremental cash flow must be $€1,000,000 * 8\% = €80,000$. Actual incremental cash flow is $€30,000$ higher. Net wealth effect = $€30,000 / 0.08 = €375,000$. Positive wealth effect since the new investment earns more than the WACC.

C. New number of shares will be 125,000.

1. Post issue share price = $€6,000,000 / 125,000 = €48$
2. Post issue share price = $€5,750,000 / 125,000 = €46$
3. Post issue share price = $€6,375,000 / 125,000 = €51$

D.

1. New shareholders gain: $25,000 * (€48 - €40) = €200,000$
Current shareholders lose: $100,000 (€48 - €50) = (€200,000)$
Net wealth effect: €0

2. New shareholders gain: $25,000 * (€46 - €40) = €150,000$
Current shareholders lose: $100,000 (€50 - €46) = (€400,000)$
Net wealth effect: (€250,000)

3. New shareholders gain: $25,000 * (€51 - €40) = €275,000$
Current shareholders gain: $100,000 (€51 - €50) = €100,000$
Net wealth effect: €375,000

E. for a new share $100,000 / 25,000 = 4$ rights will be needed.

1. Value of right: $(€48 - €40)/4 = €2$, Loss of share value = $€48 - €50 = (€2)$. Net wealth effect is €0.
2. Value of right: $(€46 - €40)/4 = €1.50$. Loss of share value = $€46 - €50 = (€4)$. Net loss per existing share (€2.50). Total negative wealth effect $100,000 * (€2.50) = (€250,000)$
3. Value of right: $(€51 - €40)/4 = €2.75$. Gain of share value = $€51 - €50 = 1$. Net gain per existing share = €3.75. Total positive wealth effect $100,000 * €3.75 = €375,000$

Total net wealth is the same, whether public or rights issue. In rights issue the complete wealth effect accrues to existing shareholders.

Chapter 5

Exercise 5.1

The table below shows the ending levels of the SSE Shanghai Composite Stock Index (based on stock prices in Chinese Yuan (¥)).

2014	3,235
2015	3,539
2016	3,104
2017	3,307

- A. What is the Average Annual Return of the index?
- B. What is the Compound Annual Growth Rate over these years?
- C. Explain why the two answers are different.

Starting end of 2014, Cindy invests ¥10,000 annually in a mutual fund that mirrors the SSE index.

- D. What is the value (¥) of her portfolio immediately after the last deposit in 2017?
- E. Calculate the annual yield (CAGR) this value implies.

At the end of 2017, the Yuan had a value of \$0.153. At the time of formulating this exercise, in November 2018, the exchange rate was \$0.144, while the SSE Index had a level of 2,645.

- F. Assume an American investor made a \$10,000 investment in the SSE at year end of 2017. What is the dollar value of his portfolio in November 2018?

Exercise 5.2

At the beginning of 2017, two investors both purchase shares in Ciscol Corporation for a total of €10,000 at a price of €50 per share.

Investor 1, does not commit additional funds, but only reinvests the dividends received. The cash dividend is paid over the number of shares he has at the start of the year.

Investor 2 keeps on buying shares for €10,000 at year end for three more years. Also at that moment he reinvests the cash dividend as mentioned above.

The year-end share prices and annual dividend payments (made at year end) were as follows:

	Year end Share Price (€)	Cash Dividend per Share (€)
2017	40	3
2018	42	4
2019	45	2.5

- A. Calculate how many shares both investors own at the end of 2019.
- B. Calculate the € value of the two portfolio's.
- C. Determine the compound annual growth rate (return) each investor achieved.
- D. Explain the difference you witness between the two returns.

Solutions Chapter 5

Solutions 5.1

A. Annual Returns

$$2015: (3,539 - 3,235)/3,235 = 9.40\%$$

$$2016: (3,104 - 3,539)/3,539 = (12.29)\%$$

$$2017: (3,307 - 3,104)/3,104 = 6.54\%$$

$$\text{Average} = 1.22\%$$

B. $(3,307/3,235)^{1/3} - 1 = 0.74\%$

C. The AAR is always higher than CAGR except when all annual returns are equal (no volatility of returns).

D.

	Annual Deposit	Price end	Buy	Cumulative	Terminal Value
2014	10,000	3,235	3.09	3.09	10,000
2015	10,000	3,539	2.83	5.92	20,940
2016	10,000	3,104	3.22	9.14	28,366
2017	10,000	3,307	3.02	12.16	40,221

E. Terminal Value of 4 year annuity: $10,000 * ((1+r)^4 - 1) / r = 40,221$.
 $r = 0.37\%$

F. Invest $\$10,000 / 0.153 = ¥65,359.477$.

$$\text{Value (¥) in November} = (2,645/3,307) * ¥65,359.48 = ¥52,275.72.$$

$$\text{Value in \$} = ¥52,275.72 * 0.144 = \$7,527.70.$$

Solutions 5.2

A. Investor 1

Start with $€10,000 / €50 = 200$ shares.

End of 2017 $(200 * €3) / €40 = 15$ shares (cumulative = 215)

End of 2017 $(215 * €4) / €42 = 20.48$ shares (cumulative = 235.48)

End of 2019 $(235.48 * €2.5) / €45 = 13.08$ (cumulative = 248.56)

Investor 2

Start with $€10,000 / €50 = 200$ shares.

End of 2017 $(€10,000 + 200 * €3) / €40 = 265$ shares (cumulative = 465)

End of 2017 $(€10,000 + 465 * €4) / €42 = 282.38$ shares (cumulative = 747.38)

End of 2019 $(€10,000 + 747.38 * €2.5) / €45 = 263.74$ (cumulative = 1,011.12)

B. Investor 1 value = $248.56 * €45 = €11,185.52$

Investor 2 value = $1,011.12 * €45 = €45,500.40$

C. Investor 1: $r = \sqrt[3]{1.1185} - 1 = 3.8\%$

Investor 2: to find r , solve $€10,000 * ((1+r)^4 - 1)/r = €45,500.40$

Trial and error gives $r \approx 8.6\%$

D. Investor 1 paid more for the shares than the ending value at the end of 2019. The only reason for the overall positive return are the dividends.

Investor 2 does benefit much more from the lower intermediate prices of 40 and 42 since also an additional €10,000 is spent on buying shares at each of those prices. As a result the return is much higher.

Chapter 6

Exercise 6.1

Consider two bonds, both with a coupon of 4% while the market rate for both is 5.5%. However, time to maturity for bond 1 is longer than for bond 2.

- A. Explain how the market values of bond 1 and 2 compare to their par values.
- B. Explain which of the two bonds has the lowest market value.
- C. Explain the nature of a deep discount bond.

Assume the coupon on a new 5 year government bond (€1,000 par value) has been set at 3% but the required rate of investors is 2.5%.

- D. Calculate what price the investors will bid when the bonds are sold through an auction.

Exercise 6.2

A 10 year government bond with a 3% annual coupon was issued 7 years ago through an action. Then, the market interest rate was 3.2%. Today it is 1.5%.

- A. Calculate the issue price of the bond (assume a face value of €1,000).
- B. What is today's market value of the bond?
- C. Calculate the achieved annual yield for someone who bought the bond when it was first issued and sells it after seven years.

Exercise 6.3

A corporate €1,000 par value bond with a 4% coupon and a 20 year maturity has a call provision that can be activated after 5 years. The call price is €1,050. The issue price was equal to the par value and 10,000 bonds were issued.

- A. Explain the benefits of a call provision for the issuing party.
- B. Suppose we're 5 years after the issue date. At what market rate will the company call the bonds?
- C. Suppose the market rate after 5 years is 3%. Calculate the size of the benefit the company can capture by calling the bonds.

Solutions chapter 6

Solutions 6.1

- A. Since market rate > coupon rate, both bonds must be trading below par.
- B. Value of Longer maturity more strongly impacted by difference between coupon and market rate so bond 1 must have lower value.
- C. It is a bond that offers no coupon between issue and maturity and is usually issued (far) below par.
- D. $€30 * (1 - 1/(1.025)^5)/0.025 + €1,000/(1.025)^5 = €1,023.23$.

Solutions 6.2

- A. $€30 * ((1 - 1/(1.032)^{10} - 1)/0.032 + €1,000/(1.032)^{10}) = €983.11$. Issue price is below par since the coupon is smaller than the market rate.
- B. $€30 * ((1 - 1/(1.015)^3 - 1)/0.015 + €1,000/(1.015)^3) = €1,043.68$
- C. The present value of the received cash flows must be equal to the initial price paid for the bond. So, $€983.11 = €30 * ((1 - 1/(1+r)^7 - 1)/r + €1,043.68/(1+r)^7$
 $R \approx 3.83\%$

Solutions 6.3

- A. This allows the issuer to refinance debt at lower interest rates by buying back bonds at a price below the market price.
- B. The company will call the bonds when the market price is higher than the call price of €1,050. To find the market rate at which the market price becomes €1,050 we have to solve: $€1,050 = €40 * ((1 - 1/(1+r)^{15} - 1)/r + €1,000/(1+r)^{15})$
This corresponds with a market rate of 3.56%. Any market rate below this will lead to a market price of more than €1,050.
- C. With a market rate of 3%, the market price = $€40 * ((1 - 1/(1.03)^{15} - 1)/0.03 + €1,000/(1.03)^{15}) = €1,119.38$.

$$\text{Total benefit} = 10,000 * (€1,119.38 - €1,050) = €693,800.$$

Or,

$$\text{Original annual interest cost} = 10,000 * €1,000 * 4\% = €400,000.$$

To buy back 10,000, €1,000 bonds at €1,050 each, the company must issue new debt worth €10,500,000. This leads to an annual interest of $€10,500,000 * 3\% = €315,000$. Annual interest savings are €85,000. The present value of this is $€85,000 * ((1 - 1/(1.03)^{15} - 1)/0.03) = €1,014,724$.

However, 15 years from today, redemption will be $10,000 * €50 = €500,000$ higher than it would have been. Present value of this is $€500,000/(1.03)^{15} = €320,931$.

$$\text{Net benefit} = €1,014,724 - €320,931 = €693,793.$$

Chapter 7

Exercise 7.1

The cost of capital for companies is usually much higher in the startup phase than later when the business is more mature.

- A. Explain why this is so.
- B. Explain how the required rate of follow up investors impacts the returns for early venture capital investors.

Exercise 7.2

Two entrepreneurs have developed a new web application that will allow companies to drastically lower their cost of procurement. The application is yet in a rudimentary stage and further development and launch will take investments beyond their means. To really get started €250,000 in funding is needed. They only have €50,000 themselves so are looking for an additional €200,000 from a venture capitalist. In the first two years, the firm will not yet generate any cash flows for the investors. From year 3 onwards, there will be a perpetual cash flow of €40,000 per year. For ease of calculations we assume cash flows to investors become available at year end. The venture capitalist intends to exit at the end of year 2 and has a required rate of return of 35%. He has managed to acquire 90% ownership of the company.

- A. At what required rate of return of follow up investors will the venture capitalist exactly meet his objective?
- B. At what required rate of return of follow up investors will the two entrepreneurs maintain the value of their original €50,000?

Solutions Chapter 7

Solutions 7.1

- A. In the early stages, risk is at its highest since uncertainty regarding future potential and profitability is at its highest too.
- B. The lower the required rate, the higher the price follow up investors are willing to pay for a stake in a company (all other things being equal).

Solutions 7.2

- A. To achieve a rate of return of 40%, the venture capitalist must be able to sell his stake for $€200,000 * 1.35^2 = €364,500$. This requires a total value of equity of $€364,500 / 0.9 = €405,000$. This is consistent with a required rate of $€40,000 / €405,000 = 9.88\%$.
- B. B. The entrepreneurs hold a 10% stake for which they paid €50,000. To maintain the original value, total equity must be worth €500,000. This implies a required rate of follow up investors of $€40,000 / €500,000 = 8\%$.

Chapter 8

Exercise 8.1

Clarkson Co. are studying the financials of Hammond Co. Hammond Co earns a perpetual pre interest annual cash flow of \$600,000 per year. It has a debt of \$4,000,000 at 6% interest. Hammond's equity is divided in 500,000 shares. The weighted average cost of capital (WACC) for both companies is 10%.

- A. What is today's market price of a Hammond Share?
- B. What is the required rate on equity for Hammond's shareholders?

Clarkson wants to acquire Hammond. They think that following a takeover they can increase Hammond's annual cash flow to a level that is 10% higher than today's. Also thanks to a takeover they will be able to slash costs of their own operations by \$80,000 a year. The takeover will cost \$250,000 in legal fees to complete.

- C. Calculate the total value of synergy's this takeover creates.
- D. What is the maximum price Clarkson should offer for a share in Hammond.?

Suppose the final price on which the takeover is settled is \$6 per share.

- E. Show how the total synergy is divided between the stockholders of Clarkson and Hammond following this price.
- F. How would a different offer price influence the value of the synergy?

Exercise 8.2

FaceCrook, an online dating site, intends to acquire Chatter, a social message service. Both companies are listed on the Nasdaq stock exchange. FaceCrook currently has 400,000 shares on the market that have a value of \$20 each. Chatter's 300,000 shares are worth \$15 a piece. FaceCrook intends to finance the acquisition by issuing new shares that will be offered to the Chatter shareholders in exchange for their shares. We assume neither company has issued any debt and that investors require a 12% return on their investment.

- A. What annual cash flow does each company currently earn for its investors?

Analists expect that by pooling the activities of the companies, the total cash flow of the new entity will become 20% higher than the original cash flows of the two separate companies. FaceCrook announces it will offer four new shares for every five shares in Chatter.

- B. Calculate how much each group of shareholders gains or loses as a result of this takeover under these conditions.
- C. What is the maximum number of shares FaceCrook could offer to Chatter so that their own shareholders neither gain nor loose in this deal?

Solutions Chapter 8

Solutions 8.1

- A. Total firm value Hammond = $\$600,000/0.1 = \$6,000,000$.
Value equity = $\$6,000,000 - \$4,000,000 = \$2,000,000$.
Value per share = $\$2,000,000/500,000 = \4
- B. Cash flow to shareholders = $\$600,000 - 6\% * \$400,000 = \$360,000$.
Required rate on equity = $\$360,000/\$2,000,000 = 18\%$
- C. C. Present value of cash flow increase = $(\$60,000 + \$80,000)/0.1 = \$1,400,000$.
Additional cost of acquisition is $\$250,000$ so net synergy = $\$1,400,000 - \$250,000 = \$1,150,000$.
- D. The maximum price equals the original price per share plus the synergy per share. $\$4 + \$1,150,000/500,000 = \$6.30$.
- E. Hammond shareholders gain $(\$6 - \$4) * 500,000 = \$1,000,000$.
Clarkson shareholders gain $(\$6.30 - \$6) * 500,000 = \$150,000$
- F. A different bid has no impact on total synergy, only on how it is divided.

Solutions 8.2

- A. FaceCrook = $(400,000 * \$20) * 0.12 = \$960,000$.
Chatter = $(300,000 * \$15) * 0.12 = \$540,000$ (total cash flow = $\$1,500,000$)
- B. New total cash flow = $1.2 * \$1,500,000 = \$1,800,000$.

Total new total market value = $\$1,800,000/0.12 = \$15,000,000$.

To acquire 300,000 Chatter shares, FaceCrook issues $300,000 * 4/5 = 240,000$ new shares. The total becomes 640,000 FaceCrook shares.

Post-acquisition value per share = $\$15,000,000/640,000 = \23.4375

FaceCrook shareholders gain $(\$23.4375 - \$20) * 400,000 = \$1,375,000$.

Chatter shareholders gain $240,000 * \$23.4375 - 300,000 * \$15 = \$1,125,000$.

Total synergy = $\$1,375,000 + \$1,125,000 = \$2,500,000$.
- C. FaceCrook shareholders break even when the final share price remains \$20. This happens when the number of shares becomes $\$15,000,000/\$20 = 750,000$ shares, so 350,000 new shares can be issued.

Chapter 9

Exercise 9.1

Echo is a trading business that conducts all of its sales and purchases of goods on credit. Its annual statements are shown below (€):

Balance sheet (average positions)			
Fixed Assets	500	Equity	400
Inventory	200	Bonds (8%)	200
Receivables	250	Trade Payables	150
		Bank overdraft (10%)	200
Total	950		950

Annual income statement	
Sales	1,800
Cost of sales	(1,400)
Other costs	(150)
Earnings before interest & tax (Ebit)	250
Interest	(36)
Profit	214

- A. How long is the cash conversion cycle (use a year of 360 days)?

To enhance working capital management one option is to give a 2% discount to clients who pay promptly. It is estimated that 50% of the customers by sales volume will take the discount and pay more quickly. As a result of this offer the average collection period would drop to 20 days. This will result in a lower need for bank overdraft financing.

- B. Show the changes on the balance sheet and income statement that would result from the new credit policy.
- C. Would you agree with this new policy when the primary yardstick for Echo is the return on investment (=ROI = Ebit / total assets)?

Exercise 9.2

Jack's road pavers is a business that builds new roads and also maintains existing infrastructure. Its customers are mostly found in the the public sector such as local government bodies that are responsible for the infrastructure in their regions. Sadly government bodies are not known for their prompt paying behavior. Annual sales are \$60,000,000 and with customers taking 3 months to pay on average, Jack is hurting cash flow wise and is always deeply in overdraft. Jack wants his customers to pay more quickly but is also afraid that tough collection policies will cost business he can not afford to lose. He therefore considers to offer a 2% discount to customers paying within half a month. It is expected that 80% of the customers will take up this offer and that the rest of the customers will keep paying after 3 months. Jack pays 12% interest on his overdraft.

- A. Is offering the discount a good idea when total profit is the main criterion?
- B. What is the maximum discount Jack could give to make this plan worthwhile? Assume the 80% of customers taking the discount remains unchanged.

Assume a particular customer pays 8% interest on his bank overdraft.

- C. Would this client take the 2% discount or rather keep paying after 3 months?
- D. At what cost of overdraft funding will the customer be indifferent to taking the discount or not?

Solutions Chapter 9

Solutions 9.1

A.

Inventory period	$\text{€}200/\text{€}1400 * 360$	51.4 days
Collection period	$\text{€}250/\text{€}1800 * 360$	50 days
Payment period	$\text{€}150/\text{€}1400 * 360$	38.6 days -
CCC		62.8 days

- B. A collection period of 20 days means the accounts receivables on the balance sheet becomes $20/360 * \text{€}1,800 = \text{€}900$. This is a drop of $\text{€}900$. As a result overdraft financing can be reduced to $\text{€}50$. On the income statement a total of $\text{€}18$ in discount costs appear. At the same time interest costs decline because of the lower need for overdraft funding.

Annual income statement (€)	
Sales	1,800
Cost of discount	$2\% * 900 = (18)$
Cost of sales	(1,400)
Other costs	(150)
Ebit	232
Interest	$8\% * 200 + 10\% * 50 = (21)$
Profit	211

- C. Total profit declines so using this as criterion the discount is too generous. Looking at ROI we get a different conclusion. Originally is it $\text{€}250/\text{€}950 = 26.3\%$. After implementation of the plan it becomes $\text{€}232/\text{€}800 = 29\%$.

Solutions 9.2

- A. Current receivables = $3/12 * \$60,000,000 = \$15,000,000$.
Accounts receivables will become $0.5/12 * \$48,000,000 + 3/12 * \$12,000,000 = \$5,000,000$.
- Savings on overdraft financing = $\$10,000,000 * 12\% = \$1,200,000$.
Cost of discounts = $\$48,000,000 * 2\% = \$960,000$. Total benefit = $\$1,200,000 - \$960,000 = \$240,000$ so good plan.
- B. Maximum amount of discounts is $\$1,200,000$. This is a percentage on sales of $\$1,200,000/\$48,000,000 = 2.5\%$
- C. Assume a $\$1,000$ invoice. The client can pay $\$980$ after half a month or the full $\$1,000$ after 3 months (2.5 months later). Assuming he needs to borrow the $\$980$ to be able to pay on time the interest cost will be $2.5/12 * 8\% * \$980 = \16.33 . The interest bill is lower than the discount he can get he'd rather pay quickly.
- D. The customer will be indifferent when the interest cost of borrowing $\$980$ for 2,5 months is equal to the discount of $\$20$. E solve the following for the Interest percentage (IP): $2.5/12 * IP * \$980 = \20 . $IP = 9.8$, so 9.8%.

Chapter 10

Exercise 10.1

A Nebraska farmer has sold a futures contract to protect himself against price fluctuations of corn between today and the harvest time in September. He locked in a price of \$4.50 per bushel and the contract size is for 60,000 bushels. Between today and actual delivery of the corn, the following spot prices have been witnessed: \$4.10, \$4.05, \$4.40 and \$4.70 (final price).

- A. Show the changes in the farmer's account (including final payment received for delivering the corn) at the exchange using the 'marked to market' approach.
- B. Demonstrate that the actual price received indeed is \$4.50 per bushel.

Exercise 10.2

It is September and a small Arline is seeking to reduce the risk of fluctuating kerosene prices and therefore wants to lock in a price today for the fuel they need next year, which is an amount of 100,000,000 kilo's. They can engage in a futures contract which sets the price at €0.40 per kilo. The airline will buy and receive the kerosene in January next year.

After buying the futures contract, the price of kerosene for delivery in January develops as follows:

October	€0.42
November	€0.38
December	€0.36
January	€0.39 (actual spot rate)

- A. Show the changes in the airline's account (including final payment for receiving kerosene) at the exchange using the 'marked to market' approach.
- B. Demonstrate that the actual price paid indeed is €0.40 per liter.

The futures contract protects the airline from increasing prices, but does not allow them to benefit from lower prices either. Therefore the financial manager is looking at options as a hedge possibility.

- C. Explain which kind of option contract (call or put) the company should get into.
- D. Explain why such a contract does offer protection against increasing fuel prices while at the same time allowing the airline to benefit from lower prices, should they occur.

Assume a strike price of €0.40 per kilo, and a total option premium of €500,000.

- E. At what spot rate in January will the cost of buying fuel using the futures contract and the option contract be equal?

Exercise 10.3

In January, four different options on Philips shares with the following characteristics are trading on the Options Exchange:

	<i>Exercise Price (€)</i>	<i>Market Price of Option (€)</i>	<i>Expiration</i>
Call 1	16	2.65	April
Call 2	20	0.35	April
Put 1	16	0.30	April
Put 2	20	2.00	April

In addition we know that the time value in the market price of Call option 1 is €0.34.

- A. What is the market price of a Philips share?
- B. Knowing the share price, explain which options are ‘in the money’, and which are ‘out the money’.
- C. Explain why also options that are out of the money can have a positive market value.
- D. Explain what happens to the market prices of the options above when the Philips share price goes up.
- E. What can you say about the market price of a put with a strike price €20 that expires in July?
- F. Can the market value of an option become less than zero?
- G. Assume an investor bought both call option 1 and put option 2 in January at the market prices mentioned above. Calculate the % gain or loss for each of the options when in April (at expiration) the share price is €17 and also when it is €22.

Solutions Chapter 10

Solutions 10.1

A.

$(\$4.50 - \$4.10) * 60,000 =$	\$24,000
$(\$4.10 - \$4.05) * 60,000 =$	\$3,000
$(\$4.05 - \$4.40) * 60,000 =$	(\$21,000)
$(\$4.40 - \$4.70) * 60,000 =$	(\$18,000)
Delivery: $\$4.70 * 60,000 =$	\$282,000
Total	\$270,000

B. Price per bushel = $\$270,000 / 60,000 = \4.50

Solutions 10.2

A.

$100,000,000 * (0.42 - 0.40) =$	2,000,000
$100,000,000 * (0.38 - 0.42) =$	(4,000,000)
$100,000,000 * (0.36 - 0.38) =$	(2,000,000)
$100,000,000 * (0.39 - 0.36) =$	3,000,000
Payment at delivery = $100,000,000 * €0.39 =$	(€39,000,000)
Total Cash flows:	(€40,000,000)

B. Actual price paid = $€40,000,000 / 100,000,000 = €0.40$.

C. They need a call option, they need to buy fuel.

D. With a call option, the cost per kilo will never be more than the strike price. When the spot rate is lower than the strike price the company will not use option and buy kerosene directly on the spot market.

E. Cost of buying kerosene using futures always is €40,000,000. Using an option contract, when the spot price is lower than €0.40, the company won't exercise the option. It will break even when the option premium has been earned back. This happens at a spot rate of $(€40,000,000 - €500,000) / 100,000,000 = €0.395$. Any spot price lower than this and the option contract is more favorable. Of course there is no way to predict this and only at the end with the benefit of hindsight is it possible to determine what would have been the best hedging technique.

Solutions 10.3

A. Market Value option = Intrinsic Value of Option (IV) + Time Value of Option (TV)

$$€2.65 = IV + €0.34, IV = €2.31$$

$$IV = \text{Share price} - \text{Exercise price. } €2.31 = P - €16. P = €2.31 + €16 = €18.31.$$

B. Call 1: $\text{€}18.31 - \text{€}16 > 0$ so 'in the money'.

Call 2: $\text{€}18.31 - \text{€}20 < 0$ so 'out the money'.

Put 1: $\text{€}16 - \text{€}18.31 < 0$ so 'out the money'.

Put 2 = $\text{€}20 - \text{€}18.31 > 0$ so 'in the money'.

C. With enough time to expiration, the option still can become in the money.

D. All calls will increase in value while all puts will go down.

E. It should be higher than $\text{€}2.00$ since it has more time to expiration than the otherwise similar option expiring in April.

F. No, it cannot become negative. It is a right, not an obligation.

G. Share price 17

Call 1 will be exercised. Pay Off = $\text{€}17 - \text{€}16 = \text{€}1.00$

Profit = $\text{€}1 - \text{€}2.65 = (\text{€}1.65)$.

Return on Investment = $(\text{€}1.65)/\text{€}2.65 = (62\%)$

Put 2 will be exercised. Pay Off = $\text{€}20 - \text{€}17 = \text{€}3.00$

Profit = $\text{€}3.00 - \text{€}2.00 = \text{€}1.00$

Return on Investment = $\text{€}1.00/\text{€}2.00 = 50\%$

Share price 22

Call 1 will be exercised. Pay Off = $\text{€}22 - \text{€}16 = \text{€}6.00$

$\text{€}6.00 - \text{€}2.65 = \text{€}3.35$

Return on Investment = $\text{€}3.35/\text{€}2.65 = 126\%$

Put 2 will not be exercised. The loss is the entire premium of $\text{€}2.00$ so 100%.