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Stockholm Business School

Exercises for individual practice in the course Finance I

Updated 2015-05-28

Preface

This exercise compendium was created for the course Finance I. Questions are marked with either “Elementary”, “intermediate” or “advanced”. The advanced questions are usually a little bit uncommon and are usually not necessary to get the concepts of the course. They are however often more complete exercises so if you wish to truly test if you can apply your knowledge these can be good to do. Unless you have a lot of time at your hand it could be good to look at them at a later stage in the course though, when you have a more complete understanding of the concepts.

Note that we use commas as thousand separators and dots as decimal separators throughout the compendium.

If you find errors of any sort in the compendium, please contact us through the fastreg forum in the forum part “Exercise Compendium Feedback”.

We are grateful to Anders Bäckström for assistance in translating this compendium, for correcting many of the mistakes found in it and also for contributing with some new questions. Also Ian Khrashchevskyi have been helpful in editing and creating new questions.

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Exercises

1. Future value

1.1 A single deposit (Elementary)

Mrs. Anderson deposited SEK 50,000 on a bank account 4 years ago. The money has grown at an effective annual rate of return of 3%. How much money does Mrs. Anderson have on her bank account today?

1.2 Multiple deposits (Intermediate)

You are planning on starting to save money. You would like to deposit SEK 15,000 every quarter on a bank account with an effective 3-months interest rate of 0.8%. You plan on deposit the money in the beginning of every quarter, starting today. How much money will you have in one year from now (including the deposit you make then, i.e. in the beginning of the fifth quarter)?

2. Present value

2.1 Time value of money (Elementary)

Imagine that you deposited money on a bank account 8 years ago. You know that the money has been growing at an average annual rate of return of 3.25%. Today you have SEK 40,000 on the account.

How much did you deposit 8 years ago?

2.2 Investment evaluation (Elementary)

An investment with an initial outlay of SEK 20,000 today is assumed to generate a cash flow of SEK 30,000 five years from now. The discount rate for the period is on average 0.8% per month. Should you go ahead with this investment? Motivate your answer.

2.3 Lottery prize (Elementary)

You just won on a lottery ticket and have the opportunity to choose between the following two alternative prizes.

Alternative 1: Receive SEK 4,000,000 today

Alternative 2: Receive SEK 15,000,000 in 10 years from now

Assume that the annual discount rate is 15%. Which of the two alternatives is better, and why?

2.4 Evaluating two investment alternatives (Intermediate)

A company is about to choose between investment A and B. The investments are mutually exclusive, i.e. only one investment can be implemented. The expected cash flows of the two investments are shown below.

	Investment A	Investment B
Initial outlay	SEK 15,000	SEK 22,000
Net cash flow year 1	SEK 5,000	SEK 10,000
Net cash flow year 2	SEK 6,000	SEK 5,000
Net cash flow year 3	SEK 10,000	SEK 12,000

The discount rate is 10%.

Which of the two investments is preferred, and why?

2.5 Magazine subscription (Intermediate)

A teacher in finance received the following two offers on a magazine subscription at the end of last year:

A one-year subscription SEK 375

A two-year subscription SEK 720

The teacher wish to subscript to the magazine for the following two years and is considering which alternative to go with, pay for the two years today or renew the one-year subscription in a year's time. The fee is paid in the beginning of each period.

Assume that the subscription prizes will increase by 5% in the following year, which of the two alternatives is preferred given that the discount rate is 8%?

2.6 Nuclear power plant and exit costs (Advanced)

Imagine that we are interested in investing in a nuclear power plant. One problem with nuclear power is that it gives rise to nuclear waste that needs to be managed for a long period of time, which in turn gives rise to high exit costs. We estimate the following cash flows for the investment.

	Nuclear power plant
Initial outlay	SEK -500 million
Cash flow year 1	SEK 850 million
Cash flow year 2	SEK 125 million
Exit costs year 3	SEK -500 million

We wish to evaluate if the attractiveness of the investment depends on the discount rate. Therefore, examine the project using the following discount rates: $r = 4.9\%$, $r = 19.0\%$ and $r = 33.1\%$.

- a) Before you start the calculations, which of the three discount rates do you think will make the investment the most and the least profitable? Motivate your answer.
- b) Calculate the NPV for the investment using all three discount rates separately. Which discount rate(s) make you draw the conclusion that the investment ought to be made?
- c) Did the result surprise you? Why did this occur?

3. Present value of an annuity

3.1 Present value of an annuity (Elementary)

The following information is given for the two investment projects A and B:

	Investment A	Investment B
Initial outlay	SEK 75,000	SEK 32,000
Annual net cash flows	SEK 15,000	SEK 9,000
Salvage value	SEK 0	SEK 0
Project life expectancy	10 Years	10 Years

- Calculate the net present value if we assume that there is no time value of money, i.e. the discount rate is 0%.
- Calculate the alternatives net present value when using a discount rate of 20 %.

3.2 Present value of a growing annuity (Elementary)

An investment of SEK 2 million will give rise to net cash flows at the end of every year for the following 20 years. The net cash flow in year 1 is SEK 400,000. In the following year the net cash flow will grow by 2 % per year. The cost of capital is 15%.

Calculate the net present value of this investment.

3.3 Present value of an annuity (Intermediate)

Maria is going to start up a company. This will require an initial investment to purchase a machine for SEK 3 million. When she is estimating the future cash flows, the following is considered:

- Cash inflows (Payment of receivables and cash payments)
- Cash outflows (Payments of salaries, rent and input goods)
- Additional investments required during the life of the investment
- Tax payments

Considering this, Maria estimates that the investment will give rise to an annual net cash flow of SEK 600,000 for a period of 10 years. After this period she will shut down the business.

The initial investment will be financed via SEK 2 million in equity and SEK 1 million in debt. The after tax weighted average cost of capital (discount rate) is 13%. What is the value of this investment for Maria?

3.4 Present value of an investment with two periods with different annuities (Intermediate)

Hilda's bakery produces muffins and pies but cannot fully make use every baker's time, since they lack machines for that. She is therefore considering investing in a new baking machine that is assumed to generate the following net cash flows for the next 12 years. Should Hilda make this investment? Assume a 12% discount rate.

Baking machine

Initial outlay	SEK 550,000
Annual net cash flow year 1-6	SEK 100,000
Annual net cash flow year 7-12	SEK 60,000

3.5 Evaluating the value of a board game (Advanced)

It is always hard, if not impossible, to estimate how much fun one will have from a board game. Nonetheless we shall now make an attempt at creating a model in order to practice our skill. We make three assumptions that the model will rest upon. We then make up numbers to test the model. The following three assumptions are made:

- 1) The utility¹ from playing the game in the beginning will increase at a high constant rate, as you and your friend learn how the game works and therefore get more joy from it.
- 2) The utility gained will settle at a constant rate after a while when you have mastered the game.
- 3) Eventually you and/or your friends will get tired of the game, and thus utility will decrease at a constant rate until you don't find it worth playing any more.

With the help of these three assumptions, we can create a model that consists of three different phases. The first phase has a constant positive growth in utility, the second phase has a constant utility (without growth) and the third phase will experience a constant negative growth in utility.

The length of the three phases as well as estimating the utility is of course not possible for us to do here. We may however use fictional numbers just to practice the computation.

Assume that the utility from playing a specific game (measured in SEK) can be estimated to SEK 30 the first month, and that the utility will increase at a constant rate of 20% per month the first 4 months. The first month is included in this phase.

The second phase with a constant utility we assume lasts for 6 months.

The final phase will last for 2 months, and we assume that the utility decreases by 50% per month. After 1 year (4+6+2 months) we will never play the game again.

How much are we willing to pay for this game, if we assume that we discount future utility by 2% per month?

¹ *Utility* is a word commonly used in economics. If something gives "utility" it means that it satisfies some kind of need for the user, it is useful and perhaps gives satisfaction. For example, if you become happy by playing a board game then playing board game gives you utility. As another example we usually assume in finance that people that make investments gain utility by the return on their investment, in other words we assume that people become happy by making a profit on an investment. We also often make the assumption that they become even happier (their utility from the investment increases) if they make a larger profit.

4. Equivalent Annual Annuity (EAA)²

4.1 Equivalent Annual Annuity of an investment (Elementary)

An investment will generate the following cash flows:

Initial outlay	SEK 15,000
Annual net cash flows	SEK 3,000
Salvage value	SEK 1,000
Projects life expectancy	8 Years

Assume that the discount rate is 9 %. What is the equivalent annual benefit of this investment?

4.2 Amortizing loan (Intermediate)

Mrs. Andersson received an amortizing loan offer from her bank with the following terms:

Loan type: Amortizing loan with equal payments
Life of loan: 4 years
Total loan amount: 100,000 SEK
Administrative fee: 525 SEK

Monthly interest rate: 0.6 %

An amortizing loan with equal payments means that you should pay an equal amount every month for all four years, and when four years has passed you should have repaid the entire loan amount and made all interest payments. (Since you pay the same sum each month, the interest payments will be a larger fraction of the payment early on.)

- a) What is the payment per month?
- b) Taking into account the administrative fee, what would be the effective interest rate? Round your answer to one decimal point. (Hint: This is equivalent to computing an IRR. We suggest that you do some of those exercises first.)

² Another name for the same method is Equivalent Annual Benefit (EAB) or Equivalent Annual Cost (EAC).

5. Internal Rate of Return

5.1 Two investments without any salvage value

You have two investment projects A and B for which you know the following:

	Investment A	Investment B
Initial investment	SEK 75 000	SEK 32 000
Annual net cash flows	SEK 15 000	SEK 9 000
Salvage value	0	0
Life span (years)	10	10

- What is the IRR of investment A? What is the IRR of investment B?
- At which cost of capital is the firm indifferent between the two investments?
- For which interval of the firm's cost of capital does the firm prefer investment A? For which intervals do they prefer investment B?

5.2 IRR of an investment with different cash flows each year (Intermediate)

Assume an investment with the following cash flows:

Initial investment	SEK 57 000
Net cash flow year 1	SEK 12 000
Net cash flow year 2	SEK 27 000
Net cash flow year 3	SEK 39 000

After the three years the investment is finished. What is the IRR? Round to whole percentages.

5.3 Which interest rate is used? (Advanced)

You have found a boat that you are interested in buying. If you buy it with cash you need to pay 50,000 SEK today. The firm which is selling the boat offers you a different payment scheme where you pay 4,000 SEK every month for a year and also pay 7,500 SEK immediately. The first monthly payment will be made one month from today, and you make a total of 12 payments.

What is the discount rate that makes the two alternatives equal in present value? Answer with the precision of one decimal point.

6. Payback

6.1 Time to pay back an investment (Elementary)

a)

The following information is given about the investment projects A and B:

	Investment A	Investment B
Initial investment	SEK 75,000	SEK 32,000
Annual net cash flow	SEK 15,000	SEK 9,000
Salvage value	SEK 10,000	SEK 0
Project life expectancy	10 years	8 years

What is the payback-period for project A and B respectively?

b)

Describe some of the pitfalls of the payback rule.

7. Real and Nominal Interest Rates

7.1 After-tax real interest rate (Elementary)

The real interest rate is 0.5 % when you do not account for tax. What is the real interest rate accounting for tax if the inflation is 1.5 % and the tax rate is 28 %?

7.2 Pre-tax real interest rate (Elementary)

The real interest rate is -0.5 % when you have accounted for tax. What is the real interest rate without accounting for the tax if the inflation is 2.4 % and the tax rate is 30 %?

7.3 Saving for a trip (Intermediate)

Lisa has a son that has just started school and is expected to finish high school in 12 years. However, she is a little bit worried that he will become tired of school as he ages. In order to motivate him to finish school she is planning to save money on a bank account today that is supposed to sponsor a trip around the world when he finish school.

Today she has found a travel agency that offers such a trip for a cost of 80,000 SEK. Assuming that you will need the same purchasing power in 12 years, how much money does she need to put in a bank account today if she is promised an annual interest rate of 5.2 % and the inflation is expected to be 1.9 % annually? Assume that the tax rate is 30 %.

8. Annual Percentage Rate (APR) and Effective Annual Rate (EAR)

8.1 Converting APR to EAR (Elementary)

Calculate the corresponding effective annual rate (EAR) for an APR of 12 % if interest payments are made

- a) Twice per year
- b) Every fourth month
- c) Once every ninth month

8.2 Converting a weekly rate to an EAR (Elementary)

A week ago you invested money in a stock that has increased by 1 % since then. Assume that we do not pay tax and that we can obtain this return every week. What will be the effective annual return?

8.3 Finding the EAR from a long-period return (Intermediate)

In 1626, a Dutch purchased Manhattan by a local tribe for a total cost of 60 Dutch guilders (the currency prior to the Euro).

Assume that you had left Manhattan untouched and sold it in 2013 at a price corresponding to 60,000,000 Dutch guilders.

What would be the effective annual return on such an investment?

8.4 SMS-loan (Advanced)

Many companies offers loan through sending an SMS. This is an example of how an offer:

Returning customers – 30-day loan

Amount	Adm. Cost	Cost of bill.	Interest payment	Total	EAR	APR
1,000 SEK	350 SEK	45 SEK	81 SEK	1,476 SEK		98.55%

The "30-day loan" implies that you should pay all costs after 30 days (at least in this example).

"Total" is the sum of repaying the loan and all costs that you need to pay for. "APR" is computed from the interest payment part. It has been computed using that a year has 365 days. If you wish to simplify your calculations slightly you could assume 360 days per year, there are answers for both options (then the APR is 97.2 %, so use this one).

- a) Compute the EAR using the APR stated
- b) Compute the EAR if you treat all costs as interest payments (as would be the case if you take a new loan to pay all old costs, then the costs would compound as well).

This is a real example from a Swedish company. The EAR reported is the one you calculate in b).

9. Bonds

9.1 Bond valuation (Elementary)

You wish to purchase a bond with the following specification:

Face Value	1,000 SEK
Coupon rate	8 %
Time to maturity	5 years

The yield to maturity applied for this bond is currently 7 % and coupons are paid once per year.

- Describe what a bond is
- What is a coupon payment and how do you compute it?
- What is the face value?
- What is the price of the bond today?
- What will happen to the price if the yield to maturity increase/decrease by 1 % (to 8 % or to 6 %)?

9.2 Bond valuation 2 (Elementary)

You are purchasing a bond the day before the coupon payment is received. After that there is another seven payments before the bond matures and they are paid once per year.

This you know:

Face Value	100 SEK
Coupon Rate	5 %
Yield to maturity	4 %

What is the value of the bond today?

9.3 Bond valuation 3 (Intermediate)

You wish to purchase a bond with a yield to maturity of 7 % that has a face value of 10,000 SEK, a coupon rate of 5 % and time to maturity of 1.5 years. The coupon payments are made annually, which means that it is 0.5 years until the next payment while the last one arrives at the same time as the face value.

What is the price you will have to pay for this bond?

9.4 Finding the coupon rate (Intermediate)

A bond has a market value of 102.07 SEK. There is currently 1.5 until maturity and the coupon payments are made annually (so there is 0.5 years until the next payment). The face value is on 100 SEK.

If the yield to maturity on the bond is 8 %, what is then the coupon rate?

9.5 Bond (Advanced)

Two years ago you borrowed money at an annual interest of 6 %. You used the money to purchase a zero-coupon bond. A zero-coupon bond is a bond that does not pay any coupons, as the name suggests.

When you purchased the bond, the following values were given:

Face value	10,000 SEK
Time to maturity	12 years
Yield to maturity	8 %

Today, two years later, you sell the bond and repay the loan together with accumulated interest for the two years. The bond is now valued according to

Face value	10,000 SEK
Time to maturity	10 years
Yield to maturity	4 %

What is your profit loss on this investment??

9.6 Bond with 9.5 years to maturity (Advanced)

You wish to purchase a Swedish government bond that has a face value of 1 000 SEK, a coupon rate of 4 % and a yield to maturity in the market of 1.7 %. The bond pays coupons annually and has 9.5 years until it matures.

What price will you have to pay for this bond?

10. One-Year Dividend Discount Model

10.1 One-year investor (Elementary)

Assume that a certain stock costs 67 today, will pay a dividend of 2.4 in one year, and is expected to be worth 72 immediately after the dividend is paid out.

- a) What is the equity cost of capital?
- b) Now assume that the company announces that it will decrease the dividend to 1 (rather than paying 2.4). Further assume that the stock value in one year is the same as previously (after the dividend), and that investors still demand the same equity cost of capital as in A. How much will the stock price decrease when the announcement is made?

10.2 One-year investor again (Elementary)

The stock SBAB is currently selling 44. It is expected to pay a dividend of 6 in one year. Assume that the equity cost of capital is 12%.

- a) What is the expected price after the dividend is paid?
- b) What is the price immediately before the dividend is paid?

10.3 One-year, two periods (Intermediate)

Assume that the stock Swedbank is expected to pay out 14 in dividend in one year. Furthermore assume that the stock price is expected to be 205 immediately after the dividend is paid out. Given an equity cost of capital of 15%.

- A. What are you willing to pay for this stock today if you plan to sell it immediately after the dividend is paid out?
- B. Now assume that the dividend (of 14) instead will be paid out in 0.5 years, and that you plan to sell the stock (for 205) in one year. Assume that the cost of capital is the same as in a, and calculate the price you are willing to pay.

11. Dividend Discount Model

11.1 Stock valuation (Elementary)

A company is expected to increase its dividend by 5 % per year for all future. They have recently distributed a dividend payment of 20 SEK per share.

If the cost of equity is 15 %, what is the price of the share today?

11.2 Company valuation (Elementary)

A company is distributing a dividend of 7 SEK/share tomorrow. The dividends are expected to grow by 3 % per year for all future. They currently have 100 000 outstanding shares and a total of 3 MSEK in debt. If the cost of equity is 13 %, what is then the total value of the company?

11.3 Stock valuation with two different periods of growth (Intermediate)

A company has recently distributed a dividend of 2 SEK/share. The expected growth rate of the dividends is 15 % per year for the next five years, and will then decrease to 5 % per year forever. Given that the cost of equity is 10 %, what is the price of the share?

11.4 Company valuation with two different periods of growth (Intermediate)

A company has recently distributed a dividend of 3 SEK/share. The expected growth rate of the dividends is 12 % per year for the next five years, and will then decrease to 5 % per year forever. Given that the cost of equity is 10 %, what is the value of the company if the number of shares is 100,000 and the debt amounts to 7 MSEK?

11.5 Two growth periods and 6 months until the next dividend (Advanced)

In 6 months, a company is paying a dividend of 2 SEK/share. Following this dividend payment, the dividend is expected to grow by 15 % annually for the next 7 years. After this 7-year growth period, the growth will decrease to 3 % and stay at that level forever.

Assume that the cost of equity is 9 %, what is the price of a share today?

12. Discounted Cash Flow Valuation

12.1 Company valuation using last year's reported numbers (Elementary)

Recently, a company reported the following numbers (all given in MSEK):

EBIT(1-t)	200
Depreciation	30
Increase in WC	20
Investments	10

The free cash flow has increased by 4 % every year for the last 10 years and is estimated to continue to increase by this amount for ever. The cost of capital of the company (WACC) is 10 %. What is the company value today?

12.2 Company valuation with a 3-year forecast (Intermediate)

You have been asked to value a company where the following forecasted numbers have been provided by the management.

Year	0	1	2	3
EBIT		200	230	250
Depreciation		20	24	27
Working Capital	100	120	125	130
Investment		50	55	60

The FCF in year 4 is estimated to be 155 and then grow by 4 % per year forever. The WACC of the company is 13 %. The tax rate is 25 %, what is the value of the company?

12.3 Company valuation with a 5-year forecast (Intermediate)

A company has made forecasts, summarized in the table, regarding future operating profits (EBIT), working capital need, investment needs and depreciation.

Year	1	2	3	4	5
EBIT(1-t)	100	130	140	170	180
Depreciation	20	25	25	30	30
Increase in WC	10	13	15	20	0
Investments	20	25	3	30	5

The company assumes that the FCF in year 6 will be 200, and that the FCF will grow by 5 % per year forever. The cost of capital of the company (the WACC) is 10%.

- What is the value of equity if the company has no debt?
- What is the value of equity if the company has debt of 400?

12.4 Company valuation with a 3-year forecast (Intermediate)

A company has made the following forecasts (numbers in MSEK):

Year	0	1	2	3
EBIT		200	180	210
Depreciation		30	40	40
Working Capital	20	30	25	35
Investment		50	30	30

They estimate that the FCF from year 3 and onwards will grow by 3 % annually for all future. The cost of capital (WACC) of the company is 9 %, and the tax rate is 26 %. What is the Enterprise Value of the company?

13. Expected return

13.1 Expected value (Elementary)

- a) An investment of 100,000 SEK can next year yield two different outcomes, either 105,000 SEK or 140,000 SEK. The probabilities associated with these outcomes are 60 % probability for the low outcome and 40 % probability for the high outcome.

What is the expected return of making this investment?

- b) An investment of 100,000 SEK can in two years yield two different outcomes, either 105,000 SEK or 140,000 SEK. The probabilities associated with these outcomes are 60 % probability for the low outcome and 40 % probability for the high outcome.

What is the expected effective *annual* return of making this investment?

13.2 Expected revenue (Intermediate)

Mike was really bad in school, so he could not get into the university and definitely does not have good knowledge in finance or math. Luckily he got a fortune not so long ago. It appeared that his belly button dance is the best one in the world, so he earned quite a fortune of EUR 10 M. Being your good friend, he comes to you and asks you to allocate his funds in the stock market, as a compensation for this he will give you 30% of the returns. You found nice fund that yields 3% return in 40% of all possible cases and 2% in the other ones. The fund charges 10% of your initial investment when you invest in the fund.

What is your expected revenue before tax in one year from now?

13.3 Expected return (Advanced)

Imagine that you are considering buying the Volvo stock. After performing extensive modelling you found out that the stock price can only rise or fall with the probability of 50%. Then you made the in-depth fundamental and technical analysis and you found that if the stock price rises, it will show 0.5% return with a probability 60%, 1.5% return with probability of 30% and will hit 5% return with probability of 10%. However, you also found out that if the stock price falls down, the return will be at -0.5% level with the probability of 30%, -1.5% return with probability 60% and will tumble down to -6% with a probability of 10%.

Given the information provided, what is the expected return of the Volvo stock under your forecast?

14. Variance and standard deviation

These questions have no level indications. All exercises are fairly long and time-consuming, but they are all fairly mechanical. This is why they have not been given any specific level.

14.1 Estimate the standard deviation of Axfood

The Axfood stock gave the owners the following annual return between 2008 and 2012, dividends are included.

	Axfood
2008	-32.63%
2009	31.04%
2010	25.78%
2011	5.61%
2012	1.34%

Use these values to calculate

- a) The average return of the Axfood stock.
- b) The variance of the return of Axfood.
- c) The standard deviation of the return of Axfood.

14.2 Estimate the standard deviation of Volvo

The Volvo stock gave the owners the following annual return between 2008 and 2012, dividends are included.

	Volvo
2008	-55.19%
2009	47.90%
2010	92.84%
2011	-34.35%
2012	21.91%

Use these values to calculate the standard deviation of the return on the Volvo stock.

14.3 Calculate the standard deviation of H&M

An analyst has provided you with the following estimations of possible states, probabilities associated with those states and outcomes in those states:

Outcome	Probability of outcome	H&M stock performance
Boom	25 %	25 %
Normal	50 %	10 %
Bust	20 %	-10 %
Financial Crisis	5 %	-45 %

What is the expected return and standard deviation of the H&M given these numbers?

15. Covariance, Correlation and Beta

15.1 Estimate the covariance and correlation between Axfood and Volvo

Axfood and Volvo had the following annual returns between 2008 and 2012,

	Axfood	Volvo
2008	-32,63 %	-55,19 %
2009	31,04 %	47,90 %
2010	25,78 %	92,84 %
2011	5,61 %	-34,35 %
2012	1,34 %	21,91 %
Average	6,228 %	14,622 %

Use the figures above to estimate:

- The covariance between Axfood and Volvo
- The correlation coefficient between Axfood and Volvo

15.2 Estimate the Beta for Axfood and Volvo

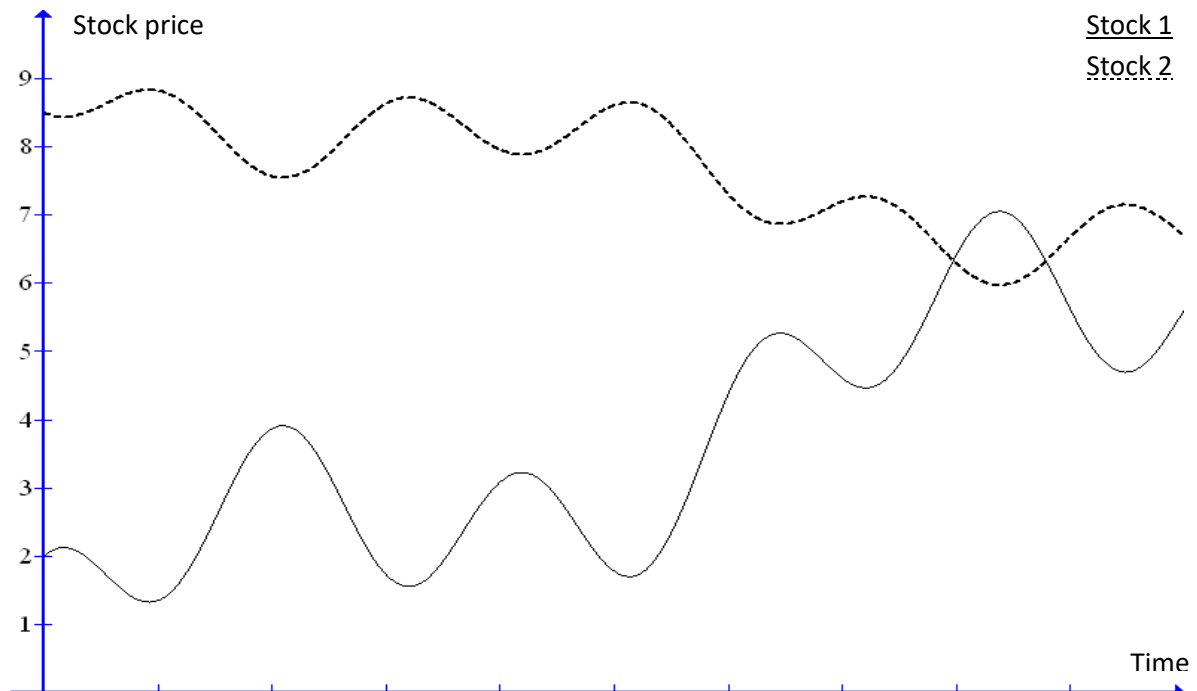
Annual returns for Axfood, Volvo and the market (market index) between 2008 and 2012 are found below,

	Axfood	Volvo	Market
2008	-32,63 %	-55,19 %	-42,06 %
2009	31,04 %	47,90 %	46,41 %
2010	25,78 %	92,84 %	23,15 %
2011	5,61 %	-34,35 %	-16,47 %
2012	1,34 %	21,91 %	11,89 %
Average	6,228 %	14,622 %	4,584 %

Use the figures above to estimate:

- Calculate the Beta for Axfood
- Calculate the Beta for Volvo

15.3 Interpret the covariance/correlation for two stocks (Advanced)



Use the picture above and chose what alternative that is correct.

- A. It looks like the covariance between the stocks is -1
- B. It looks like the covariance between the stocks is -0.5
- C. It looks like the correlation coefficient between the stocks is -1
- D. It looks like the correlation coefficient between the stocks is -0.5
- E. None of the statements are correct.

16. Portfolio Theory

16.1 Portfolio return and risk (Elementary)

You are supposed to evaluate the risk and return of an equity portfolio consisting of stock A and stock B. The expected return of stock A and B is 15% and 20% respectively. The standard deviation of stock A and B is 10% and 20% respectively.

The portfolio consists of 40% in stock A and the rest in stock B. The correlation coefficient between the two stocks is 0.5.

What is the expected portfolio return and the portfolio standard deviation?

16.2 Portfolio return and risk again (Elementary)

A portfolio consists of the assets A and B below:

	Holmen	SSAB
Expected return	10 %	20 %
Risk (standard deviation)	24 %	38 %

The correlation coefficient between Holmen's and SSAB's return is 0.29.

Assume that you invest 45% of the portfolio in SSAB. What will be the portfolio risk, measured as standard deviation?

16.3 Portfolio with the minimum risk (Elementary)

A fund manager that, for some strange reason, only holds two securities in the portfolio would like to minimize the portfolio risk (standard deviation).

	Bond 1	Bond 2
Expected return (Nominal)	5 %	4 %
Risk (standard deviation)	7 %	5 %

The correlation coefficient between the two bonds is estimated to 0.5. What composition should the portfolio have in order to minimize the risk?

16.4 Portfolio with the minimum risk (Intermediate)

A fund manager is a bit uncertain about how efficient diversification actually is, since bonds generally are less risky than stocks. She have for this reason asked you to analyze a specific example of a SAS bond and SAS stock to determine if it is possible to decrease the risk by adding stocks to the portfolio, instead of investing everything in the bond.

	SAS Bond	SAS Stock
Expected return (nominal)	5,2 %	16,4 %
Risk (standard deviation)	8,3 %	45 %

The correlation coefficient between the stock and the bond is estimated to 0.91

- What composition should the portfolio have in order to minimize the risk?
- Is this a reasonable test of the statement that diversification always decreases the risk?
Motivate your answer.

16.5 Portfolio theory with a desired real return (Intermediate)

A life insurance company which to place its holdings so that they yield a 5% annual real return. The inflation is expected to be 2% per year. The life insurance company evaluates the following investment alternatives:

	Stocks	Bonds
Expected return (nominal)	11 %	6 %
Risk (variance)	0,0625	0,0009

The covariance between the stocks and bonds is 0.00375.

What will the risk (standard deviation) of the portfolio be?

16.6 Rational choices of portfolios (Intermediate)

The following information about stock A and B is given:

	Stock A	Stock B
Expected return	8 %	12 %
Risk (standard deviation)	40 %	50 %

The correlation coefficient between stock A's and stock B's return is 0.4.

A friend of yours is thinking about investing all her money in some of the following ways:

- 100% in stock A
- 100% in stock B
- 70% in stock A and 30% in stock B (portfolio 1)
- 80% in stock A and 20% in stock B (portfolio 2)

We don't know anything about her risk preferences, only that she is risk averse (dislikes risk). Which of the alternatives should your friend choose? Motivate your answer.

16.7 Expected return of a portfolio (Advanced)

Carl own 100 stocks in Avanza and 50 stocks in Holmen. What is the expected return of his portfolio if the following is true?

- A Holmen-stock costs today 185 SEK
- An Avanza-stock costs today 175 SEK
- The expected return of the Holmen-stock is 6 %
- The expected return of the Avanza-stock is 7,5 %

17. CAPM

17.1 Expected return with CAPM (Elementary)

Compute the expected return on equity (or cost of equity) for a company with a beta $\beta = 1.1$. Assume that the risk-free rate is 1.9 % and that the market risk-premium (not the expected return of the market) is 4.9 %. Round your answer to whole percentages.

17.2 Expected return with CAPM (Elementary)

Compute the expected return on equity (or cost of equity) for a company with a beta $\beta = 1.2$. Assume that the risk-free rate is 0.5 % and that the expected return of the market (not the market risk-premium) is 5 %. Round your answer to whole percentages.

Note, after these two CAPM questions you should understand the difference between the market risk-premium and the expected return of the market.

17.3 Expected return with CAPM when beta is not given (Intermediary)

You own a stock that has a standard deviation of the return of 25 %. The standard deviation of the return of the market portfolio is 15 %. The risk-free rate is 4 % and the expected return on the market portfolio is 9 %. The correlation between the stock and the market is 0.8.

What is the expected return of the stock according to CAPM?

17.4 Use CAPM to find the expected return of the market (Advanced)

Assume that CAPM holds for all stocks and that we know the following:

- The expected return of Nordea is 13 %, and Nordea has a $\beta = 1.6$.
- The expected return of SAAB is 9 % and Saab has a $\beta = 0.8$.

Find the risk-free rate and the expected return of the market.

18. Options

18.1 A sold call option and a purchased put option (Elementary)

An option portfolio consists of a sold (short) call option and a purchased (held/long) put option. The options are on the same underlying stock and have the same exercise date. The call option's strike price is 150 SEK and the put option's strike price is 180 SEK. Assume that the stock's spot price is 180 SEK on the exercise date and try to answer the following questions:

- a) What is the value of the sold (short) call option on the exercise date?
- b) What is the value of the purchased (held/long) put option on the exercise date?
- c) What is the portfolio value on the exercise date?

18.2 A sold call option and a sold put option (Elementary)

You have sold (gone short) a call- and a put option on the same underlying stock and exercise date. The call option's strike price is 210 SEK and the put option's strike price is 190 SEK. Which of the following statements is correct? (neglect the premium when considering the alternatives)

- A. If the stock's spot price 1 month before the exercise date is 190 SEK, the portfolio value is 0 SEK.
- B. If the stock's spot price 1 month before the exercise date is 220 SEK, the portfolio value is 0 SEK.
- C. If the stock's spot price on the exercise date is 200 SEK, the portfolio value is 0 SEK.
- D. If the stock's spot price on the exercise date is 180 SEK, the portfolio value is 0 SEK.
- E. None of the statements are correct!

18.3 Speculating with options (Intermediate)

You are speculating in how a certain stock will move in the future by selling (going short) two options. One of the options is a call option with a strike price of 120 SEK. The other option is a put option with a strike price of 110 SEK. The stock price is today 115 SEK. Give an example of an outcome when your portfolio will yield a loss by evaluating the following statements:

- A. For example if the stock price is approximately constant until the expiration date.
- B. For example if the stock price decreases 4 SEK until the expiration date.
- C. For example if the stock price increases 6 SEK until the expiration date.
- D. For example if the stock price is 120 SEK on the expiration date.
- E. The question cannot be answered without more information.

18.4 A purchased call option and a purchased put option (Intermediate)

You have a portfolio consisting of a purchased call option with a strike price of 120 SEK and a purchased put option with a strike price of 110 SEK. Both options are on the same underlying stock and have the same exercise date. Neglect any premium when answering the questions.

- a) What is the portfolio value if the stock's spot price on the expiration date is 115 SEK?
- b) What is the portfolio value *one month before the expiration date* if the stock's spot price is 115 SEK? (Answer alternatives: 0, >0 or <0)
- c) What is the portfolio value on the expiration date if the stock's spot price is 125 SEK?
- d) What is the portfolio value on the expiration date if the stock's spot price is 100 SEK?

18.5 Reason about option portfolios (Intermediate)

Given that the stock price is 115 SEK, which of the statements below is correct? All options have a strike price of 110 SEK and all statements should be analyzed on the expiration date. Neglect any premium.

- A. A portfolio consisting of two sold call options has a positive value.
- B. A portfolio consisting of two purchased call options has a value of 5 SEK.
- C. A portfolio consisting of one sold and one purchased call option has a value of 5 SEK
- D. A portfolio consisting of one purchased put option and one sold call option has a negative value.
- E. None of the statements are correct.

18.6 Two purchased put options and two sold put options (Intermediate)

You have gone long in two put options with a strike price of 120 SEK and 150 SEK respectively. You have at the same time gone short on two put options with a strike price of 110 SEK and 130 SEK respectively. Which of statements is correct? (Assume that the portfolio was created so close to the expiration date so that we can neglect the time value of money)

- A. The minimum net payout on the expiration date is -10 SEK
- B. The maximum net payout on the expiration date is 40 SEK
- C. To create the portfolio, you have had to pay more than 30 SEK (net) in premium.
- D. None of the statements are correct.

Correct answers

1. Future value

1.1 56,275 SEK

1.2 76,209.64 SEK

2. Present Value

2.1 30,969.88 SEK

2.2 No, the net present value of the investment is negative.

2.3 Alternative 1

2.4 Investment A should be chosen since it's NPV is the highest.

2.5 A 2-year subscription is preferred.

2.6 a) -

b) NPV = -9.265 MSEK if $r = 4.9\%$

NPV = 5.848 MSEK if $r = 19.0\%$

NPV = -2.872 MSEK if $r = 33.1\%$

c) -

3. Present value of an annuity

3.1 a) Inv. A: 75,000, Inv. B: 58,000

b) Inv. A: - 12,113, Inv. B: 5,732

3.2 797,564 SEK

3.3 255,746 SEK

3.4 NPV = -13.8813 SEK, do not make the investment

3.5 The value of the game is 452 SEK

4. Equivalent Annual Annuity

4.1 380.56 SEK/year

4.2 a) 2403.9 SEK per month

b) The effective rate is 0.62 %.

5. Internal Rate of Return

5.1 a) IRR of investment A = 15.1 %; IRR investment B = 25.1 %

b) 6.6 %

c) Investment A is preferred if the discount rate is below 6.6%, investment B is preferred in the interval $6.6 \% < \text{discount rate} < 25.1 \%$.

5.2 15 %

5.3 1.9 %

6. Payback

6.1 5 years for investment A and 3.6 years for investment B.

7. Real and Nominal Interest Rates

7.1 -0.054 %

7.2 0.29 %

7.3 65,290.70 SEK

8. APR and EAR

8.1 a) 12.36 %

b) 12.49 %

c) 12.18 %

8.2 67.77 %

8.3 3.6344 %

8.4 a) 157.96 % or 154.63 % if you use 360 days per year.

b) 11,308.2 % or 10,591.4 % if you use 360 days per year.

9. Bond

9.1 a-c, see literature.

d) 1,041 SEK

e) Increase of 1 % lowers the price to 1000 SEK. Decrease of 1 % increase the price to 1084 SEK.

9.2 111 SEK

9.3 9,970 SEK

9.4 7 %

9.5 2,293.67 SEK

9.6 1,220.12 SEK

10. One-Year Dividend Discount Model

10.1 a) 11.04%

b) -1.26075 SEK or -1.88%

10.2 a) 43.28 SEK

b) 49.28 SEK

10.3 a) 190.43 SEK

b) 191.32

11. Dividend Discount Model

11.1 210 SEK

11.2 10.91 MSEK

11.3 63.9 SEK

11.4 15.478 MSEK

11.5 66.48 SEK

12. Discounted Free Cash Flow Model

12.1 3,467 MSEK

12.2 1,493 MSEK

12.3 a) The value of equity is 3,002.38 SEK

b) The value of equity is 2,602.38 SEK

12.4 2,412.95 MSEK

13. Expected Return

13.1 a) 19 %

b) 9.09 %

13.2 64,800 EUR

13.3 -0.2 %

14. Variance and standard deviation

14.1 a) $\bar{x} = 6.228 \%$

b) $\sigma_{\text{Axfood}}^2 = 0.063303367$

c) $\sigma_{\text{Axfood}} = 25.16 \%$

14.2 $\sigma_{\text{Volvo}} = 60.31 \%$

14.3 $E[R_{\text{HM}}] = 7\%$ and $\sigma_{\text{HM}} = 16.7 \%$ (rounded to one decimal)

15. Covariance, Correlation and Beta

15.1 a) $\sigma_{\text{Axfood,Volvo}} = 0.1265602$

b) $\rho_{\text{Axfood,Volvo}} = 0.834$.

15.2 a) $\beta_{\text{Axfood}} = 0.67$

b) $\beta_{\text{Volvo}} = 1.51$

15.3 Alternative C is correct.

16. Portfolio Theory

16.1 $\mu_p = 18 \%$ och $\sigma_p = 14.4 \%$

16.2 $\sigma_p = 24.4 \%$

16.3 19.23 % in bond 1, and 80.77 % in bond 2

16.4 a) We should invest everything in the bond.

b) Ask us during an open session

16.5 $\sigma_p = 6.97 \%$

16.6 Either portfolio 1, or everything in stock B (depending on risk aversion level)

16.7 $\mu_p = 6.98 \%$

17. CAPM

17.1 7.29 %

17.2 5.9 %

17.3 11 %

17.4 $r_f = 5 \%$ and expected return on the market = 10 %

18. Options

18.1 a) -30 SEK

b) 0 SEK

c) -30 SEK

18.2 Statement C

18.3 Statement C

18.4 a) 0 SEK

b) >0 SEK

c) 5 SEK

d) 10 SEK

18.5 Statement D

18.6 Statement D