Introduction to Finance
Final Exam

The exam lasts 2h. Calculators are authorized. Written and printed materials are authorized. Any other type of materials is not authorized. The exam is 13-pages long.

Exercise 1 (2.5 points)

You are considering launching a new project. The business has expected cash flows of $135,000 per year, for an infinite number of periods. The first cash flow will be realized one year from now. The discount rate is 6.5%.

1. (0.75 point) What is the present value of the project?

2. (0.75 point) Now suppose you can invest in a technology that would improve the quality of the project to $220,000 per year. How much are you willing to pay for this new project.

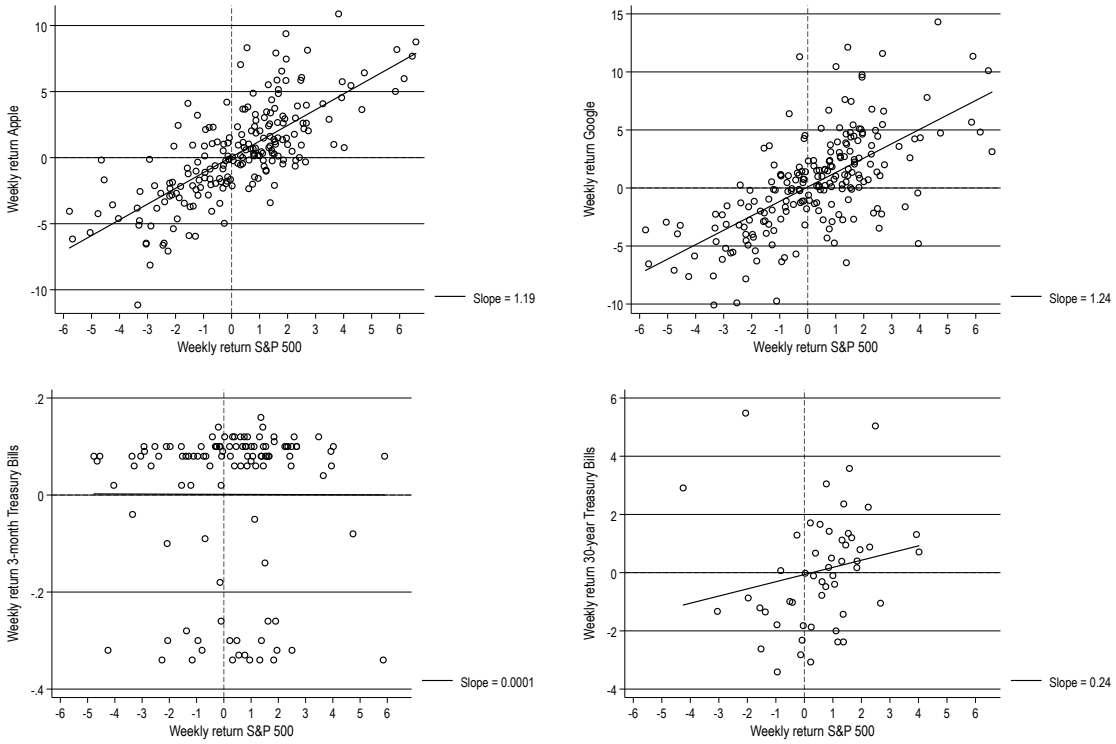
3. (1 point) The technology actually takes 4 years to be implemented. It costs $200,000 in year 0 and $200,000 in year 2. The cash flows are $120,000 the first four years and then grow at an 5% rate indefinitely. What is the Net Present Value of the project?

Exercise 2 (4 points)

Google is planning to build a phone. Its main competitor will be Apple.

Google has $27 billion of debt. The cost of debt is 5%. Its current stock price is $173 with 12 343 000 000 shares. The expected return on the market portfolio is 12%. Suppose the corporate tax rate is 21%. The return of 3-month treasury bills is 4.5%. The return of 30-years treasury bills is 4.6%.

The four figures below show the correlation between different securities and the market, identified as S&P 500. The slope of the line is indicated in the legend.



a. (0.5 point) In the CAPM, how do we define the beta of an asset?
b. (0.5 point) Which asset can we assume is the risk-free asset? What is the beta of Google stock? What is the beta of Apple stock?
c. (1 point) Using the CAPM, determine the cost of equity of Google. You do not need to unlever the beta.
d. (1 point) What is Company A's weighted average cost of capital (WACC)?

Google standard deviation of weekly return is 4.2. and Apple standard deviation of weekly returns is 3.6. The correlation between both stocks is 58%.

e. (1 point) Suppose you were to create a portfolio of Apple and Google Stocks using $2000. You purchase $400 of Apple shares and $1600 of Google shares. What will be the beta, the standard deviation of the returns of this portfolio? Conclude on the role of diversification on risk.

Exercise 3 (2.5 points)

ABC Corporation is a mid-sized utility firm that distributes a stable flow of dividends. You are a financial analyst tasked with evaluating the company's investment decision-making process, in particular, the investment in a new project that has an IRR of 9%. This project has a first payment at the end of period 0 and generates positive cash-flows in the future.

It has the following financial information in year 0: Stock price: $95 ; Earnings per Share (EPS): $5 ; Payout ratio = 60% ; Return on Equity (ROE): 12% ; Weighted Average Cost of Capital (WACC): 8%

1. (0.5 point) Define the market efficiency. Give two examples of failures of market efficiency.

2. (0.5 point) If ABC Corp's quarterly earnings report is better than expected, discuss what the market efficiency suggests about the potential reaction in ABC stock price.
3. (0.5 point) Should the firm invest in the new project?
4. (1 point) Calculate the firm's dividend in period 0 and in period 1. What is the firm value in period 0. Is it over-valued or under-valued?

Multiple Choice Questions (4 points)

Multiple answers are possible. 0.5 point per question. No negative points.

1. Assume the CAPM holds. Then, a project's discount rate is always defined as
   A. The alternative return investors could have earned by investing instead in other investment opportunities with similar systematic risk.
   B. The alternative return investors could have earned by investing instead in the market portfolio.
   C. The expected return on the project's equity.
   D. None of the above.

2. What is the present value of a growing perpetuity that pays $100 a year, forever, starting in t=1, with a growth rate of 6% and a discount rate of 5%?
   A. $10,000.
   B. $2,000.
   C. -$10,000.
   D. Infinity/Undefined.
   E. None of the above.

3. Project A has an IRR of 20% and requires an investment today of $100. Project B has an IRR of 25% and requires an investment today of $100. Which of the following statements is correct and includes the correct decision?
   A. Invest in project B, it has a higher NPV.
   B. Invest in project B, it has a higher IRR.
   C. Invest in project A, it has a lower IRR.
   D. Invest in project A, is has a higher NPV.
   E. Need more info.

4. Company H has a share beta of 1.5 whilst company L has a share beta of .8. This means that other things being equal:

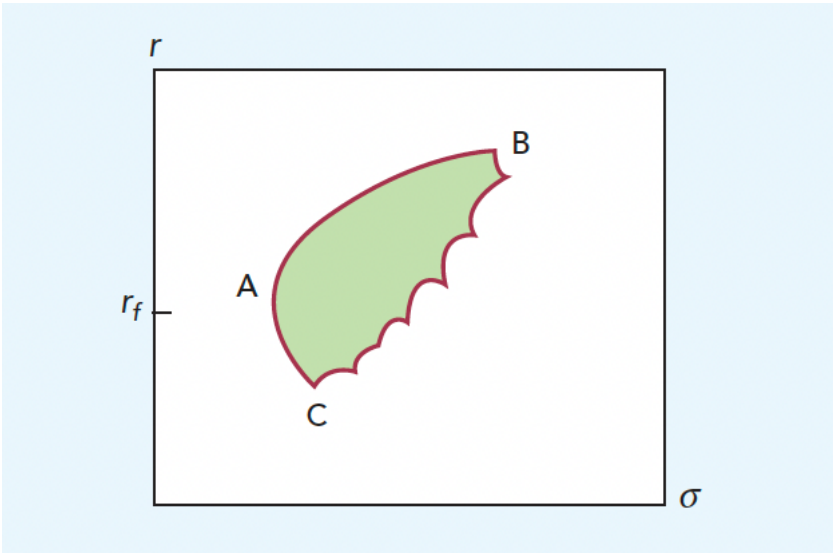
   A. H will outperform L when the market is rising
   B. L will outperform H when the market is rising.
   C. H will always outperform L
   D. The returns on H will be 1.5/.8 that of L

5. If cash flows are constant, and the opportunity cost of capital decreases
   A. The present value of the project decreases
   B. The present value of the project increases
   C. The present value will stay the same
   D. It depends on other information

6. If a company has net sales of $1.5 million, net income of $90,000, and total assets of 1 million.

A. Its asset turnover ratio is 1.5.
B. Its asset turnover is 0.09.
C. Its profit margin is 0.06.
D. Its profit margin is 0.09.

7. Based on the following figure which represens the risk and return of different portfolios, which statement(s) is (are) right?



A. The optimal portfolio maximizes the Sharpe ratio.
B. The optimal portfolio minimizes the Sharpe ratio.
C. The green area represents the set of optimal portfolios.
D. All portfolios on the red line are preferable to portfolios in the green area.

8. Diversification allows to

A. Reduce the systematic risk.
B. Reduce the specific risk.
C. Increase the beta of a stock.
D. Remove all types of risk.

Problem (8 points)

You work for the ministry of energy transition. The ministry is willing to introduce a tax on cash flows in order to favor the investment in green projects rather than in polluting projects. The government first need to estimate how profitable are investments in each of these projects. You concentrate on two typical investments.

The Green Company

The Green Company produces solar panels. You gather the following information from publicly listed companies.

Company	Industry	Common Stock Beta	Stock Price	Number of stocks	Debt
A	Green Cars	1.5	27	225M	696M
B	Green Planes	1.1	37	300M	333M
C	Solar Panels	2.1	27	136M	50M
D	Diesel Cars	2.3	12	90M	110M
E	Solar Panels	1.7	7	131M	249M

All companies' debt betas are equal to zero. The market risk premium is 4%, and the risk-free rate is 1%. Assume that the CAPM holds and that there are no corporate taxes.

a. (1 point) What is the beta that the Green Company must use for computing its return on assets?

b. (1 point) What would be the return on assets of the company using the CAPM?

c. (0.5 point) You find another company that is not publicly listed. The stock of this company is traded now at a price of 14 euros. You learn from forecasts that a dividend flow of 1 euro is expected next year and that this dividend is forecasted to have a stable growth rate of 1.5%. What is the return of this company?

Using additional information from the market you are finally able to set the opportunity cost of capital to 8%. You now want to estimate the NPV of the project. An investment of 10 million is expected in year 0. This will generate cash-flows of 1 million during the 10 next periods. During year 10, a new investment of 20M is also necessary. From year eleven, and in perpetuity, the expected cash flows will then be 1.5M a year, growing by 4% each year.

d. (1.5 point) What is the NPV of the project? [*Hint: Decompose the cash flows between: i) the initial investment, ii) the CF of the first 10 years, iii) the second investment, iv) the CF from year 11*]

The Polluting Company

The Polluting Company has a 12% equity cost of capital, and a 4.5% debt cost of capital. The price of its stock is 12 euros and there are 500M shares. The debt-to-equity ratio of the company is 0.4. The market risk premium is 4%, and the risk-free rate is 1%.

a. (0.5 point) What is the Beta of the Polluting company?

b. (0.5 point) What is the WACC of the Polluting Company?

The Cash flows from year 1 are expected to be 3.5M and grow by 7% every year during 20 years. The cash flows then stop after 20 years (a cash flow is paid in year 20 but not in year 21). The initial investment is 40M. Assume the opportunity cost of capital is 7.5%.

c. (1 point) What is the NPV?

The tax

The ministry is planning to tax the CF of the polluting company. Only the positive CF are taxed. The government wants to tax the Polluting Company so that its NPV is lower than the one of the Green Company. Assume the opportunity cost of capital is still 7.5% for the Polluting Company and 8% for the Green Company.

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a. (1 point) What is the minimum tax rate that should be set ?*[Hint: A CF of X taxed at the rate* τ *brings an after-tax CF of* $(1-\tau)\times X$*]*

In addition, the ministry plans to invest 185M in several green projects.

Project	NPV	Cost of investment	Environmental quality (in %)
A	-1	25	95
B	20	40	85
C	12	64	72
D	5	51	71
E	-13	10	59
F	5	53	58

a. (0.5 point) What projects would be chosen if the environmental quality criterium is the only criteria of choice?

b. (0.5 point) What projects would be chosen according to the NPV and the profitability index?