Written Exam at the Department of Economics winter 2018-19

Corporate Finance and Incentives

Final Exam

December 21, 2018

(3-hour closed book exam)

Answers only in English.

This exam question consists of 4 pages in total

NB: If you fall ill during an examination at Peter Bangs Vej, you must contact an invigilator who will show you how to register and submit a blank exam paper. Then you leave the examination. When you arrive home, you must contact your GP and submit a medical report to the Faculty of Social Sciences no later than seven (7) days from the date of the exam.

Be careful not to cheat at exams!

- You cheat at an exam, if during the exam, you:
- Make use of exam aids that are not allowed
- Communicate with or otherwise receive help from other people
- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Or if you otherwise violate the rules that apply to the exam

The exam consists of 4 problems. All problems must be solved. The approximate weight in the final grade of each problem is stated. A problem can consist of different sub-questions that do not necessarily have equal weight. Please provide intermediate calculations.

Problem 1 (CAPM 25%)

Consider five risky assets described by the following data. Their expected returns are given in the vector

$$b = \begin{bmatrix} 0.095 \\ 0.022 \\ 0.036 \\ 0.051 \\ 0.083 \end{bmatrix}.$$

The variance-covariance matrix for the returns is the following:

$$A = \begin{bmatrix} 0.56 & -0.12 & 0.12 & -0.03 & -0.04 \\ -0.12 & 0.27 & -0.07 & -0.14 & -0.01 \\ 0.12 & -0.07 & 1.17 & -0.11 & 0.11 \\ -0.03 & -0.14 & -0.11 & 0.64 & 0.32 \\ -0.04 & -0.01 & 0.11 & 0.32 & 0.54 \end{bmatrix}.$$

The risk-free interest rate is $r_f = 2.0\%$.

1) Identify the global minimum variance portfolio of risky assets, and calculate its expected return, variance, and standard deviation.

2) Find the efficient (tangent) portfolio of risky assets, and calculate its expected return, variance, and standard deviation.

3) An investor desires expected return 6.0%. Find the portfolio on the efficient frontier of risky assets which has this return, and compute its variance and standard deviation.

4) Suppose the investor includes the risk-free asset to form a portfolio with expected return 6.0%. Compute the smallest standard deviation that can be obtained in this fashion.

Problem 2 (Corporate Finance 25%)

A firm lives for one year in a risky world. It owns a project which will terminate one year from now, paying out cash at that time. The world will be in one of two states, B or G. The project provides after-tax cash 130 in state G, and 60 in state B (think of million Kroner). Risk-neutral pricing assigns probability 70% to state G. The safe interest rate is 5%.

The firm is financed by equity and debt. Debt promises the amount 110 next year. In state B, the firm will default, and creditors will actually receive 60. Equity holders with limited liability can keep whatever value is left tomorrow after creditors have received their payments. Investors pay no personal taxes.

The firm has a possibility to take an action to reduce the project's risk. If this action is taken, the project instead provides after-tax cash 120 in state G, and 90 in state B.

1) Compute the present value of debt, equity, and the firm in the original situation, where the firm does not reduce risk.

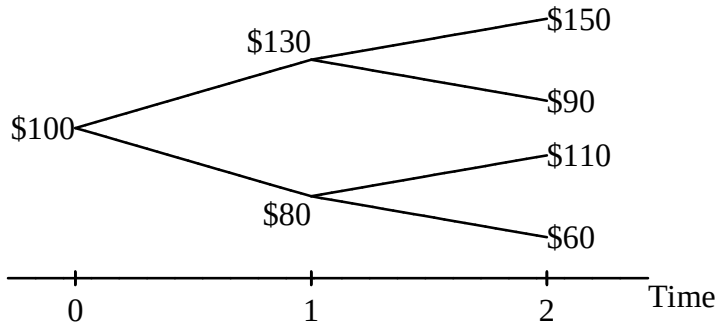
2) Compute the present value of debt, equity and the firm in case the firm takes the costly action to reduce risk.

3) If equity holders make the decision, what will they choose?

4) What is the efficient choice for the firm: should it take the costly action to reduce risk? Briefly comment on your finding.

Problem 3 (Options 25%)

A non-dividend paying stock currently costs $S_0 = \$100$. In the next two periods its market price S can evolve as shown in the tree below. The constant risk free rate is $r_f = 1.5\%$ per time period.



1) Compute the risk-neutral probabilities for each branch in the tree.

2) Consider three European call options expiring at time 2. Their respective strike prices are \$85, \$100, and \$115. Compute the market values C at time 0 for all three options

3) Consider three European put options expiring at time 2. Their respective strike prices are \$85, \$100, and \$115. Compute the market values P at time 0 for all three options

4) Does this problem satisfy the assumptions of the put-call parity?

Problem 4 (Various Themes 25%)

1) Result 6.6 from Grinblatt and Titman may be formulated as follows: The asset market is arbitrage-free if and only if there exist numbers $\lambda_1, \ldots, \lambda_K, r_f$ such that every asset satisfies

$$\alpha_i = r_f + \sum_{k=1}^{K} \beta_{ik}\lambda_k.$$

Please explain this equation: what is the meaning of k, K, i, α, r_f, β, λ? Which model does this come from? How is the equation useful?

2) Discuss the following from the perspective of arbitrage and investor behaviour. The Economist magazine printed this on December 1, 2018: "Many types of mutual fund are barred from holding non-investment grade (ie, junk) bonds. But junk is no longer a stunted and shameful offspring. The high-yield market in America is now worth $1.2trn. And investment-grade bonds have also come down in the world. Around half are rated BBB, a notch above junk. ... [Investor] comfort varies with the business cycle. The best returns are made in the early stages. The default rate is still high. Selling by panicky investors has driven bond prices down, and pushed up yields. Then, as the signs of economic recovery become clear, bond prices rally. ... It is in the latter stages of the cycle, when confidence returns, that things become more hazardous. Lots of bonds are issued to finance projects that will look questionable with hindsight. ... Eventually, the economy is squeezed. This is perilous for firms with heavy debts, which rely on steady profits to pay the interest. Spreads start to widen. Default rates creep up, then surge. And bond prices plummet. Where the present cycle differs is in the scale of bond issuance. Relative to America's GDP, the debt of companies now exceeds its previous peak of 2009. Capital markets have more than filled the gap left by slower bank lending. The stock of outstanding bonds has doubled. The share of triple-B bonds has steadily increased. ... The $3trn or so of corporate bonds that lie just above the junk-bond threshold pose a particular threat. ... there may not be enough buyers of junk to snap up such newly fallen angels without prices falling steeply."

3) It is argued that one consequence of firms combining in a merger is a reduction in their total corporate tax bill. Please explain how this can happen.