Written Exam at the Department of Economics winter 2019-20

Corporate Finance and Incentives

Final Exam

February 14, 2020

(3-hour closed book exam)

Answers only in English.

This exam question consists of 4 pages in total

Falling ill during the exam
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.
- leave the examination.
- contact your GP and submit a medical report to the Faculty of Social Sciences no later than five
(5) 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

$$b = \begin{bmatrix} 0.055 \\ 0.002 \\ 0.021 \\ 0.011 \\ 0.042 \end{bmatrix}.$$

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

$$A = \begin{bmatrix} 0.48 & -0.05 & 0.07 & -0.12 & 0.02 \\ -0.05 & 0.28 & -0.10 & -0.01 & -0.02 \\ 0.07 & -0.10 & 0.85 & -0.25 & 0.10 \\ -0.12 & -0.01 & -0.25 & 0.51 & 0.13 \\ 0.02 & -0.02 & 0.10 & 0.13 & 0.39 \end{bmatrix}.$$

The risk-free interest rate is $r_f = 1.0\%$.

1) Find the minimum variance portfolio of risky assets, and calculate the expectation, variance and volatility of this portfolio's return.

2) Find the efficient tangent portfolio of risky assets, and calculate the expectation, variance and volatility of this portfolio's return.

3) Compute the beta for each of the five stocks.

4) Explain the meaning of the efficient frontier and the capital market line.

Problem 2 (Corporate Finance 25%)

A firm owns only one project which will terminate one year from now, paying out cash at that time. The world will be in one of three states, L, M or H. The project delivers after-tax cash 40 in state L, 80 in state M, and 130 in state H. Risk-neutral pricing assigns probability $1/3$ to each of the three states. The safe interest rate is 1%.

The firm is financed by equity and debt. Debt promises the amount 70 next year to creditors. In state L, the firm will default, and creditors will only receive the available after-tax cash delivered by the project. Equity holders with limited liability can keep whatever

after-tax cash is left after creditors have received their payments. Investors pay no personal taxes.

The firm has a possibility to change the project's risk. If this action is chosen, the project instead provides after-tax cash 33 in state L, 90 in state M, and 121 in state H.

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

2) Compute the present value of debt, equity and the firm in case the firm chooses to change risk.

3) Compute the variance of the after-tax cash flows in both cases. Which one has lowest variance?

4) Which of the two choices is respectively best for creditors and best for equity holders? Which of the two choices is efficient? Briefly explain the intuition behind your result.

Problem 3 (Options 25%)

Consider European put and call options written on the same underlying asset, with identical strike price K and identical expiration date. Suppose that the underlying asset pays dividends.

1) The put-call parity can be expressed as

$$C = P + S - PV(Div) - PV(K).$$

Explain the terms in this formula.

At the end of January 2020, the following data were obtained from the CME for European options with strike price \$3200 written on the S&P 500 index, expiring at the end of April 2020: call price \$114.20 and put price \$90.80. The underlying asset was quoted at \$3225.70. The US Treasury posted a 3 month (annualized) safe yield of 1.55%.

2) Compute $PV(K)$ with these data.

3) Find $PV(Div)$ with these data.

On the same day, similar options with strike price \$3300 had call price \$55.60 and put price \$131.80.

4) Recompute $PV(Div)$ using this other options pair. If there is a difference with your answer in part 3), do you think it can be attributed to a failure in the put-call parity, a random measurement error using different data, or anything else?

Problem 4 (Various Themes 25%)

1) Theorem 1 from Sørensen (2019) may be formulated as follows: The asset market is arbitrage-free if and only if there exist positive probabilities $q_1, \ldots, q_K$ and interest rate r such that every asset satisfies

$$p_i = \frac{v_{i1}q_1 + \cdots + v_{iJ}q_J}{1 + r}.$$

Please explain this equation: what is the meaning of i, J, p, v? Which model does this come from? How is the equation useful?

2) Discuss the following text from the perspective of mergers and acquisitions as well as corporate governance. CNN Business reported on January 23, 2020: "Xerox is dropping the niceties. It really, really wants to merge with HP, and it has gone hostile. Xerox (XRX) has been attempting a takeover for months, and HP (HPQ) has twice rejected Xerox's bids. HP said Thursday Xerox's proposal 'significantly undervalues HP and creates meaningful risk to the detriment of HP shareholders.' It has also raised significant concerns about Xerox's business strategy, noting that its revenue fell nearly 10% in 2019. But Xerox says combining the companies, which are in similar businesses, could save tremendously on costs. 'We believe HP shareholders will be better served by a new slate of independent directors who understand the challenges of operating a global enterprise and appreciate the value that can be created by realizing the synergies of a combination with Xerox,' Xerox CEO John Visentin said in a statement Thursday. (...) Although HP still has a sizable PC business, fewer customers are buying ink from HP. Ink sales had long been HP's profit generator: HP would take losses on its printer sales, generating the bulk of its income from ink. But smartphones make printing less crucial, and many customers who do print are able to find cheaper ink suppliers. The company announced in October that it would cut between 7,000 and 9,000 jobs by 2022. At the time, Enrique Lores, HP's CEO, called the move 'bold and decisive action' to help the company in its next chapter. HP's former CEO, Dion Weisler, stepped down late last year for a family matter. Xerox, like HP, relies on a dying business for the bulk of its sales and profit. It sells and services copy machines and printers, primarily for corporations. But sales are falling, declining in each of the past seven quarters."

3) Discuss the following claim: "Just like a firm's capital structure, the value of insurance must come from reducing the cost of market imperfections on the firm."