

Written Exam at the Department of Economics winter 2017-18

Corporate Finance and Incentives

Final Exam

February 12, 2018

(3-hour closed book exam)

Please note that the language used in your exam paper must correspond to the language for which you registered during exam registration.

This exam question consists of 4 pages in total

NB: If you fall ill during an examination at Peter Bangsvej, you must contact an invigilator in order to be registered as having fallen ill. In this connection, you must complete a form. Then you submit a blank exam paper and 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.

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 four risky assets $i = 1, \dots, 4$ described by the following data. Their expected returns are given in the vector

$$b = \begin{bmatrix} 0.043 \\ -0.019 \\ 0.053 \\ 0.062 \end{bmatrix}.$$

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

$$A = \begin{bmatrix} 1.11 & -0.28 & 0.15 & -0.06 \\ -0.28 & 0.61 & 0.05 & -0.58 \\ 0.15 & 0.05 & 2.22 & -0.05 \\ -0.06 & -0.58 & -0.05 & 0.78 \end{bmatrix}.$$

The risk-free interest rate is $r_f = 0.5\%$.

- 1) Identify the global minimum variance portfolio of risky assets, and calculate its expected return and variance.
- 2) Find the efficient (tangent) portfolio of risky assets, and calculate its expected return and variance.
- 3) Consider an equally weighted portfolio, invested with 25% in each asset. Determine whether this portfolio is on the efficient frontier of risky assets.
- 4) Assume that assets are priced consistently with the capital asset pricing model (CAPM). Find the betas for all four assets.

Problem 2 (Merger 25%)

Two firms consider a merger. Each firm has a short-lived asset which will pay a terminal cash amount one year from today. Four outcomes are possible next year. The following table shows payoffs (in million Kroner) and risk-neutral probabilities.

Outcome	Probability	Firm 1 Payoff	Firm 2 Payoff
1	0.5	50	20
2	0.2	50	-10
3	0.2	-30	20
4	0.1	-30	-10

There are no direct synergies, so the merged firm will receive the sum of these payoffs.

When a firm has payoff X in some outcome, it must pay corporate tax $0.3 \max\{0, X\}$.

When a firm's payoff is negative in some outcome, it is bankrupt. When a single firm is bankrupt, it loses 10 million Kroner in legal costs. If the merged firm is bankrupt, it loses 30 million Kroner.

1) Suppose firm 1 is alone. Compute its corporate tax payment and its legal costs in each of the four outcomes, as well as their risk-neutral expectations.

2) Suppose firm 2 is alone. Compute its corporate tax payment and legal costs, both in all four outcomes and in risk-neutral expectation.

3) Suppose the firms have merged. Compute the merged firm's corporate tax payment and legal costs, both in all four outcomes and in risk-neutral expectation.

4) Compare the expectation from sub-question 3) with the sum of expectations from 1) and 2). Compare the tax payments, the legal costs, as well as the sum of those. Does the merged firm have lower taxes and costs, or not, and why?

Problem 3 (Options 25%)

Consider a European put option and a European call option 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.

2) Briefly explain how this put-call parity can be derived.

At the end of January 2018, the following data were obtained from the CME for European options with strike price \$2840 written on the S&P 500 index, expiring at the end of April 2018: call price \$64.30 and put price \$59.10. The underlying was quoted at \$2845.20. The US Treasury posted a 3 month (annualized) safe yield of 1.44%.

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

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

Problem 4 (Various Themes 25%)

- 1) The fundamental theorem of asset pricing derives the asset pricing formula

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

as equivalent to the absence of arbitrage portfolios. Explain the terms in this formula, and discuss their interpretation.

2) Discuss the following from the perspective of corporate finance and taxes. An opinion piece on Apple, published by The Financial Times on January 18, 2018, contained the following passages: “The iPhone maker took a stab at asserting its national significance this week with the boast that it will be ploughing \$350bn directly into the US economy over the next five years — in payments to suppliers, capital spending, and a \$38bn tax bill on past foreign earnings. President Donald Trump was quick to attribute this to his recent tax changes, an impression Apple did not dispel. (...) But, seen from the outside, the US tax legislation has had no affect at all on Apple’s investment intentions in its home country. The capital spending and supplier payments appear to reflect nothing more than business as usual, with some allowance for growth. The one payment that sticks out is the \$38bn tax on foreign earnings that were amassed over many years — something widely mis-named as repatriation tax, because companies will have to pay this new levy whether or not they bring the money home. Ironically, the sheer scale of this payment is a testament to the effectiveness of Apple’s previous tax avoidance. A proportion of every penny of foreign tax it has paid in the past can be offset against its US liability now. (...) Apple has had more than enough financial flexibility to make any investments it wants in the US, so why change now? It could have borrowed more against its foreign cash, or applied some of its excess cash flow. The fact that it has not shows that it makes no business sense — a consideration that will not change just because politicians in Washington DC wish it so. Acting preemptively to highlight its national economic importance — and allowing the mistaken view to take hold that this somehow reflects an increased investment tied to the recent tax legislation — is certainly a smart move. But this should not detract from the reality: Apple shareholders are in line for a massive payday when the company finally decides to bring its foreign cash home.”

3) What is the asset substitution problem? Describe it, and explain how it could lead to inefficient financing of firms. You may also discuss instruments of corporate governance to handle this problem.