Written Exam for the B.Sc. or M.Sc. in Economics winter 2015-16

Corporate Finance and Incentives

Final Exam/ Elective Course/ Master's Course

February 10, 2016

(3-hour closed book exam – access to Excel)

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. I.e. if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by "eksamen på dansk" in brackets, you must write your exam paper in Danish.

This exam question consists of 3 pages in total

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 (APT 25%)

Assume that the stocks of four firms have expected returns that depend on three factors as shown in the following four equations.

$$\begin{aligned} r_1 &= .07 + 2F_1 + F_2 + F_3, \\ r_2 &= .02 + F_1 - F_2 + 2F_3, \\ r_3 &= .09 + 3F_1 + 2F_2, \\ r_4 &= -.04 + 4F_1 - 3F_2 + F_3. \end{aligned}$$

1) Find a portfolio of the four stocks that eliminates factor risk of the four stocks, and compute its return r_f.

2) Find the weights of the three pure factor portfolios constructed from the four stocks.

3) Determine the factor risk premiums $\lambda_1, \ldots, \lambda_3$ for the three factors.

4) Rewrite the expected returns from the four factor equations on the form $\bar{r}_i - r_f = \sum_{n=1}^{3} \beta_{i,n}\lambda_n$.

Problem 2 (Fixed Income 25%)

Consider a market with three safe bonds that pay exactly one, two, and three years from today. The cash flow matrix is:

$$C = \begin{bmatrix} 6 & 6 & 106 \\ 0 & 107 & 0 \\ 56 & 56 & 0 \end{bmatrix}.$$

Market prices for the three bonds are

$$\pi = \begin{bmatrix} 104.68 \\ 99.51 \\ 102.6 \end{bmatrix}.$$

1) Find the discount factors d_t for all three years.

2) Compute the term structure of safe interest rates.

3) Compute the Macaulay duration for each of the three bonds.

Problem 3 (Investment Opportunity 25%)

Consider a firm that has been financed by debt and equity. The debt is in the form of a zero-coupon bond that promises bond holders to get 100 million Kroner one year from today. Capital markets are perfect.

The firm initially has one short-lived asset which will pay a terminal cash amount one year from today. This amount depends on the state of the world which can be high or low. In the high state, the asset pays 130 million Kroner, in the low state 110 million Kroner.

Suppose that the risk-free interest rate is 3%. Assume that for risk-neutral asset pricing, the market attaches probability 40% to the high state.

1) What is the value of the firm and the value of its equity?

Suppose next that firm owners have an opportunity to alter the cash flow. This requires no payment today, but the effect is to increase the firm's income by $60Z$ in the high state, and reduce it by $40Z$ in the low state. Here, $Z > 0$ measures the scale of the investment.

2) Find a critical value $Z^* > 0$ with the following property. When $Z < Z^*$, all investors are indifferent to the investment. When $Z > Z^*$, equity holders gain while bond holders lose if the firm invests at scale Z.

3) Find a critical value $Z^{**} > Z^*$ with the following property. When $Z^* < Z < Z^{**}$, bond holders lose whenever Z is marginally raised. When $Z > Z^{**}$, bond holders are indifferent to the investment scale Z (as long as it remains above Z^{**}).

Problem 4 (Various Themes 25%)

1) Define the size effect, and discuss its relation to capital market efficiency.

2) Under which assumptions do we have equivalence of the following three methods of project valuation: the Weighted Average Cost of Capital method, the Adjusted Present Value method, and the Flow-to-Equity method?

3) Explain intuitively why a firm with very risky cash flows is less likely to gain from a tax shield of debt?

4) Define a European call option and its payoff at expiration. Explain also which are the variables to appear in the Black-Scholes formula:

$$C_0 = S_0 N(d_1) - K e^{-r_f T} N(d_2),$$

with

$$d_1 = \frac{\ln\left(\frac{S_0}{K e^{-r_f T}}\right) + \sigma^2 T/2}{\sigma\sqrt{T}} \text{ and } d_2 = d_1 - \sigma\sqrt{T}.$$