Answer Sheet to the Written Exam

Corporate Finance and Incentives

February 2020

In order to achieve the maximal grade 12 for the course, the student must excel in all four problems.

The four problems jointly seek to test fulfillment of the course's learning outcomes: "After completing the course, the student is expected to be able to:

Knowledge:

1. Identify, describe and discuss financial problems encountered by firms and investors,
2. Account for and understand the core models and methodologies in the field of Financial Economics,
3. Define the core concepts of Financial Economics,
4. Criticize and reflect upon the main models in Finance, relating them to current issues in financial markets and corporate finance.

Skills:

1. Select and apply core models and methodologies to analyse standard problems in Finance, partly using Excel,
2. Master the analysis of given problems, assessing models and results, putting results into perspective,
3. Argue about financial problems and issues in a scientific and professional manner, drawing upon the relevant knowledge of the field.

Competencies:

1. Bring into play the achieved knowledge and skills on new formal problems,
2. Select and evaluate solutions to complex, unpredictable situations in financial markets or corporations,
3. Approach more advanced models, methodologies and topics in Finance."

Problems 1–3 are particularly focused on knowledge points 1–3, skills 1–3, competencies 1 and 2. Problem 4 emphasizes knowledge points 1–4, skill 3, and competencies 1 and 3.

Some numerical calculations may differ slightly depending on the commands chosen for computation, so a little slack is allowed when grading the answers.

Problem 1 (Asset pricing 25%)

1) Use matrix inversion in Excel. Compute $z = A^{-1}\mathbf{1} = (3.20, 5.26, 2.60, 3.91, 0.70)^T$, normalized to the minimum-variance portfolio $x_m = (0.204, 0.336, 0.166, 0.250, 0.045)^T$. Its expected return is $x_m^T b = 2.00\%$ with variance $x_m^T A x_m = 0.0638$ and volatility $\sqrt{x_m^T A x_m} = 0.253$.

2) Compute $A^{-1}(b - r_f\mathbf{1})$ and normalize it to $x_e = (0.577, -0.053, -0.027, 0.008, 0.495)^T$. Expected return $x_e^T b = 5.20\%$, variance 0.2676, volatility 0.517.

3) From the CAPM equation $E[R_i] = r_f + \beta_i (E[R_{eff}] - r_f)$ isolate $\beta_i = (b_i - r_f) / \left(x_e^T b - r_f\right)$. This gives $\beta_1 = 1.072$, $\beta_2 = -0.191$, $\beta_3 = 0.262$, $\beta_4 = 0.024$, $\beta_5 = 0.763$. Alternatively, use (11.23) from Berk and DeMarzo to compute $\beta = Ax_e / \left(x_e^T A x_e\right)$.

4) See sections 11.4 and 11.7 in Berk and DeMarzo.

Problem 2 (Corporate Finance 25%)

1) The present value of debt is $D = (40 + 70 + 70)/(3.03) = 59.41$. The present value of equity is $E = (10 + 60)/(3.03) = 23.10$. The present value of the firm is $V = D + E = 82.51$.

2) The present value of debt is now $D_c = 57.10$. The present value of equity is $E_c = 23.43$. The present value of the firm is $V_c = 80.53$.

3) In the first case, the variance of $(40, 80, 130)$ is 1356. In the other case, it is 1328, which is lower. (The Excel command for variance may estimate 3/2 of these numbers, i.e. 2033 and 1992, which is also an acceptable answer to this question).

4) Since $D > D_c$, creditors prefer the original cash flow. Since $E < E_c$, equity holders prefer the changed risk. Since $V > V_c$, it is efficient to not change risk. Perhaps surprisingly, equity holders are alone in preferring the case with lower risk. But this is because the change also substitutes some cash in state L (where it lands in the pockets of creditors) with a little extra cash over the combined states M and H (where equity holders are residual claimants). The mechanism is similar to that in the asset substitution problem where, however, it is more intuitive to associate the equity holders' gain with greater risk.

Problem 3 (Options 25%)

1) C is the current market price (or premium) on the call option. P is the price on the put. S is the current market value of the underlying asset. In this formula, PV means present value, i.e., the current market value of a claim on the cash-flow in the parenthesis. Dividends Div denote the risky cash-flow paid to a holder of the underlying asset until the option expires. K refers to a safe payment of strike price K on the expiration date.

2) The safe payment of $K = \$3200$ three months ahead should be discounted by the safe

interest rate. This is annually 1.55%. The result is

$$PV\left(K\right)=\frac{\$3200}{1.0155^{3/12}}=\$3187.72.$$

3) Rearranging the put-call parity, isolate $PV\left(Div\right)=P+S-C-PV\left(K\right)=\$90.80+\$3225.70-\$114.20-\$3187.72=\$14.581$.

4) Inserting the data from the other options pair gives $PV\left(Div\right)=14.565$. The put-call parity is derived from a simple arbitrage argument, but some options are not very actively traded, so perhaps the assumption of no arbitrage is inaccurate. The difference is small, and could well be caused by small inaccuracies in the reported market data. Considerations from chapter 13 about investor behaviour could perhaps also explain a difference. More data would be needed to distinguish among these explanations.

Problem 4 (Various Themes 25%)

1) See chapter 3on arbitrage-free pricing from Sørensen (2019).

2) A good answer could discuss points such as the following. The text refers to a hostile takeover attempt by Xerox. Based on the description of their businesses, one plausible reason is to realize economies of scale and scope, possibly including monopoly gains and efficiency gains. If one firm has made operating losses, the combination may be able to take advantage of tax savings. Mentioning HP shareholders and new directors, the Xerox CEO appears to imply that there is a corporate governance weakness at HP — as such, Xerox could be seen to improve this, creating value for HP shareholders. Last year's departure of HP's CEO could potentially signal a conflict among shareholders and HP's executives. Section 28.5 discusses takeover defenses in the style of corporate governance arrangements that HP could use to fend off the hostile bid from Xerox.

3) The claim appears on page 1058 in Berk and DeMarzo. See the explanation and discussion in section 30.1.