Financial Economics Field Exam — January 2008

There are two questions on the exam, representing Asset Pricing (236D = 234A) and Corporate Finance (234C). Please answer *both* questions to the best of your ability. Do not spend too much time on any one part of any problem (especially if it is not crucial to answering the rest of that problem), and don't stress too much if you do not get all parts of all problems.

Good luck!

Question #1. Asset Pricing

Consider a financial market with three types of agents: (i) an insider; (ii) market makers; and (iii) noise traders. The market is open for one period, and one risky financial asset is traded. Denote the terminal value of the asset by v, a normally distributed random variable with expected value zero and variance σ_v^2.

The market operates the following way. The insider, who has zero endowment of the risky asset, observes v and then places a market order for purchasing x shares. The insider has constant absolute risk aversion a, so he maximizes

$$\mathrm{E}\left[-\exp\left\{-aW\right\}\right]$$

where W is his terminal wealth.

Risk neutral market makers observe the total order flow $x+u$, where u is the demand of noise traders, which is independent of v and normally distributed with mean zero and variance σ_u^2. Competition among market makers results in the market price

$$p = \mathrm{E}\left[v|x+u\right].$$

The insider behaves strategically: in deciding his optimal strategy, he takes into account the effect of his demand on the price p.

(a) Assuming that W is normally distributed, show that the insider's optimization problem is equivalent to maximizing

$$\mathrm{E}\left[W\right] - \frac{a}{2}\cdot \mathrm{var}\left[W\right]$$

where the expectation and variance are conditional on the insider's information (i.e., v).

(b) Assume that the market price is a linear function of the total order flow

$$p = \lambda\left(x+u\right).$$

Express W as a function of x, v, u and λ. Compute the mean and variance of W conditional on v and solve for the optimal choice of x by maximizing the insider's objective. Express x as a function of λ and exogenous parameters. Why is demand x finite? What is x in the special case where the insider is risk neutral?

(c) Denote the total order flow by $y = x+u$. Note that the price is determined as

$$p = \mathrm{E}\left[v|y\right] = \mu + \lambda y$$

where linearity of the conditional expectation follows from joint normality. Viewing the conditional expectation as a regression, compute the parameter μ and derive an equilibrium condition for λ as a function of exogenous parameters.

(d) Interpret λ as a measure of illiquidity. What is λ when the insider is risk neutral? What is λ when the risk aversion of the insider approaches infinity? Based on these results, what kind of relationship do you expect between the insider's risk aversion and λ? What is the economic intuition for this? [Note: explicitly characterizing λ as a function of a is difficult.] How would this result be affected if the insider could observe the value of noise demand u before submitting his order?

(e) Now suppose that the insider is the CEO of the firm that is being valued, and he is overconfident about the prospects of his company. Specifically, he believes – incorrectly – that the terminal value of the firm will be $v^* = v + v_0$ where the constant $v_0 > 0$ is the insider's overconfidence. If market makers know that the insider is overconfident and know v_0, what happens to the market price p compared to the fully rational case? Is this result similar to the conclusions of the De Long et al paper? Why? What would happen to the price if the market makers were not aware of the insider's overconfidence?

Question #2. Corporate Finance
Two important capital structure puzzles are the so-called "pecking-order of financing" and "debt conservatism."

(a) Explain both puzzles. Make sure to distinguish debt-conservatism from "low leverage." **(3 points)**

(b) To understand why these stylzided empirical facts are puzzling,

- state the Modigliani-Miller theorem (1958). (Make sure to spell out all assumptions!)
- Then explain the arbitrage-based proof, comparing the value of two companies A and B, with debt outstanding of D_A and D_B and equity issued E_A and E_B.
- Then explain why we should not observe a pecking-order of financing or debt conservatism in a Modigliani-Miller world.

(3 points)

We now consider the possibility that both puzzles are explained by differences in beliefs between managers (CEOs), on the one hand, and outside investors, on the other hand.

We model the decision of a manager to undertake and finance an investment project of given scale, with cost I and stochastic return $\widetilde{R}$, given by R_G with probability $p \in (0;1)$ and R_B with probability $1-p$, where $R_G > I > R_B \geq 0$. The firm pays taxes at marginal rate τ on the net return $\widetilde{R} - I$ if $\widetilde{R} > I$. (If the returns are lower than the cost of investment, no tax is due.) The cost and the return distribution are common knowledge. We assume perfectly competitive debt and equity markets and normalize the risk-free interest rate to zero. The firm has existing assets A and, in addition, internal funds C. The number of shares outstanding is s' and any newly issued shares are denoted as s. The CEO maximizes the perceived expected value of the company to existing shareholders. We denote the expectations of a rational manager with $E[\cdot]$ and the expectations of an overconfident manager with $\hat{E}[\cdot]$, and we denote the valuation of assets outstanding of a rational manager as A and of an overconfident manager as $\widehat{A}$. Overconfidence implies that the CEO overestimates (after-tax) project returns, $\hat{E}[\tilde{R} - \tau 1_{\{R>I\}}(\tilde{R} - I)] > E[\tilde{R} - \tau 1_{\{R>I\}}(\tilde{R} - I)]$, and the value of assets in place, $\widehat{A} > A$.

(c) Assume that the CEO decides to implement the investment project. Write down the perceived expected value of the company to existing shareholders, i.e. the maximand of the CEO, conditional on implementing the investment project and on using an amount $c \leq C$ and issuing shares s' to finance the project. Write out separately the formula for rational and for overconfident CEOs. (**Hint:** The only differences in the formula for rational and for overconfident CEOs should be the expression for expectations, $E[\cdot]$ versus $\hat{E}[\cdot]$, and for assets, A versus $\widehat{A}$.) **(4 points)**

We first consider the unconditional choice between internal financing (i.e. using cash and riskless debt, denoted by $c \leq C$) and equity. Let's start from the decision of a rational manager.

(d) Show that a rational CEOs is indifferent between using internal finance and equity to finance the investment project (conditional on implementing the investment project.)

Remember that competitive equity markets imply that new shareholders (the owners of the s' new shares) receive their reservation utility, i.e. that the participation constraint holds with equality. (**Hint:** The reservation utility of new shareholders is equal to the financing gap, $I - c$.) **(4 points)**

Consider the unconditional choice between internal financing (i.e. using cash and riskless debt, denoted by $c \leq C$) and equity.

(e) Now show that an overconfident CEOs strictly prefers internal finance to equity. (As in **(d)**, still consider the unconditional choice between internal financing (i.e. using cash and riskless debt, denoted by $c \leq C$) and equity.) **(4 points)**

(f) Your finding in (e) implies that an overconfident CEO uses (weakly) more internal financing than a rational CEO. Provide an economic intuition for this result. **(2 points)**

To complete the pecking order, we analyze the choice between risky debt and equity, conditional on accessing external capital markets. That is, we consider the situation that the CEO has decided to implement the investment project and has realized that he has to use some external financing (either debt or equity or both), e.g., since there are not sufficient internal funds C available. To simplify this part of the analysis, we set other assets including cash equal to zero, $\widehat{A} = A = C = 0$. As before, s is the number of shares outstanding and s' the number of newly issued shares. Let's denote as w the face value of debt, d the market value of debt, and L the deadweight loss from bankruptcy. Interest payments $w - d$ are tax deductible. As before, assume that new shareholders receive exactly their reservation utility $(I - d)$ in expectations, and similarly, let's assume that new lenders (debtholders) receive exactly their reservation utility in expectations. We assume that the CEO cannot raise more financing than needed for the investment project, $d \leq I$.

(g) Write down the new maximization problem, i.e. the new objective function, the participation constraint for new shareholders, the participation constraint for debtholders, and the constraint that debt is risky but limited by I. (**Hint:** This last constraint can be written as $R_B \leq d \leq I$.) How do the formulas for rational and overconfident CEOs differ? Describe verbally how you would solve for the optimum. **(4 points)**

(h) Solving the maximization problem written down under **(g)**, one can show that overconfident CEOs choose full debt financing more often than rational CEOs. Taking all results together, this implies (1) that overconfident CEOs use less of *any* external financing, including debt, than rational CEOs and (2) conditional on using external financing (risky debt or equity), use debt, relative to equity, more than rational CEOs. How do these findings relate to the "debt conservatism" and the "pecking-order" puzzles discussed above? **(4 points)**

(i) You now want to test empirically whether overconfident CEOs make different capital structure decisions than rational CEOs, usin a panel data set with information about the capital structure decisions of rational and of overconfident CEOs. You focus on testing whether overconfident CEOs issue more debt, conditional on using external financing. Write down the empirical regression specification, using the commonly employed 'financing deficit framework' of Shyam-Sunder and Myers (1999). Make sure to explain your notation, give all definitions, and to be specific about the econometric estimation method as well as the calcultion of standard erros. **(8 points)**