Financial Economics Field Exam — August 2008

There are two questions on the exam, representing Macroeconomic Finance (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. Macroeconomic finance

All parts of this question have equal weight.

Consider an endowment economy where log consumption c_t follows

$$c_{t+1} = c_t + \mu + \varepsilon_{t+1} + \nu_{t+1}$$

where μ is a constant, $\varepsilon_{t+1} \sim N(0, \sigma^2)$, ν_{t+1} equals zero with probability $1 - p$ and $\log[1 - d]$ with probability p, $1 > d \geq 0$, and $p \geq 0$ is a small number. Here ν_{t+1} can be interpreted as an unlikely "disaster" event where consumption drops by d percent. We assume that ε and ν are independent from each other and i.i.d. over time, and that the representative consumer maximizes utility over lifetime consumption:

$$\max \mathrm{E}_t \sum_{j=0}^{\infty} \delta^j \frac{C_{t+j}^{1-\gamma}}{1 - \gamma}.$$

(a) Compute $m = \log \mathrm{E}_t[C_{t+1}/C_t]$, the log growth rate of consumption. To do this, recall (i) that the expectation of the product of independent random variables is the product of their expectations; and (ii) the formula for the expected value of a lognormal random variable. In the process you will need to compute $\log \mathrm{E}_t[\exp(\nu_{t+1})] = \log[1 - p + p(1 - d)]$; do this using the fact that for small x, $\log(1 - x) \approx -x$. How does the probability of disasters p affect expected consumption growth?

(b) Write down the stochastic discount factor in period t. Use the SDF to express the log riskfree rate r_f. Write r_f as a function of exogenous quantities using the approximation for the log function the same way as in (a). Does the presence of disasters ($p > 0$) increase or reduce the riskfree rate of return? Explain.

(c) Consider the risky asset which is a claim to next period's total endowment C_{t+1}. Express the price of this asset, P_t, with the key asset pricing equation, using the SDF from (b). Compute $\log[P_t/C_t]$.

(d) Show that $\log \mathrm{E}[1 + R_{t+1}] = \log \mathrm{E}[C_{t+1}/C_t] - \log[P_t/C_t]$ where R_{t+1} is the return of the risky asset introduced in (c). Using this equation and your results from (a) and (c), compute the expected excess return $\mathrm{E}[R_{t+1}] - R_f \approx \log \mathrm{E}[1 + R_{t+1}] - r_f$. Compare your result to the expected excess return in the absence of disasters ($p = 0$). Is the equity premium higher now? What asset pricing puzzles can this model help explain?

(e) Suppose that the probability of disaster p is time-varying. Based on your results in (b) and (d), what type of variation would you expect to see in the equity premium and the riskfree rate? Are these predictions consistent with facts?

(f) Qualitatively, what would the presence of disasters imply for the price of out-of-the-money put options on the stock market? Recall, the payoff of a put option with strike X and expiration date T is $\max[X - P_T, 0]$, and the option is out of the money if X is smaller than the current stock price (i.e., the payoff from exercising the option today would be zero).

Question #2. Corporate Finance

This question deals with optimal corporate governance: How can shareholders ensure that managers act in shareholders' best interest? We will evaluate different approaches.

One remedy of managerial misbehavior is to provide investors with control rights in case things "go sour" and the manager misbehaves ("damage control"): investors step in and overrule the manager's corporate decision, and the manager is "punished" (e.g., receives less remuneration or loses his job). Investor control is meant to have a beneficial ex-post and ex-ante effect. Ex post, investors can prevent managers from actions that would maximize managers' private benefits but not shareholder value; ex ante, investors are reassured that managers will not divert money and, hence, are more willing to provide financing in the first place.
Let's walk through a simple model of investor control rights and see whether this is always the case.

Consider an owner-manager of a firm with cash A and an investment project that costs I, with $I > A$. The project yields $R > 0$ with probability p and zero otherwise. The manager can affect the success probability p by either acting in the best interest of shareholders, in which case $p = p_H$, or "misbehaving" and extracting a private benefit $B > 0$, in which case $p = p_L < p_H$. We assume that $p_L R < I - A$. Misbehaving is observable to investors but not verifiable, and hence contracts can only condition on success or failure of the project, but not on managerial behavior. Both investors and the manager are risk-neutral; the manager is protected by limited liability, and the interest rate is zero.

(a) What is the manager's incentive constraint which ensures that he does not misbehave? What is the necessary and sufficient condition for the manager to be able to obtain financing from investors? What is the pledgeable income, i.e., the maximum expected income investors can obtain while preserving incentive compatibility? **(3 points)**

(b) Now consider a control right that affects the probability of success in case of managerial misbehavior ("damage control"). Assume that exercising the control right has no effect in the case of good behavior, but raises the probability of success in the case of misbehavior from p_L to $p_L + \nu$ ($\nu > 0$), though not as high as p_H: $p_H > p_L + \nu$. Exercising control rights comes at a cost $\gamma > 0$ borne by the manager.
    First consider the unrealistic scenario when the manager himself can decide whether the control right is exercised. Under what condition will the manager exercise the control right? (Assume that the manager does *not* exercise the control right when indifferent between exercising and not exercising.) What are the incentive constraints that ensure that the manager behaves? Show that compared to the baseline setting without control rights, pledgeable income remains the same if $vB/(p_H - p_L) < \gamma$, and is decreased otherwise. **(10 points)**

(c) Now consider the more realistic scenario when the control right is given to investors. Assume that, when indifferent, investors choose to exercise the control right. Show that investors will always exercise the control right. Then derive the new incentive constraint for

the manager to behave and show that the financing condition is now:

$$p_H \left[R - \frac{B}{p_H - p_L - v} \right] \geq I - A.$$

(**3 points**)

(d) Based on your results in parts (a)-(c), does the allocation of control rights to investors help prevent managerial misbehavior (ex-post effect)? Does it help to ease access to financing (ex-ante effect) relative to the baseline setting without control rights? Relative to the (unrealistic) setting of assigning the control right to the manager? How does the allocation of control rights to investors affect NPV? (**3 points**)

Another potential mechanism to address agency problems between corporate managers and shareholders is the board of directors.

(e) The policy debate often assumes that adding independent directors to a board will improve company performance. However, the bulk of the empirical literature that tests the impact of board independence on firm performance fails to find a significant link. Explain how you might interpret this finding. Be sure to consider endogenous director selection. (**2 points**)

(f) Recent literature has suggested several potential instruments for board independence. One approach is to instrument for the proportion of independent directors on the board with its lagged value. Another approach is to exploit recent regulatory changes due to SOX. For example, one can instrument for changes in board independence using a dummy variable which indicates non-compliance with SOX requirements prior to its passage (100% independent audit committee; > 50% independence overall). Briefly describe the conditions a valid instrument must satisfy. What are the merits of the two instruments for board independence proposed above? (**6 points**)

A third approach is to provide incentives via compensation contracts.

(g) The design of compensation contracts has attracted much attention, both in practice and among academics, because of the recent empirical development of executive pay in the U.S. Provide an overview of the empirical development of top executives' pay since the 1980's. Be sure to mention the basic components (structure) of executive pay, how the composition and level of executive pay has changed over time, what sample of firms and sample periods you are referring to. (**4 points**)

(h) Empirical research on executive compensation focuses on estimating the sensitivity of executives' pay to the performance of their companies. Explain the agency-theory based motivation for measuring the relation between pay and performance. (**2 points**)

(i) Describe the typical empirical measure of pay-to-performance sensitivity. Then list two empirical problems with these approaches: why may the empirical measure of pay-performance sensitivity used in practice mismeasure this sensitivity? (**4 points**)

(j) Much of the corporate-governance debate about executive pay revolves around the question whether high-rank executives are paid "too much." In this discussion, it often remains vague what is meant with being paid "too much." Propose a useful benchmark for being paid "too much." To what extent (if any) does the sensitivity of an executive's pay to his or her company's performance indicate whether s/he is paid "too much"? **(4 points)**