

# Financial Economics Field Exam — August 2010

There are two questions on the exam, representing Macroeconomic Finance (234A) and Corporate Finance (234C). The two questions have equal weight. 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 - Arbitrageurs and the crowded trade effect**

*All parts of this question have equal weight.*

Consider an economy over three dates,  $t = 0$ ,  $t = 1$  and  $t = 2$ , where the riskfree rate is zero, and the risky asset has a terminal payoff  $V = F + \varepsilon$  at  $t = 2$ . Assume that  $F$  and  $\varepsilon$  are independent, normally distributed, both with mean zero and unit standard deviation. The supply of the risky asset is zero. Assume that the price of the risky asset at  $t = 0$  is  $P_0 = 0$ .

(a) A unit mass of news-watchers observe  $F$  (but not  $\varepsilon$ ) at  $t = 1$ , and form biased expectations  $E^n[V] = (1 - \delta)F$ , where  $0 \leq \delta \leq 1$  measures their bias ( $\delta = 0$  means no bias). They correctly perceive variances, and invest at  $t = 1$  to maximize

$$E^n[w] - (1/2) \text{Var}(w)$$

where  $w$  is their terminal wealth. Show that news-watchers demand  $D^n = F(1 - \delta) - P_1$  shares at  $t = 1$ . What is the equilibrium price  $P_1$  in an economy with only news-watchers? Does it equal fundamental value  $F$ ? Why?

(b) Now suppose that rational (unbiased) arbitrageurs also participate at  $t = 1$ , have the same preferences as news-watchers, and also observe  $F$ . What is their demand at  $t = 1$ ? Is the demand curve of arbitrageurs downward sloping (do they demand more shares when the price is low)? If the mass of arbitrageurs is  $m$ , what is the equilibrium price? Why doesn't it equal fundamental value? Compute  $(P_1 - F)/F$  which measures the extent of mispricing. What happens to this measure when  $m$  increases?

(c) Now suppose that arbitrageurs do not observe  $F$ , but can condition their demand on the price  $P_1$ . To solve for equilibrium, guess that arbitrageurs completely learn  $F$  from  $P_1$ . Given their knowledge of  $F$ , how many shares do they demand? What is the implied equilibrium price? Is it different from (c)? Verify your guess: does this price fully reflect  $F$ ?

(d) Continuing, given  $P_1$ , how do arbitrageurs compute  $F$ ? Use this to express the total demand of arbitrageurs as  $D^a = m \cdot \phi P_1$  with some constant  $\phi$ . What is the sign of  $\phi$ ? Is the demand curve of arbitrageurs downward sloping now (do they demand more when the price is low)? Why?

(e) What is the momentum effect? Can the logic of the above model help explain the momentum effect? Describe the intuition. Note, while the model itself is static, the logic can also be explained dynamically.

(f) Now suppose that the mass of arbitrageurs is  $m = \theta N$  where  $N$  is known but  $\theta$  is unobserved and has some exogenous probability distribution with support  $[\theta_L, \theta_H]$ . We can think about  $\theta$  as a measure of how "crowded" is this arbitrage trade, i.e., how many other arbitrageurs are active in it. Suppose that arbitrageurs continue to follow a linear strategy, where they each demand  $\varphi P_1$  shares with some  $\varphi > 0$  which they solve for optimally. Given  $\varphi$ , compute the equilibrium price  $P_1$  from the market clearing condition. Does this price fully reflect fundamental value now? Do you expect that arbitrageurs fully learn  $F$ ? Describe the signal extraction problem they face: what are possible reasons for observing a high price

$P_1$ ? Relate this to the externality that early momentum traders impose on late momentum traders in the Hong and Stein (1999) model.

(g) Now suppose that  $N \rightarrow \infty$  (but  $\theta$  continues to be random), i.e., arbitrage capital in this market large, but its exact amount remains uncertain. It can be shown that  $\varphi N$  converges to some finite limit  $\Phi^*$ . Using this, what is the equilibrium price  $P_1$  in the limit? Does competition between arbitrageurs eliminate all mispricing? What are the two conflicting effects of  $N$  growing large? Does competition drive arbitrageurs' profits to zero? (Explain intuitively.) Based on this model, should we conclude in the real world that low profits by arbitrageurs indicate an approximately efficient market?

## Question #2. Corporate Finance - Identifying managerial (mis-)behavior in mergers and acquisitions

This question analyzes managerial decision-making in the context of mergers and acquisitions, in particular the role of moral hazard (empire building), managerial misvaluation (overconfidence), and investors' misvaluation. Consider an acquiror  $A$  and a target  $T$ , consisting of  $K_A$  and  $K_T$  units of capital, respectively, which includes cash. For simplicity, neither firm has debt, and hence the value to shareholders is equal to the units of capital times the valuations per unit of capital,  $S_A$  and  $S_T$ , i.e., the acquiror's value is  $V_A = S_A K_A$  and the target's value is  $V_T = S_T K_T$ . If the merger takes place, the value of the merged company,  $V$ , may be higher or lower than the sum of the merged units of capital, depending on synergies. To capture the value created or destroyed in the merger, we decompose  $V$  into the sum of the merged acquiror-capital, evaluated at  $S_A$ , plus the merged target-capital, evaluated at  $S_T$ , plus (possibly negative) synergies  $e$ . Target shareholders agree to the merger if they are paid at least the current value of the target company (in cash or stock).

1. As the default case, assume that the CEO of the acquiror  $A$  maximizes the value owned by current  $A$ -shareholders and that there is no asymmetric information about valuations, including the synergies  $e$ 
  - (a) Derive the value of the (portion of the) merged company **owned by old (acquiror) shareholders** and calculate the fraction  $\alpha$  of the merged company that will be owned **by new (target) shareholders** (if any) under (i) full cash financing and (ii) full stock financing. Denote the amount of cash used by  $c$ . (4 points)
  - (b) Conclude for which  $e$  a merger will take place, i.e., when the acquiror CEO will want to pursue a merger and target shareholders agree to tender their shares, and how it will be financed. Provide the intuition for your findings. (3 points)
  - (c) What are the acquiror's and the target's announcement returns (in %) and what are the acquiror's long-run abnormal returns (in %, including the announcement effect) if a merger takes place? (3 points)
2. Now consider an empire-building CEO. Rather than maximizing the value owned by (old) shareholders he maximizes his personal benefit, which is proportional to the total value (i.e., the total size) of the company. Denote the personal benefit with  $\gamma V$  (or  $\gamma V_A$  if no merger takes place).
  - (a) What is the CEO's utility under no merger, a cash-financed, and a stock-financed merger, as a function of the firms units of capital and, if applicable, synergies? (2 points)
  - (b) Conclude when a merger takes place and how it is financed. Provide the intuition for your findings. (3 point)
  - (c) What are the acquiror's and the target's announcement returns (in %) and what are the acquiror's long-run abnormal returns (in % including the announcement effect) if a merger takes place? What are the differences to the baseline case without empire building (Question 1) if any? (2 points)

3. As a further alternative, consider an overconfident CEO, who attempts to maximize the value owned by (old) shareholders but overestimates the true value of his current company to be  $\hat{S}_A > S_A$  per unit of acquiror-capital. In addition, he overestimates the synergies to be  $\hat{e} > e$  if the merger takes place.
- What is the CEO's perceived value of the (portion of the) company owned by old (acquiror's) shareholders under no merger, a cash-financed, a stock-financed, and a mixed-financing merger? (*4 points*)
  - Conclude when a merger takes place and how it is financed. Provide the intuition for your findings. (*5 points*)
  - What are the acquiror's and the target's announcement returns (in %) and what are the acquiror's long-run abnormal returns (in % including the announcement effect) if a merger takes place? What are the differences to the baseline case without empire building (Question 1) if any? (*2 points*)
4. Return to the assumption of a rational CEO, who maximizes the value owned by (old) shareholders, but allow for investor misvaluation. Specifically, the acquiror's company is currently misvalued at  $\tilde{S}_A$ , either overvalued at  $\tilde{S}_A > S_A$  or undervalued at  $\tilde{S}_A < S_A$ . The target company is valued correctly at  $S_T$ , and synergies are correctly perceived to be  $e$ . Assume that investors correct their misvaluation at some time after the merger is completed (or would have been completed if the CEO decides not to pursue it.)
- What is the CEO's perceived long-term value of the (portion of the) company owned by old (acquiror's) shareholders under no merger, a cash-financed, and a stock-financed merger? (*4 points*)
  - Conclude when a merger takes place and how it is financed. Provide an intuition for your findings. (*5 points*)
  - First, as a benchmark, calculate the acquiror's longterm returns (in %) if no merger takes place. What are the acquiror's and the target's announcement returns (in %) and what are the acquiror's long-run abnormal returns (including the announcement effect) if a merger takes place in the different scenarios under which a merger does take place? Make sure to sign the effects. (*6 points*)
  - Consider the case of zero synergies. In the scenario under which a CEO does a stock-financed merger, show that shareholders are still better off than if the CEO does not pursue a merger. Explain the intuition. (*3 points*)
5. Now consider the empirical implications of your analysis above. (If you got stuck in one of the questions, just use your intuition!)
- List the possible explanations (among the four scenarios we have considered) for a stock-financed merger with negative longterm returns and whether they imply that the merger is value-destroying or not. (*2 points*)
  - Explain how one could distinguish between the possible explanations, theoretically, why it is hard to do so empirically, and suggest an empirical approach (even if imperfect) to distinguish the two explanations. (*5 points*)