

# Financial Economics Field Exam — August 2007

There are three questions on the exam, representing Asset Pricing (236D or 234A), Corporate Finance (234C), and Empirical Finance (239C). Please answer *exactly* two 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 an economy with two traded assets, a safe asset with net return zero, and a risky asset that makes a single dividend payment of

$$D_T = D_0 + \sum_{j=0}^T \varepsilon_j$$

on a finite future date  $T$ . Here  $\varepsilon_j \sim N(0, \sigma^2)$  are i.i.d., and each  $\varepsilon_j$  can be decomposed as  $\varepsilon_j = \varepsilon_j^1 + \varepsilon_j^2 + \dots + \varepsilon_j^z$  for some fixed  $z > 0$  integer, where the  $\varepsilon_j^k$  ( $k = 1, \dots, z$ ) are i.i.d. normal.

This economy has  $z$  equal-sized groups of news-watchers, who gradually learn the information contained in the  $\varepsilon_j^k$  news. Learning about  $\varepsilon_{t+z-1}$  starts in period  $t$ , when group 1 observes  $\varepsilon_{t+z-1}^1$ , group 2 observes  $\varepsilon_{t+z-1}^2$ , and so on, with group  $z$  observing  $\varepsilon_{t+z-1}^z$ . In period  $t+1$ , groups “rotate” in learning about  $\varepsilon_{t+z-1}$ : now group 1 observes  $\varepsilon_{t+z-1}^2$ , group 2 observes  $\varepsilon_{t+z-1}^3$ , and so on, with group  $z$  observing  $\varepsilon_{t+z-1}^1$ . Thus all subinnovations of  $\varepsilon_{t+z-1}$  are observed by exactly two groups at the end of period  $t+1$ . Learning about  $\varepsilon_{t+z-1}$  continues in this fashion over the subsequent periods, and by the end of period  $t+z-1$ ,  $\varepsilon_{t+z-1}$  becomes publicly known. This procedure implies that at the end of some date  $t$ , any given agent knows  $\varepsilon_t$  completely, knows  $z-1$  of the  $z$  sub-innovations in  $\varepsilon_{t+1}$  (i.e., a “share”  $(z-1)/z$  of  $\varepsilon_{t+1}$ ), knows a share  $(z-2)/z$  of  $\varepsilon_{t+2}$ , and so on, and knows a share  $1/z$  of  $\varepsilon_{t+z-1}$ . Thus, while agents in different groups have different information, on any given date they have the same “amount” of information. (Throughout this problem, you can assume that  $t$  is much smaller than  $T$ , so  $t+z-1$  does not “bump” into  $T$ ).

(a) Suppose that news-watchers have utility function

$$U = E[-\exp\{-a \cdot c_T\}]$$

where  $c_T$  is consumption in period  $T$  and  $a$  measures risk aversion. News-watchers choose their portfolios on every date  $t$ . Each time, however, they assume (incorrectly) that they will have to hold their chosen portfolio until  $T$ , i.e., that they will not be able to rebalance before  $T$ . Show that, under these assumptions, the number of shares of the risky asset demanded by a news-watcher in group  $i$  on date  $t$  is

$$x_{it} = \frac{E_{it}[D_T] - P_t}{a \cdot \text{var}_{it}[D_T]}$$

where  $P_t$  is the asset price, and  $E_{it}$  and  $\text{var}_{it}$  are the conditional mean and variance. Explain the comparative statics of  $x_{it}$  with respect to  $E_{it}[D_T]$ ,  $\text{var}_{it}[D_T]$  and  $a$ .

(b) Assuming that news-watchers only use information contained in the news they observe when computing  $E_{it}[D_T]$  and  $\text{var}_{it}[D_T]$ , (i.e., that they ignore the information content of the asset price), prove

$$\frac{1}{z} \sum_{i=1}^z E_{it}[D_T] = D_t + \frac{1}{z} [(z-1)\varepsilon_{t+1} + (z-2)\varepsilon_{t+2} + \dots + 2\varepsilon_{t+z-2} + \varepsilon_{t+z-1}]$$

where  $D_t = D_0 + \sum_{j=0}^t \varepsilon_j$ .

(c) Denote the supply of the risky asset by  $Q$  and assume that there is a unit mass of news-watchers (so each group has a mass of  $1/z$  people). Write down the market clearing

condition for the risky asset. Using the notation  $\theta = a \cdot \text{var}_{it} [D_T]$ , and treating  $\theta$  as a constant (this can be justified if  $T$  is very large), rewrite this condition to express  $P_t$ .

(d) Now suppose that the price of the asset at time  $t - 1$  is  $P_{t-1} = 0$ , and then a single shock of  $\varepsilon_{t+z-1}^1 = 1$  occurs, after which all other sub-innovations equal zero. Plot the asset price  $P_s$  against time  $s$  for  $t - 1 \leq s \leq T$ . Is the asset underpriced/overpriced in the short term? In the long term? Explain the intuition. What facts in finance are consistent with this model?

Now we add another class of agents, called momentum-traders. Suppose that at the beginning of each date  $t$ , momentum traders submit a quantity order  $\phi \cdot \Delta P_{t-1}$ , where  $\phi > 0$  is an exogenous parameter, and  $\Delta P_{t-1} = P_{t-1} - P_{t-2}$  is the price change in the previous period. Momentum traders then hold their positions for  $j$  periods. There are  $j$  generations of momentum traders, thus at each date  $t$ , exactly one generation submits a new quantity order.

(e) The quantity orders of momentum traders can be thought of as affecting the supply of the risky asset  $Q$ . Using this insight, express the asset price  $P_t$  as an ARMA process.

(f) Assuming that  $P_s = 0$  for all  $s \leq t - 1$ , and that  $\varepsilon_s^i = 0$  except for  $\varepsilon_{t+z-1}^1 = 1$ , plot  $P_s$  against time  $s$  for  $t - 1 \leq s \leq T$ . Is the asset underpriced/overpriced in the short term? In the medium term? In the long term? Can this model explain additional facts relative to the pure news-watcher model?

(g) Now suppose you add a positive mass of fully rational agents. Will they eliminate all mispricing? Why?

## Question #2. Corporate Finance

Consider a company  $A$  that announces the acquisition of another company  $T$ . The acquisition is fully stock-financed:  $A$  has  $s$  shares outstanding and issues additional  $s'$  shares to target shareholders. The stand-alone values one day prior to the merger announcement are  $V_{-1}^A$  and  $V_{-1}^T$  and one day after the merger announcement  $V_{+1}^A$  and  $V_{+1}^T$ . Let's assume that the merger is completed at the end of the day after the merger announcement (lawyers and investment bankers have become incredibly fast and efficient ...), and denote the value of the joint company on that day by  $V_{+1}^{AUT}$ .

(a) Provide the formula for the 'announcement effect', separately for  $A$  and  $T$ , to measure the abnormal returns from the merger for the shareholders of acquiring company and for the target company. Provide also the formula for overall abnormal returns, measuring the net announcement effect, denoting the market return from day  $-1$  to day  $+1$  by  $R_{-1,+1}^m$ .

(b) Suppose that you find that the abnormal acquiror returns are negative, but you believe that the negative returns do not indicate that the merger is (jointly) value-destroying across the two companies. Rather you suspect that  $A$  'overpaid' so that  $A$ -shareholders are worse off. How can we use the abnormal returns calculated above to test this hypothesis? Calculate the threshold value for the number of newly issued shares,  $\bar{s}'$ , so  $A$  overpays iff  $s > \bar{s}'$ . Provide an interpretation of the formula.

(c) Calculate the minimum number of shares,  $\underline{s}'$ , for which  $T$ -shareholders are willing accept the tender offer. Provide an interpretation of the formula. Explain why  $A$  may need to pay more than the minimum, i.e., why  $s > \underline{s}'$ , due to 'free-riding' as pointed out by Grossman and Hart (1980). Assume that  $A$  needs to acquire at least 50% of  $T$ -shares for the merger to be completed.

(d) Suppose that the additional test from (b) indicates that the negative abnormal returns to  $A$  are not (only) due to overpayment, but you are still not convinced that the merger is value-destroying. List two more alternative interpretations of the negative abnormal acquiror returns, which allow for the merger to be value-creating, with a brief explanation.

(e) At the morning of the second day after the merger, before the markets open, the Department of Justice decides not allow the merger for anti-trust reasons. (Inspired by our fast lawyers and bankers, the DOJ has become incredibly fast, too ...) Explain how one can use this policy experiment to distinguish between value destruction and the alternative interpretations you listed under (c). Be specific about the returns you calculate to test different explanations.

(f) Suppose that your calculations from (d) indicate that your initial prior was right: Despite the negative abnormal announcement effect, you can use the policy experiment to prove that the merger was value-creating (or, rather, would have been value-creating, had it gone through.)

Explain why one should not generalize the inference from this – why might the abnormal returns to this policy experiment not representative of the average merger in a broad cross-section of mergers?

(g) Let's now assume that the initial negative abnormal returns of the acquirer were due to overvaluation, as pointed out by Shleifer and Vishny (2003), even though the merger was value-creating (or, rather, even though the merger would have been value-creating had it gone through). What will be the stock price reaction of  $A$  to the announcement of the merger break-up? Specify both the sign of the returns and whether  $A$  will reach its pre-merger level  $V^A$  again (adjusted for daily expected returns).

(h) The table below is from a recent working paper (Savor, 2006), in which the author undertakes a similar exercise as the policy experiment discussed above. (He uses a broad sample of 'failed bids' including all failed bids other than those failed "due to mispricing of the acquirer. See the notes for a definition of the other subsamples.) Discuss the results in the table. In particular, discuss what the first and fifth column (+/-1 day returns) imply, given your calculations and derivations above. Then discuss the additional insights from columns 2-4 and 6-8. How do you interpret the differences between stock-financed and cash-financed bids?

Table VIII: Acquirer Announcement and Long-Term Abnormal Returns upon Merger Termination

Full Failed Sample contains all unsuccessful bids. Restricted Failed Sample contains only bids that fail because of developments affecting the target or because of exogenous reasons. Exogenous Failed Sample contains only bids that fail for exogenous reasons. Abnormal returns over a  $(-m, +n)$  event window around the bid termination announcement date ( $AR_{-m,n}^F$ ) are computed as the difference between the buy-and-hold return for the acquirer and the buy-and-hold return for a portfolio of 10 firms matched on industry, size, and market-to-book.

Panel A: Full Failed Sample								
	Stock-Financed Acquirers				Cash-Financed Acquirers			
	$AR_{-1,+1}^F$	$AR_{+2,+250}^F$	$AR_{+2,+500}^F$	$AR_{+2,+750}^F$	$AR_{-1,+1}^F$	$AR_{+2,+250}^F$	$AR_{+2,+500}^F$	$AR_{+2,+750}^F$
Mean	0.024	-0.194	-0.245	-0.397	0.028	0.091	0.199	0.240
T-stat	2.54	-4.53	-3.88	-4.74	1.13	1.53	1.23	1.44

  

Panel B: Restricted Failed Sample								
	Stock-Financed Acquirers				Cash-Financed Acquirers			
	$AR_{-1,+1}^F$	$AR_{+2,+250}^F$	$AR_{+2,+500}^F$	$AR_{+2,+750}^F$	$AR_{-1,+1}^F$	$AR_{+2,+250}^F$	$AR_{+2,+500}^F$	$AR_{+2,+750}^F$
Mean	0.023	-0.224	-0.255	-0.392	0.005	0.124	0.262	0.360
T-stat	2.86	-3.84	-3.03	-3.48	0.56	1.38	1.09	1.56

  

Panel C: Exogenous Failed Sample								
	Stock-Financed Acquirers				Cash-Financed Acquirers			
	$AR_{-1,+1}^F$	$AR_{+2,+250}^F$	$AR_{+2,+500}^F$	$AR_{+2,+750}^F$	$AR_{-1,+1}^F$	$AR_{+2,+250}^F$	$AR_{+2,+500}^F$	$AR_{+2,+750}^F$
Mean	0.027	-0.220	-0.249	-0.289	0.006	0.181	0.329	0.436
T-stat	3.67	-3.73	-3.08	-2.70	0.57	1.66	1.11	1.52

### Question #3. Empirical Finance

Imagine that one of your professors has the following intuitive idea about stock valuation. She suspects that stocks of U.S.-listed companies with a higher fraction of their sales in the U.S. have lower expected returns than stocks of companies with a lower fraction of their sales in the U.S. Her view is that investors overvalue stocks with a high fraction relative to those with a low fraction of their sales in the U.S. Her reasons are based on behavioral finance:

(a) When investing, people tend to put money into companies that have recently been brought to their attention, such as through newspaper articles or through direct purchasing of their products and services. Companies that do more of their business in the U.S. are more likely to be brought to the attention of U.S. investors.

(b) If investors have favorable impressions of a company's products or services, they tend to buy shares in that company, but do not tend to short shares of companies when they are disappointed in products or services. Thus on average, the more contact that investors have with a company's products or services, the higher will be the demand for the company's stock.

Your professor has asked for your help in testing her hypothesis. Assume you have standard data on stocks. You also have, for each stock, an annual time series on the fraction of the company's annual sales that were made in the U.S.

Your job

1. You first want to test whether companies with higher fraction of sales in the U.S. have lower expected returns. What testing strategy do you recommend? Describe your recommended strategy step by step, including the data retrieval and a description of the assets that you choose to study, the empirical model you want to estimate (including the calculation of standard errors), and the hypothesis tests you want to construct. Make sure to write out the regression equation(s) and to define your variables. How can we be sure that any cross-sectional variation in expected returns associated with sales are not driven by other reasons for variations in expected returns, such as differences in market betas?
2. Suppose that having a higher fraction of U.S. sales does predict lower expected returns. However, companies that do business primarily outside the U.S. are probably subject to different economic shocks than are companies that do business primarily in the U.S., suggesting a risk-based explanation for your findings. What kind of risk might these companies be subject to? How would you construct a factor that captures this source of risk? Can you test whether this risk factor affects expected returns? Do these results help distinguish between behavioral and risk-based explanations for the patterns that you uncover?
3. Suppose you can collect additional data to test the specific behavioral explanation outlined above against the story that companies selling abroad are more exposed to an additional source of risk. What data would you collect? How would you go about testing this?
4. Risk-based and behavioral explanations have also been proposed for the "standard" factors in finance. Provide two distinct risk-based explanations for the value effect. How would you test these? Use your knowledge of the data and the literature (such as Yogo, 2007) to evaluate the validity of these explanations.