Boston College, MF 820
Spring 2005, Answers
Professor Strahan
Final Exam

Name:_____

Write all answers on the exam. You may use the back of pages if necessary.
The exam has 100 points.
You are allowed a 1-page, 2-sided cheat sheet. Calculators are permitted, but not computers.
There are 8 pages (some are blank); please verify this! Please read all of the questions carefully!
You have 2.5 hours.
Be brief, but show all relevant calculations (partial credit will be assigned).
Your answers must be legible. Good Luck!

True, False, Uncertain. (7 points each)
Explain why the following statements are true, false, or uncertain

1. Securitization has allowed banks to improve both credit and liquidity risk management, and has thus made banking safer.

U. It is true that securitization improves loan liquidity and makes it easier for banks to shed some of their credit risk. Sometimes a loan, such as a residential mortgage, is removed completely from a bank's balance sheet via securitization. In other cases, typically for business lending where credit risk is more important, the bank will hold some of the securities issued by the SPV (the residual tranche, as in Bistro case), or the bank will sometimes provide credit enhancement. Typically the originating bank will hold the riskiest tranche of these securities, so much of the credit risk remains with this bank even though funding comes mainly from the bond or commercial paper markets. Thus, securitization could lead to riskier banks. Moreover, as we saw in the Bistro case, the Basel I capital regime has encouraged banks to securitize their lowest risk, highest credit quality loans, again potentially leading to riskier banking in general.

2. Small businesses benefit by concentrating their business with a single financial institution.

T. This is the result of research on small business credit (Petersen & Rajan article). Small firms benefit via concentration because the lender can learn about the borrower's credit worthiness over time by establishing a long-term relationship with the firm. Having multiple banks at this stage in a firm's life creates several costs. First, the information available to an individual lender is less useful if the firm has multiple banking relationships, because the lender does not see the whole picture. Second, there would be duplication of effort required to collect information if

there are multiple lenders. Third and perhaps most important, if a small and unknown firm attempts to borrow from additional banks, there is an adverse selection problem because the new (and less informed) bank will tend to assume the worst about the borrower's creditworthiness. As firms get larger (and thus both more reputable and more transparent), it makes sense to have multiple banking relationships in order to reap the benefits of competition across banks.

3. Leverage ratios at financial institutions have become less useful as a measure of risk over time.

T. This is one of the big takeaway points from the LTCM case, where almost all of the economic (opposed to accounting) leverage occurred through off-balance sheet derivatives such as interest rate swaps. Financial institutions can use derivatives either to hedge risks or to add risks, thus making simple balance sheet measures such at leverage (i.e. the ratio of total debt to total assets) increasingly misleading as banks and other financial firms have increased their use of derivatives. This explains why modern approaches to risk management take an integrated approach to all positions, both on and off the balance sheet, and focus on the distribution of changes in shareholder wealth using techniques such as VAR. Also, it is pretty standard today for financial institutions to disclose and discuss the VAR in quarterly and annual reports.

4. The Basel II capital accord removes the incentive for banks to hold excessively risky loans.

U. The statement represents one of the goals of Basel II. A major defect of Basel I, as we saw in the Bistro case, is that it gives banks a strong incentive to sell or securitize their safest loans, and to hold their riskiest loans, because the required capital under Basel I is the same for all loans to businesses regardless of credit risk. Under Basel II, the capital requirement is based on objective measures of the borrower's expected default frequency (or rating), as well as the loss given default. This is a big step in the right direction. Basel II, however, will not fully resolve the problem of 'regulatory arbitrage' because required capital will not reflect the systematic risk embedded in a loan. For example, loans with high levels of systematic risk (e.g. loans that tend to default during business downturns) will receive higher yields than loans that default randomly (because the market demands a higher average return for loans with more systematic risk). Thus, banks should hold more capital against such loans, since they are likely to default when the bank's portfolio as a whole is doing poorly. But, the Basel II approach does not account for this at all. Therefore, banks continue to have some incentive to hold loans with high levels of systematic risk relative to those with lower levels of systematic risk, all else equal.

5. Firms benefit by using their lender to act as lead underwriter when they issue public equity for the first time in an IPO.

U. There is a tradeoff that we discussed in the ABN Amro case between certification v. conflict of interest when a firm uses its lender to underwrite securities (especially equity). On the one hand, informed underwriters (past lenders to the firm) can do a better job of pricing the offering, and if the underwriter is reputable (i.e. trusted by the market), then the issuer will probably get a

higher price in the offering. On the other hand, there is a clear potential conflict of interest for the underwriter; for instance, the underwriter might be tempted to push an offering in order to protect its loans to the issuing firm from defaulting. This conflict would lead investors to be less willing to purchase securities if the underwriter is not trusted by the market - for example, if the underwriter were not experienced and reputable.

Longer Questions

1. Imagine that you are managing a trading portfolio with 100 shares of stock in Samsung. The current price is 12,800 Won (the South Korean currency). The standard deviation of the daily return on Samsung estimated over the past 3 months is 1 percent.

A. Use delta normal to compute the 1-day, 99% VAR for a South Korean bank (i.e. in Won). (5 points)

Delta = 100; sigma = 0.01; the risk factor equals the price of the stock (P)

So, VAR(1-day, 99%) = $2.33*\Delta*P*\sigma = 2.33*100*(12,800)*0.01 = 29,824$ Won

B. The $/Won exchange rate is currently 1/980 (that is $1 = 980 Won), and the standard deviation of the exchange rate (in percentage terms) is 0.4% per day, again using the past 3 months of data. Also, the correlation between the percentage change in the exchange rate and the return on Samsung is estimated to be equal to 0.5. Use delta normal to compute the 1-day, 99% VAR for the same trading portfolio from the perspective of a US bank (i.e. in dollars). (10 points)

The portfolio Value in Dollars = 100*P*E; where P = Samsung price in Won=12,800; E = $/Won exchange Rate= 1/980. There are 2 risk factors now, so we need to compute 2 VARs, and then aggregate them up to the portfolio level. From above, the risk in the stock price is 29,824 Won = $30.43.

To compute the Exchange-Rate VAR, we need the Delta with respect to the exchange rate, which equals 100*P = 1,280,000

So, VAR(1-day, 99%) = $2.33*\Delta^E*E*Sigma^E = 2.33*1,280,000*(1/980)*0.004 = \$12.17$

The portfolio VAR in dollars = $\sqrt{}[30.43^2+12.17^2+2(0.5)(30.43)(12.17)]$ = **$38.01**

C. During past three months, the $/Won exchange rate decreased by 2 percent (this was the largest absolute change during the period). Also, the standard deviation of the percentage change in the exchange rate was 1% per day during the first three months of last year. How do these additional facts affect your assessment of risk if you are running a US bank? What other risk

measures would you like to see? (10 points)

Two issues are of immediate concern with these new facts. First, the exchange rates are probably NOT normally distributed if there was a 2% decline over the past 3-months. That translates into an exchange rate change equal to 5 standard deviations (0.02/0.004 = 5), which is exceptionally unlikely under a normal distribution. The delta normal method only works well if distributions are approximately normal; the approach is particularly poor as you move further out into the tails of the distribution (i.e. 99% VAR is off, but the 99.9% VAR would be even worse).

Second, the distribution of the exchange rate may not be stable over time. Clearly the data were much more variable last year, and we are missing that variation by focusing only on the past three months. This may be OK if market conditions remain as they are now, but if conditions change, then our VAR could massively *understate* the true risk.

As a risk manager, I would like to see the following additional items:

> Historical estimation rather than delta normal, so that we do not impose an distributional assumptions on the data;
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> Stress tests - compute the worst loss that we would experience using the past 3-months of data, for example;
>
> Vary the estimation period - recompute the VAR using a much longer estimation period so that we are sure to capture periods of high volatility. Also, recompute the stress tests using a much longer estimation period.
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> You also might want to consider specific scenarios (War with North Korea?), and think about what would happen to your portfolio under such nightmare scenarios

2. There are three types of innovative firms in the economy: smart firms, average firms, and dumb firms. Smart firms produce designs for projects that succeed 90% of the time, average firms produce designs for projects that succeed 80% of the time, and dumb firms produce designs for projects that succeed 70% of the time. The innovators know their own type (i.e. the smart firms know they are smart, etc.). Each design is worth $1 million when successful and $0 when unsuccessful.

Assume that potential investors (i.e. buyers of designs) can't distinguish firm types, but know that there are 1000 firms of each type. Innovative firms are willing to sell designs to investors if the price offered is greater than or equal to the expected value of the design.

A. Holding constant the share of each firm in the economy, how much would an investor be willing to pay for a new project design?

Investors will be willing to pay the expected gross return based on the average across all three firm types. This equals the following expression: (1/3)*0.9*$1 million+(1/3)*0.8*$1 million+(1/3)*0.7*$1 million = $800,000.

B. Which firms will be willing to sell their designs at the price found in A?

At a price of $800,000, only the average and dumb firms will be willing to sell their projects! The smart firms will not sell because their projects are worth $900,000.

C. Is the price in part A an equilibrium price? Why or why not? If not, explain what the equilibrium will look like. That is, explain what the price of designs actually sold will be and what type of designs get sold.

Based on the answer to B, we can see that $800,000 is not an equilibrium. At this price, the smart firms drop out, so the expected return on the projects falls to: (1/2)*0.8*$1 million+(1/2)*0.7*$1 million = $750,000. At a price of $750,000, however, the average firms now will not want to sell, since their projects are worth $800,000. Thus, the equilibrium price must equal $700,000. At this price, only the dumb firms sell their projects.

D. What happens to the equilibrium if investors can tell the difference between firm types?

If investors can tell the difference between firm types, then each firm will sell its project at a different price. Smart firms will sell for the expected return of $900,000; average firms will sell for the expected return of $800,000; and dumb firms will sell for the expected return of $700,000.

E. Is this a moral hazard problem?

No. Since the firms' actions are not affected by the financing decisions, there is no moral hazard

problem here. The problem is adverse selection. Since investors could not determine who was good and who was bad, only the bad firms were able to sell their projects.

3. Why are Alan Greenspan and the Bush Administration worried about the GSEs (Fannie Mae and Freddie Mac)? Describe the possible ways to address these worries, and the costs and benefits associated with each policy prescription. What should be done, if anything? How is the situation with the GSEs similar to or different from the S&Ls during the 1980s? (20 points)

The big concern with the GSEs is related to their dramatic growth over the past 10 years, combined with the market's clear belief that the GSEs are de facto insured or protected by the government. For example, the GSEs borrow at rates that are below AAA, most likely because market participants believe that their bonds would be bailed out in default by the government. Thus, the GSEs have a strong incentive to buy and hold, rather than buy and securitize, mortgages, thereby reaping the benefits of their ability to borrow at subsidized rates. This incentive has been exploited massively, so that each of the 2 main GSEs holds nearly $1 trillion in mortgages today. This huge portfolio potentially exposes the GSEs to interest rate risk; in addition, the GSEs are exposed to credit risk not only with repsect to mortage that they hold by also those that they have securitized. This is a classic case of moral hazard associated with government guarantees.

Concern about the GSEs came to a head in recent years when they have seemed to have engaged in income smoothing that makes their profits appear less volatile than they really are. Why is this a concern? Because the GSEs are so large and hold very little capital - much less than banks as a fraction of their balance sheets. With so much leverage, a small error in hedging the interest rate risk could lead to insolvency. Some observers also worry that the GSEs are so large that their attempts to hedge interest rate risk in derivatives markets could destabilize a large number of their counterparties.

How can we address the risks concentrated in the GSEs? One solution is to increase regulation - increase scrutiny of GSE activities by outside monitors. Another solution, which is being done now to some degree, is to force the GSEs to hold more capital (e.g. Fannie Mae cut its dividend). Capital helps reduce the likelihood of insolvency, and also reduces the GSEs incentive to hold a high-risk portfolio. The third solution, and the one Greenspan has pushed, is to force the GSEs to be smaller. This last solution is intended to get at the root of the moral hazard problem itself, which is that the market perceives (rationally) that the GSEs are 'too big to fail'. Each of these three solutions would increase costs to the GSEs, but currently almost all of the value embedded in the government subsidy goes to GSE shareholders, rather than to homeowners.

Finally, there are clear parallels with the S&Ls during the 1980s, which used insured deposits to grow rapidly and exploit the subsidy associated with having government guarantees. A big difference, however, is that the GSEs are much larger and more concentrated. This creates two differences, one good and the other bad. On one hand, being very large worsens the 'too big to

fail' problem and helps make the GSEs a more potent political force (although the S&Ls weren't so shabby at politics). However, because there are just 2 GSEs and because they are so profitable, they have strong incentives to avoid failure - to fail would kill the goose that is laying all of those golden eggs!