Boston College
MF 820
Professor Strahan
Midterm Exam Answers
Spring 2006

True, False, Uncertain.
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. Direct finance is more efficient than indirect finance because you do not need to compensate a financial intermediary.

F. Direct finance is not always feasible. When information asymmetry is important – for example at small and young firms – the outside investor must take steps to collect information to overcome adverse selection problems (e.g. the problem of attracting low quality or high risk borrowers) and moral hazard problems (e.g. the problem of borrowers not working hard once they have received financing). Since information collection is costly, it is more efficient to delegate this job to a single intermediary, rather than have many diffuse investors attempt to do it. Thus, for some borrowers, indirect finance is more efficient and thus less costly than direct finance. (Also see the answer to the last long problem for more on this issue.)

3. Value-at-risk tends to understate the true risk during periods of high market volatility.

U. Depends on the modeling approach. If the VAR is based on a short historical estimation period, or if the model places most of its weight on data from the recent past, then the VAR will reflect periods of high (and low) volatility. However, if the VAR is based on a very long periods of data, it will tend to understate risk when markets are unusually volatile, and overstate risk when markets are unusually calm. Of course, if the market abruptly shifts from one of low volatility to one of extremely high volatility, no model will be able to pick this shift up until it has been going on for a while. Concern about such 'regime shifts' is one reason why things like

scenario analyses and stress tests are prudent.

4. The breakeven interest rate on a loan depends only on the loan's probability of default and its loss given default (i.e. its salvage value).

F. The breakeven interest rate depends on both the expected payoffs to the loan (which depend on the interest rate charged, the loss given default and the probability of default) and on the loan's *required return*. The required return itself depends on loan risk. Loans that tend to default during systematic downturns (i.e. high-beta loans) will tend to have to come with a higher required return to compensate the lender for bearing systematic risk relative to loans that default randomly (or loans that default during economic booms, which are rare).

5. A rational investor would not lend to a U.S. commercial bank at 3 percent when numerous creditworthy borrowers are willing to pay 6 percent for the same funds.

F. What matters is each asset's "net all-in return." The expected net explicit and implicit return to the investor may be lower than 3 percent on direct loans and higher than 3 percent on deposits. Banks offer yields to depositors in convenience, liquidity, and options on other services that the customer may request. Moreover, the default risk on bank deposits is extremely low, in that a reputable bank's credit is supported by a diversified portfolio, risk-management policies, and guaranteed by the FDIC.

6. The risks of a receive-fixed, pay-floating rate swap are equivalent to the risks of buying a fixed rate Treasury financed by short-term borrowing.

F. There is a difference in credit risk. In the case of the swap, the counterparty is usually a bank, which could default on the swap. In contrast, there is a lower probability that the U.S. government would default on its Treasury Securities.

Longer Questions

1. Bank Two has the following ***market-value*** balance sheet (expressed in millions of dollars):

Assets	
Short Term Loans	1000
Long-Term Loans	500
Liabilities	
5-year CDs	1350
Net Worth	150

The short-terms loans are zero coupon and repaid at the end of 1 year. The long-term loans are zero coupon loans that mature in 3 years. On the liability side, the 5-year CDs are also zero coupon.

Assume that the yield curve is flat and interest rates are 5% today.

a. Compute the exact and approximate changes in the value of Bank Two's net worth for a 1% increase in interest rates.

Exact change:

$$[1000x(1.05/1.06)-1000]+[500x(1.05^3/1.06^3)-500]-[1350x(1.05^5/1.06^5)-1350]$$

$$= \quad [991-1000]+[486-500]-[1288-1350] = \quad 39$$

Approximate change (duration):

D*(short-term loan)	=	1/1.05	=	0.952
D*(long-term loan)	=	3/1.05	=	2.857
D*(CDs)	=	5/1.05	=	4.762

$$D^*(NW) = 0.952x(1000/150)+2.857x(500/150)-4.762x(1350/150) = -26.988$$

So:

$$\text{Change in NW} = -(-26.988)x150x0.01 = 40.48$$

b. Does Bank Two's net worth have positive or negative convexity?

Since the approximate increase in equity is larger than the actual change in equity, we know we have *negative* convexity. Convexity =~ Actual change - approximate change = 39 - 40.48 < 0

c. Suppose you want to duration hedge the bank's equity by buying a 10-year Treasury STRIP

financed with overnight borrowing in the interbank market. How many STRIPs do you need to purchase? (A Treasury STRIP is a zero-coupon bond based on U.S. Treasuries.) (8 points)

We need enough STRIPs so that the new position will *decrease* in value by $40.48m when rates rise by 1%. Note that since we finance the position with overnight borrowing, the additional liabilities do not change in value with rates, so we can ignore them.

D* of STRIPS = 10 / 1.05 = 9.5238

Let STRIP be the market value of STRIPs that we want to add to the firm's balance sheet. Then we want:

-40.48 = -(9.5238)xSTRIPx(0.01) ==>

So, we need to add $425 in STRIPs to the asset-side of the bank's balance sheet to make the duration of net worth equal to zero.

d. What are the drawbacks to the strategy in part c relative to hedging with interest rate swaps? (4 points)

The main drawback here is that we need to fund the position with $425 million in additional borrowing in the overnight market. This could create a liquidity problem if something goes wrong and the bank has trouble borrowing. The interest rate swap does not require any capital to set up the hedge. A cost of using the swap, however, is the addition of counter-party risk, which needs to be managed carefully.

2. Here are the returns on IBM's stock over the past 50 days, sorted from highest to lowest:

0.024761
0.022764
0.02217
0.021297
0.017776
0.015693
0.01538
0.01532
0.014075
0.013994
0.013832
0.010394
0.008982
0.007824
0.0076
0.007089
0.00707
0.006769
0.005239
0.005148
0.004462
0.004427
0.001976
0.001021
-0.00167
-0.00169
-0.00451
-0.00468
-0.00486
-0.0057
-0.00615
-0.00754
-0.00961
-0.01034
-0.01112
-0.0122
-0.01234
-0.01498
-0.01545
-0.01578
-0.01878
-0.01888
-0.01964
-0.02352
-0.02394
-0.02551
-0.03283
-0.04634
-0.04712
-0.04763

a. You have a position worth $100 million in IBM's stock. What is the 1-day VAR with 95% confidence using historical simulation?

Our 95% VAR over 1-day will be somewhere between the second and third worst returns for IBM's stock over the estimation period (since 2/50 = 0.04 and 3/50=0.06). So,

VAR(95%) between:

0.04634x($100m) = $4.634m

and

0.04712x($100m) = $4.712m

b. The standard deviation of the return series above is 0.0174. Compute the 1-day VAR with 95% confidence using Delta-Normal. Why are the two methods so different?

VAR(95%) = (1.65)(0.0174)x100 = 2.871m

The difference reflect the non-symmetry of IBMs return over the past 50 days. The normal distribution is symmetric, but over this period IBMs low returns (which matter for VAR) were much worse than their high returns were good (best return is only about 2.5%). So, by assuming normality we reach a very different answer.

c. Provide an estimate of the VAR over a 1-year holding period. What assumptions are you making for this to be valid? (4 points)

We can use the root t rule, applied to the Delta-Normal estimate:

VAR(95%, 1-year) = $\sqrt{}$250x(2.871) = $45.39m

Assumptions:

Zero expected return.

To adjust, you would subtract the expected return over 1 year, which in this case would be around $10 million (about 10% per year, say).

IBM stock has a normal distribution

IBM's returns are independently distributed over time. Without independence, the root t rule does not work! (Many people in class missed this part.)

It does not make sense statistically to apply the root t rule to the historical simulation estimate.

5. Describe the key differences between bank loans and bonds. Explain what kinds of firms are more likely to issue bonds and why. Explain what kinds of firms are likely to use bank loans instead and why.

The first part of the question is pretty much straight out of the lecture notes (I have elaborated a little):

> The key difference between bonds and bank loans has to do with their ownership. Bonds are owned by many investors, whereas bank loans are owned by one or, in the case of syndicated lending, a few banks.
>
> Because bank loans are owned by one or a few banks (and because banks are specialists in credit-risk management):
>
> > A lot of information is collected before the loan is made (due diligence)
> > Banks loans are usually secured
> > They have many covenants
> > Distressed loans usually worked out
> > And bank loans are relatively illiquid
>
> Concentrated ownership allows a bank to be efficient at both collection of information at the outset of the loan, and diligent monitoring of complex covenants over the life of the loan.
>
> Because bonds are owned by lots of investors:
>
> > Information collection is delegated to ratings agencies
> > Bonds usually not secured
> > Loose covenants
> > Distressed bonds often end up in Bankruptcy Court
> > Bonds are relatively liquid
>
> Diffuse ownership forces bond holders to have to delegate the initial information gathering role to ratings agencies. Also, with diffuse ownership it is harder to engage in active and diligent monitoring during the course of time, hence there tend to be relative few of these.

Firms that suffer from greater information asymmetry are more likely to borrow from banks because the bank has an advantage over the bond market in solving the adverse selection and moral hazard problems. These kinds of firms tend to be smaller, younger, and less reputable.

Bond market borrowers tend to have fewer information problems. Thus, the more diffuse ownership and weaker incentives to do due diligence and to monitor is not as important. The

advantages of liquidity (and diversification) thus trump the disadvantage of having diffuse ownership. Hence, bond market borrowers tend to be larger, older and better established than bank borrowers.