

## Using derivatives to hedge interest rate risk: A student exercise

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### ABSTRACT

In a world of fluctuating asset prices, many firms find the need to hedge in order to avoid or reduce losses. From a gold miner selling gold derivatives to airlines buying oil futures to protect against rising fuel costs, hedging is common practice across many different industries. In this paper, we provide students with a simplified example of a bank hedging against interest rate risk. We provide an exercise that allows students to analyze the interest risk of a bank, calculate how to hedge that risk, and examine the impacts of hedging under different scenarios.

Keywords: derivatives, hedge, finance, investing, investments



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## INTRODUCTION

Risk Management is a key concept in Finance. Firms across the globe find the need to hedge against big swings in asset prices both to lock in prices for planning purposes and to protect against potential losses. Hedging involves a trading position intended to offset unforeseen changes in the price of some reference asset or index. Corporations are exposed to uncertainties regarding the prices of a variety of assets such as currencies, interest rates, equity values, and various commodities. Hedging refers to activities undertaken by the firm in order to mitigate the impact of these uncertainties on the value of the firm. Several different firms use hedging techniques to help manage risk. Southwest is commonly referenced as an example of a company successfully using hedging against increases in jet fuel costs.

A principal measure to gauge a bank's performance is its net interest margin (NIM). Net interest margin is defined as the revenues generated from the bank's assets (commercial loans, auto loans, mortgages and other assets) less the bank's interest expense from its liabilities (primarily from the interest paid on customer deposits) divided by the revenue generating assets. A negative value is a reflection of suboptimal decision making on behalf of the bank's management as interest expenses are greater than the amount of returns generated by investments.

There are a few key factors underlying the bank's net interest margin. The gap ratio is simply the bank's interest rate sensitive assets minus the interest rate sensitive liabilities. Gap analysis provides a measure of the bank's net interest rate risk exposure. The bank's rate sensitive assets and liabilities are those likely to increase or decline significantly in value when interest rates change. A gap ratio greater than 1 indicates there are more rate sensitive assets than liabilities and vice-versa. When interest rates are rising, banks with a gap ratio above 1 will profit. When rates are falling, the opposite holds true.

The profitability of a bank also depends on its net interest spread. The spread is the difference in the rate the bank earns on its assets (loans) and the rate the bank pays on liabilities (deposits). The bank's net interest spread increases as the yield curve steepens. The benefit comes from being able to pay lower rates on short-term deposits and receive higher rates on longer-term loans. Interest rate fluctuations play a crucial role in the profitability of banks and the bank's management must be aware of the impact based on the asset-liability gap and its net interest spread.

This exercise is designed to show students that the performance of a bank is highly sensitive to changes in interest rates and how to control for a given change in rates. Students are placed in the role of CFO for a bank and are responsible for making the decision to hedge and the potential implications of not hedging. Hedging, in the exercise, is performed using both futures and options. We find that an exercise which walks the students through the process of hedging provides superior understanding and retention of the subject versus only receiving a traditional lecture.

The exercise includes an examination of two different banks with simplified structures to focus on the bank's interest rate risk. Each bank exhibits both variable and fixed assets along with fixed expenses and different interest rates applied to each of the assets. Students are provided with information regarding the current prime rate of interest, T-Bill futures prices, and the estimated sensitivity of future prices to changes in the prime rate. Students must use this information to estimate the bank's profitability under the current interest rate environment. The students are also required to estimate the bank's interest rate risk exposure using gap analysis. Once the students figure out the net interest rate exposure for the bank, they must figure out how to use futures contracts to implement a hedging strategy for the institution.

Finally, the students examine four potential scenarios regarding varying levels of prime interest rates. Each successive rate results in a change of the bank's net interest margin, ROA, and ROE. Changes in the prime rate may impact these metrics negatively or positively depending whether the bank's gap ratio is negative or positive. The students calculate the net interest margin, ROA, and ROE under each of the given prime rates in order to compare and contrast the values under the hedged versus not hedged scenarios. For the second bank example, students examine this same information but also include a hedging strategy utilizing options. Options afford an interesting wrinkle as they offer a choice to exercise, not the obligation that futures require. In this second bank example, the students are required to decide not only whether to hedge but also how to hedge, using options or futures.

The in-class exercise provides students with the opportunity to analyze the hedging decisions made by banks using the information provided from a preceding lecture. The task includes calculating the proper hedge, measuring the results under different interest rate scenarios, and deciding if hedging is the superior strategy. We make the simplifying assumption in the exercise that the bank will either be fully hedged or not at all. This assumption could be relaxed to choose different levels of hedging where a set percentage of interest rate exposure could be evaluated. The exercise can easily be expanded to additional topics such as basis risk, margin issues regarding futures, and several others. For example, basis risk may be demonstrated where the futures contract price does not move with the asset price as given within the problem. The type of hedging may also be explored, where students are permitted to choose from several hedging strategies including swaps, forwards, futures, options, or some combination of all of them. In this case each group may be allowed to select their own hedging strategy independently.

## LITERATURE REVIEW AND LEARNING OBJECTIVES

Theoretically, the idea of hedging should not matter, as the costs of hedging should be offset by the benefits. Sometimes asset prices will move in one's favor and sometimes in an adverse direction. This is described in the basic Modigliani Miller (MM) world that hedging does not change the value of the firm. The MM assumptions include the absence of financial distress costs, contracting costs, and capital market imperfections. With this in mind, why would firms hedge. As we relax these assumptions we start to see why firms may want to hedge. Financial distress is a real cost for firms and managers, being risk averse, want to avoid financial distress and will hedge to do so. Since financial distress is costly, firms have incentives to reduce the probability of it occurring. Smith and Stulz (1985) argue that hedging is one method by which a firm can reduce the volatility of its earnings and help firms avoid financial distress and bankruptcy. Furthermore Mayers and Smith (1987) shows hedging reduces the probability that the firm will default on its promised payments. Lower chances of probability of default leads to lower bond costs for the firms.

Froot, Scharfstein, and Stein (1993) examine the role of capital market imperfections in determining the demand for corporate hedging. Since access to capital is costly, firms with investment projects requiring funding will hedge their cash flows to avoid a shortfall thus eliminating the need to access the capital markets. Not included in the MM assumptions is manager's ability (or perceived ability) to predict future asset values given their experience within a certain industry. For instance, Southwest is often acknowledged for their ability to successfully hedge against rising fuel prices. Carter, Rogers, and Simkins (2004) discuss the case of Southwest and their decision to hedge fuel prices.

So, what does research show empirically about hedging and market value of firms? In other words, does hedging increase the value of the firm? Allayannis and Weston (2001) test the relation

between firm value and the hedging of foreign risk. They find that the value of firms that hedge is higher and that this hedging premium is statistically and economically significant. Carter, Rogers, and Simkins (2006) studied the airline industry and find that hedging increases the value of the firm. To the contrary, Jin and Jorion (2006), examined oil and gas producers and conclude that hedging within these firms did not significantly increase their market values. The authors do show that hedging reduced their sensitivity with oil and gas prices but had no correlation to market value. Empirically, there are benefits from hedging in a world with imperfect capital markets and may serve to increase firm value across certain industries and asset types.

With that in mind, we have designed this exercise to increase the comprehension of students who often struggle with the process and analysis required for hedging. The learning objectives for the exercise are:

1. Calculate a bank's interest rate risk.
2. Calculate the amount of futures/options to hedge interest rate risk.
3. Determine if a bank should hedge
4. Determine the best hedging tool, futures or options.

## OVERVIEW

Bank A provides an example of a simplified bank with both fixed and variable assets and fixed and liabilities. Some other simplifying assumptions include; no credit losses, no new loans, and no fee income. The assets provide income to the bank while the liabilities lead to expenses for the bank. Students need to combine this information in order to compute the net interest income and net income for the bank for a given level of the prime interest rate. Information is also provided on futures contracts which may be used to hedge interest rate risk. The interest rate risk is borne from the fact that Bank A has a mismatch of variable (or rate sensitive) assets and variable liabilities.

To open the exercise, the bank's interest rate risk is analyzed and the base case income statement scenario for a given interest rate is calculated. Students are then required to determine the proper number of futures contracts needed to implement a hedge. The basis of this decision stems from examining the futures contract changes in relation to changes in interest rates and then examining the gap between variable assets and liabilities as these will be the only ones impacted by changes in the prime interest rate. The next part of the exercise provides four different scenarios for changes in the prime interest rate which will impact variable assets and liabilities disproportionately. Under each of these scenarios, calculations of net interest margin, ROA, and ROE are completed for a bank that hedged with futures and one that was unhedged. Finally, students will decide whether to hedge or not hedge based upon the four equally weighted probabilities. To this end, students calculate, compare, and contrast the expected value and standard deviation of hedging with futures verse not hedging.

In the second part of the exercise, students examine Bank B which includes the same information as Bank A, but now introduces options as well as futures. This provides another level of intrigue as options owners have the right but not the obligation to exercise their options. Of course the options will only be exercised when it makes financial sense to do so; otherwise the option will simply expire worthless. This piece of the exercise provides three potential scenarios including not hedging, hedging with futures, and hedging with options.

## STUDENT EXERCISE

### Bank A

Bank A has 500 million in assets, of their assets 400 million have fixed interest rates while the other 100 million have variable interest rates tied to prime rate. The fixed rate loans have an interest rate of 7.5% and the variable loans are priced on average at prime plus 1%. Currently prime rate is at 6%. Bank A has 460 million in liabilities, with 160 million in long-term fixed CDs and the remainder in deposits which have variable rates of interest. The long-term fixed CDs are currently averaging a rate of 3.5%, while deposits are based upon prime rate and are priced at 3.0% below the current prime interest rate level. The Bank CFO currently feels that interest rates may increase over the next few months. He has identified T-Bill futures contracts that he may elect to hedge with. The size of the contract is 10,000 T-Bills and is currently priced at 95.00 for a maturity of six-months. The CFO has estimated that a 10 basis point change (0.10 percent or .001) in the prime rate will lead to a 0.20 percent change in T-Bill price in either direction depending on interest rate movements. The banks current fixed expenses are \$14 million.

1. Given the scenario above what is the bank's risk? How can they mitigate this risk? Given the current conditions what is the bank's interest spread/ROA/ROE? How can this spread be affected by changing interest rates?
2. How would you hedge in this situation and how many contracts would you purchase to perfectly hedge your position based upon the size of the contract and the CFO's estimate of price change in the futures contract?
3. What is the effect to the bank's spread, ROA, and ROE if interest rates change to if they hedge and if they do not hedge:
  - a. Prime Rate: 6.5%
  - b. Prime Rate: 5.5%
  - c. Prime Rate: 10%
  - d. Prime Rate: 4%

Assuming that all four had equal probability would you hedge using futures or not? Why?

### Bank B

Bank B has 800 million in assets, of their assets 200 million have fixed interest rates while the other 600 million have variable interest rates tied to prime rate. The fixed rate loans have an interest rate of 6.5% and the variable loans are priced on average at prime plus 1.5%. Currently prime rate is at 5%. Bank B has 740 million in liabilities, with 540 million in long-term fixed CDs and the remainder in deposits, which have variable rates of interest. The long-term fixed CDs are currently averaging a rate of 3%, while deposits are based upon prime rate and are priced at 2.5% below whatever prime is currently priced at. The Bank CFO currently feels that interest rates may decrease over the next few months, but is very uncertain about the direction of future interest rates. He has identified T-Bill futures contracts that he may elect to hedge with. The size of the contract is 10,000 T-Bills and is currently priced at 96.00 for a six-month T-Bill. The CFO has estimated that a 10 bps change in prime

rate will lead to a 0.25 change in T-Bill price by either direction depending on interest rate movements. There are also options available on this future and the cost of both the put and call option are \$1.5 per T-Bill or \$15,000. The bank's current fixed expenses are \$20 million.

1. Given the scenario above what is the bank's risk? How can they mitigate this risk? Given the current conditions what is the bank's net interest margin (NIM)/ROA/ROE? How can this spread be affected by changing interest rates?
2. How would you hedge in this situation and how many contracts would you purchase to perfectly hedge your position based upon the size of the contract and the CFO's estimate of price change in the futures contract?
3. What is the effect to the bank's spread, ROA, and ROE if interest rates change to if they hedge and if they do not hedge? How would this change if you purchased the option on the future?
  - a. Prime Rate: 5.25%
  - b. Prime Rate: 4.00%
  - c. Prime Rate: 9.50%
  - d. Prime Rate: 3.00%

Assuming that all four outcomes had equal probability what would you do and why?

## TEACHING NOTES

The steps of the exercise are outlined below. A numerical summary of the answers to the exercises are provided in the Exhibits at the end of the paper. After lecturing about the application of derivatives and why firms hedge, the exercise is given to students who are given about 10-15 minutes to read through the information. The exercise can be given all at once or can be split into Bank A following a discussion about futures and Bank B following discussions about both futures and options.

### Part 1

#### *Bank A*

1. Given the scenario above what is the bank's risk? How can they mitigate this risk? Given the current conditions what is the bank's interest spread/ROA/ROE? How can this spread be affected by changing interest rates?

$NIM = \text{Net Interest Income} \div \text{Total Assets}$  or  $NIM = (37,000,000 - 14,600,000) \div 500,000,000 = 4.48\%$ .  $ROA = NI \div \text{Total Assets}$  or  $ROA = 8,400,000 \div 500,000,000 = 1.68\%$

\* Banks are highly levered so it is common to observe low ROA values. An ROA of 1% is actually an indication of strong performance.

$ROE = NI \div (\text{Total Assets} - \text{Total Liabilities})$  or  $ROE = 8,400,000 \div (500,000,000 - 460,000,000) = 21\%$

Students can typically work through this part without too many problems. The assumption is students have knowledge of income statements as this is needed to calculate bank spread (or net interest margin), ROA, and ROE. A common student question at this point in the exercise is how to

calculate the bank's equity. It becomes clear quickly when the accounting equation is written on the board ( $A - L = E$ ). The instructor may want to ask the students whether the bank has more variable assets or liabilities and what the impact would be if rates were to rise. Bank A has greater liabilities versus assets and would suffer from rising rates. Bank B is the opposite case with a higher level of variable assets. Banks typically have more variable liabilities because they predominantly raise money through short-term variable deposits and most bank customers' desire fixed rate loans.

2. How would you hedge in this situation and how many contracts would you purchase to perfectly hedge your position based upon the size of the contract and the CFO's estimate of price change in the futures contract?

This is the typically first stumbling block for students. After letting students work for a few minutes on the exercise, guidance on solving this problem may be provided. There are two keys in calculating the requisite number of contracts to hedge properly. First, the students must take the variable assets minus variable liabilities and divide this difference by the hedge ratio. Next, the resulting figure is then divided by the total contract size for T-Bills, which is 10,000 T-Bills. The hedge ratio is calculated by dividing the dollar change in the T-Bill futures contract divided by the corresponding interest rate change. For example for Bank A the -\$200 million gap (interest rate exposure) is divided by the hedge ratio of 200 ( $\$0.20 / .001$ ) then divided by 10,000 T-Bills per contract. This totals 100 futures contracts to be shorted.

3. What is the effect to the bank's NIM, ROA, and ROE if interest rates change to if they hedge and if they do not hedge:
  - a. Prime Rate: 6.5%
  - b. Prime Rate: 5.5%
  - c. Prime Rate: 10%
  - d. Prime Rate: 4%

Assuming that all four had equal probability would you hedge using futures or not? Why? Students must calculate net interest margin, ROA, and ROE for each of the four different scenarios. This is similar to the process conducted in question 1 of the exercise but students now will have to calculate two different methods that can be selected by the CFO of the bank. One is remaining unhedged and the other is to hedge using futures. Since in question 2, the calculation was made to hedge perfectly, the bank will always end up with the same net interest margin, ROA, and ROE as in calculated in the first question. This is because the hedging gain or loss offsets any gain or loss from interest rates moving down for Bank A. If the bank decides to remain unhedged than interest rates moving up will impact the bank's net interest margin, ROA, and ROE, while lower rates will increase these numbers. In other words, the bank is leveraged to interest rates if unhedged and interest rate changes are eliminated if the bank hedges. As shown in the answer below extreme changes in interest rates changes the bank's financial results greatly.

| Hedged            |            |            |            |
|-------------------|------------|------------|------------|
| <u>Prime Rate</u> | <u>NIM</u> | <u>ROA</u> | <u>ROE</u> |
| For All Rates     | 4.48%      | 1.68%      | 21.00%     |

| Unhedged          |            |            |            |
|-------------------|------------|------------|------------|
| <u>Prime Rate</u> | <u>NIM</u> | <u>ROA</u> | <u>ROE</u> |
| 6.5%              | 4.28%      | 1.48%      | 18.50%     |
| 5.5%              | 4.68%      | 1.88%      | 23.50%     |
| 10%               | 2.88%      | 0.08%      | 1.00%      |
| 4%                | 5.28%      | 2.48%      | 31.00%     |

## Part 2

### Bank B

1. Given the scenario above what is the bank's risk? How can they mitigate this risk? Given the current conditions what is the bank's interest spread/ROA/ROE? How can this spread be affected by changing interest rates?

Bank B is the opposite case with a higher level of variable assets (600,000,000) than variable liabilities (200,000,000).

$NIM = \text{Net Interest Income} \div \text{Total Assets}$  or  $NIM = (52,000,000 - 21,200,000) \div 800,000,000 = 3.85\%$

$ROA = NI \div \text{Total Assets}$  or  $ROA = 10,800,000 \div 800,000,000 = 1.35\%$

$ROE = NI \div (\text{Total Assets} - \text{Total Liabilities})$  or  $ROE = 10,800,000 \div (800,000,000 - 740,000,000) = 18\%$

Bank A has greater liabilities versus assets and would suffer from rising rates. Bank B is the opposite case with a higher level of variable assets and will benefit from rising rates.

2. How would you hedge in this situation and how many contracts would you purchase to perfectly hedge your position based upon the size of the contract and the CFO's estimate of price change in the futures contract?

For Bank B the +\$200 million gap (interest rate exposure) is divided by the hedge ratio of 250 (\$0.25 / .001) then divided by 10,000 T-Bills per contract. This totals long 160 futures contracts.

3. What is the effect to the bank's spread, ROA, and ROE if interest rates change to if they hedge and if they do not hedge? How would this change if you purchased the option on the future?
  - a. Prime Rate: 5.25%
  - b. Prime Rate: 4.00%
  - c. Prime Rate: 9.50%
  - d. Prime Rate: 3.00%

Assuming that all four outcomes had equal probability what would you do and why?

Bank B adds a level difficulty as now the bank can pick one of three different options, hedge with futures, hedge with options, or remain unhedged. Options provide a challenge to students, as now they must decide whether or not to exercise the option. Of course they will only exercise the option to enter the futures contract when it is profitable. This sets up a different type of hedge. When interest rates move against the bank, they can use the option to hedge, and when interest rates move in a favorable direction for the bank, they can simply not exercise the option and benefit from the change in interest rates. This provides a good opportunity to talk about this benefit of using an option verse another derivative, but the downside of using an option to hedge is the cost of the option premium.

In this part, students will need to calculate the expected value and standard deviation of the hedge with futures verse no hedge decision. For Bank B, there would be three different possibilities including hedging with options. Students will evaluate the hedging decision based upon the calculations from this part.

| Hedged            |            |            |            |
|-------------------|------------|------------|------------|
| <u>Prime Rate</u> | <u>NIM</u> | <u>ROA</u> | <u>ROE</u> |
| For All Rates     | 3.85%      | 1.35%      | 18.00%     |

| Unhedged          |            |            |            |
|-------------------|------------|------------|------------|
| <u>Prime Rate</u> | <u>NIM</u> | <u>ROA</u> | <u>ROE</u> |
| 5.25%             | 3.98%      | 1.48%      | 19.67%     |
| 4%                | 3.35%      | 0.85%      | 11.33%     |
| 9.5%              | 6.10%      | 3.60%      | 48.00%     |
| 3%                | 2.85%      | 0.35%      | 4.67%      |

**Options Analysis**

Prime 5.25%

|                          |              |       |        |
|--------------------------|--------------|-------|--------|
| Exposure Amount          | -400,000,000 | ROA   | ROE    |
| Change in Spread         | 1,000,000    |       |        |
| Change in Futures Price  | 0.62         |       |        |
| Hedge Gain or Loss       | -1,000,000   | 1.35% | 18.00% |
| Change in Spread/ROA/ROE | 0            |       |        |
| Option Value             | -2,400,000   |       |        |
| New Net Income/ROA/ROE   | 9,400,000    | 1.18% | 15.67% |

Prime 4.00%

|                          |              |       |        |
|--------------------------|--------------|-------|--------|
| Exposure Amount          | -400,000,000 | ROA   | ROE    |
| Change in Spread         | -4,000,000   |       |        |
| Change in Futures Price  | -2.50        |       |        |
| Hedge Gain or Loss       | 4,000,000    | 1.35% | 18.00% |
| Change in Spread/ROA/ROE | 0            |       |        |
| Option Value             | 1,600,000    |       |        |
| New Net Income/ROA/ROE   | 8,400,000    | 1.05% | 14.00% |

Prime 9.50%

|                          |              |       |        |
|--------------------------|--------------|-------|--------|
| Exposure Amount          | -400,000,000 | ROA   | ROE    |
| Change in Spread         | 18,000,000   |       |        |
| Change in Futures Price  | 11.25        |       |        |
| Hedge Gain or Loss       | -18,000,000  | 1.35% | 18.00% |
| Change in Spread/ROA/ROE | 0            |       |        |
| Option Value             | -2,400,000   |       |        |
| New Net Income/ROA/ROE   | 26,400,000   | 3.30% | 44.00% |

Prime 3.00%

|                          |              |       |        |
|--------------------------|--------------|-------|--------|
| Exposure Amount          | -400,000,000 | ROA   | ROE    |
| Change in Spread         | -8,000,000   |       |        |
| Change in Futures Price  | -5.00        |       |        |
| Hedge Gain or Loss       | 8,000,000    | 1.35% | 18.00% |
| Change in Spread/ROA/ROE | 0            |       |        |
| Option Value             | 5,600,000    |       |        |
| New Net Income/ROA/ROE   | 8,400,000    | 1.05% | 14.00% |

|                            |            |
|----------------------------|------------|
| Based on all 4 - Non Hedge |            |
| Average Income             | 12,550,000 |
| ROA                        | 1.57%      |
| ROE                        | 20.92%     |
| Income STDEV               | 11,441,882 |

The net interest margin if the bank is unhedged averages 4.07%.

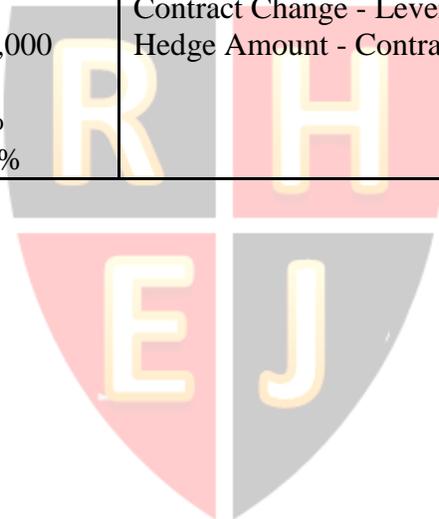
|                               |            |
|-------------------------------|------------|
| Based on all 4 - Option Hedge |            |
| Average Income                | 13,150,000 |
| ROA                           | 1.64%      |
| ROE                           | 21.92%     |
| Income STDEV                  | 8,845,903  |

The net interest margin if the bank is hedged with options averages 4.14%. More importantly, the standard deviation of outcomes is significantly lower. The primary decision of interest becomes should the bank hedge and how. Based upon the improvement in net income and reduction of standard deviation by hedging versus not hedging. At this point students can decide one of two hedging options. Hedging with futures would eliminate standard deviation but yield a lower expected net income. Hedging with options provides a larger expected net income, but with a larger standard deviation. A key point to bring up at this time is that the standard deviation calculated with hedging with options is skewed towards increasing net income as hedging with options provides a floor for losses but leaves the ceiling for gains open.

**Exhibit 1**

**Answer Bank A**

| Assets             | Rate  | Income     | Liabilities                | Rate  | Expense     | Prime<br>6% |
|--------------------|-------|------------|----------------------------|-------|-------------|-------------|
| 400,000,000        | 7.50% | 30,000,000 | 160,000,000                | 3.50% | 5,600,000   |             |
| 100,000,000        | 7.00% | 7,000,000  | 300,000,000                | 3.00% | 9,000,000   |             |
| Interest<br>Income |       | 37,000,000 | Interest<br>Expense        |       | 14,600,000  |             |
| Net Int.<br>Income |       | 22,400,000 | NIM                        | 4.48% |             |             |
| Fixed<br>Expenses  |       | 14,000,000 | Exposure Amount - SHORT    |       | 200,000,000 |             |
| Net Income         |       | 8,400,000  | Contract Change - Leverage |       | 200         |             |
| ROA                |       | 1.68%      | Hedge Amount - Contracts   |       | 100         |             |
| ROE                |       | 21.00%     |                            |       |             |             |



| Assets          | Rate  | Income     | Liabilities              | Rate  | Expense     | Prime |
|-----------------|-------|------------|--------------------------|-------|-------------|-------|
| 400,000,000     | 7.50% | 30,000,000 | 160,000,000              | 3.50% | 5,600,000   | 6.50% |
| 100,000,000     | 7.50% | 7,500,000  | 300,000,000              | 3.50% | 10,500,000  |       |
| Interest Income |       | 37,500,000 | Interest Expense         |       | 16,100,000  |       |
| Net Int. Income |       | 21,400,000 | NIM                      | 4.28% |             |       |
| Fixed Expenses  |       | 14,000,000 | Exposure Amount          |       | 200,000,000 |       |
|                 |       |            | Change in Spread         |       | -1,000,000  |       |
|                 |       |            | Change in Futures        |       |             |       |
| Net Income      |       | 7,400,000  | Price                    |       | 1.00        |       |
| ROA             |       | 1.48%      | Hedge Gain or Loss       |       | 1,000,000   |       |
| ROE             |       | 18.50%     | Change in Spread/ROA/ROE |       | 0           |       |

| Assets          | Rate  | Income     | Liabilities              | Rate  | Expense     | Prime |
|-----------------|-------|------------|--------------------------|-------|-------------|-------|
| 400,000,000     | 7.50% | 30,000,000 | 160,000,000              | 3.50% | 5,600,000   | 5.50% |
| 100,000,000     | 6.50% | 6,500,000  | 300,000,000              | 2.50% | 7,500,000   |       |
| Interest Income |       | 36,500,000 | Interest Expense         |       | 13,100,000  |       |
| Net Int. Income |       | 23,400,000 | NIM                      | 4.68% |             |       |
| Fixed Expenses  |       | 14,000,000 | Exposure Amount          |       | 200,000,000 |       |
|                 |       |            | Change in Spread         |       | 1,000,000   |       |
|                 |       |            | Change in Futures        |       |             |       |
| Net Income      |       | 9,400,000  | Price                    |       | -1.00       |       |
| ROA             |       | 1.88%      | Hedge Gain or Loss       |       | -1,000,000  |       |
| ROE             |       | 23.50%     | Change in Spread/ROA/ROE |       | 0           |       |

| Assets          | Rate   | Income     | Liabilities              | Rate  | Expense     | Prime  |
|-----------------|--------|------------|--------------------------|-------|-------------|--------|
| 400,000,000     | 7.50%  | 30,000,000 | 160,000,000              | 3.50% | 5,600,000   | 10.00% |
| 100,000,000     | 11.00% | 11,000,000 | 300,000,000              | 7.00% | 21,000,000  |        |
| Interest Income |        | 41,000,000 | Interest Expense         |       | 26,600,000  |        |
| Net Int. Income |        | 14,400,000 | NIM                      | 2.88% |             |        |
| Fixed Expenses  |        | 14,000,000 | Exposure Amount          |       | 200,000,000 |        |
|                 |        |            | Change in Spread         |       | -8,000,000  |        |
|                 |        |            | Change in Futures        |       |             |        |
| Net Income      |        | 400,000    | Price                    |       | 8.00        |        |
| ROA             |        | 0.08%      | Hedge Gain or Loss       |       | 8,000,000   |        |
| ROE             |        | 1.00%      | Change in Spread/ROA/ROE |       | 0           |        |

| Assets          | Rate  | Income     | Liabilities              | Rate  | Expense     | Prime |
|-----------------|-------|------------|--------------------------|-------|-------------|-------|
| 400,000,000     | 7.50% | 30,000,000 | 160,000,000              | 3.50% | 5,600,000   | 4.00% |
| 100,000,000     | 5.00% | 5,000,000  | 300,000,000              | 1.00% | 3,000,000   |       |
| Interest Income |       | 35,000,000 | Interest Expense         |       | 8,600,000   |       |
| Net Int. Income |       | 26,400,000 | NIM                      | 5.28% |             |       |
| Fixed Expenses  |       | 14,000,000 | Exposure Amount          |       | 200,000,000 |       |
|                 |       |            | Change in Spread         |       | 4,000,000   |       |
|                 |       |            | Change in Futures        |       |             |       |
| Net Income      |       | 12,400,000 | Price                    |       | -4.00       |       |
| ROA             |       | 2.48%      | Hedge Gain or Loss       |       | -4,000,000  |       |
| ROE             |       | 31.00%     | Change in Spread/ROA/ROE |       | 0           |       |

|                                    |           |
|------------------------------------|-----------|
| Based on all 4 - Non Hedge Average |           |
| Income                             | 7,400,000 |
| ROA                                | 1.48%     |
| ROE                                | 18.50%    |

**Exhibit 2**

**Answer Bank B**

| Assets          | Rate  | Income     | Liabilities                | Rate  | Expense     | Prime 5% |
|-----------------|-------|------------|----------------------------|-------|-------------|----------|
| 200,000,000     | 6.50% | 13,000,000 | 540,000,000                | 3.00% | 16,200,000  |          |
| 600,000,000     | 6.50% | 39,000,000 | 200,000,000                | 2.50% | 5,000,000   |          |
| Interest Income |       | 52,000,000 | Interest Expense           |       | 21,200,000  |          |
| Net Int. Income |       | 30,800,000 | NIM 3.85%                  |       | 28,400,000  |          |
| Fixed Expenses  |       | 20,000,000 | Exposure Amount LONG       |       | 400,000,000 |          |
| Net Income      |       | 10,800,000 | Contract Change - Leverage |       | 250         |          |
| ROA             |       | 1.35%      | Hedge Amount - Contracts   |       | 160         |          |
| ROE             |       | 18.00%     | Option Amount - Contracts  |       | 160         |          |
|                 |       |            | Option Premium             |       | 15,000      |          |

| Assets          | Rate   | Income     | Liabilities              | Rate  | Expense      | Prime |
|-----------------|--------|------------|--------------------------|-------|--------------|-------|
| 200,000,000     | 6.50%  | 13,000,000 | 540,000,000              | 3.00% | 16,200,000   | 5.25% |
| 600,000,000     | 6.75%  | 40,500,000 | 200,000,000              | 2.75% | 5,500,000    |       |
| Interest Income |        | 53,500,000 | Interest Expense         |       | 21,700,000   |       |
| Net Int. Income |        | 31,800,000 | NIM                      | 3.98% |              |       |
| Fixed Expenses  |        | 20,000,000 | Exposure Amount          |       | -400,000,000 |       |
| Net Income      |        | 11,800,000 | Change in Spread         |       | 1,000,000    |       |
| ROA             | 1.48%  |            | Change in Futures Price  |       | 0.62         |       |
| ROE             | 19.67% |            | Hedge Gain or Loss       |       | -1,000,000   | 1.35% |
|                 |        |            | Change in Spread/ROA/ROE |       | 0            |       |
|                 |        |            | Option Value             |       | -2,400,000   |       |
|                 |        |            | New Net Income/ROA/ROE   |       | 9,400,000    | 1.18% |

| Assets          | Rate   | Income     | Liabilities              | Rate  | Expense      | Prime |
|-----------------|--------|------------|--------------------------|-------|--------------|-------|
| 200,000,000     | 6.50%  | 13,000,000 | 540,000,000              | 3.00% | 16,200,000   | 4.00% |
| 600,000,000     | 5.50%  | 33,000,000 | 200,000,000              | 1.50% | 3,000,000    |       |
| Interest Income |        | 46,000,000 | Interest Expense         |       | 19,200,000   |       |
| Net Int. Income |        | 26,800,000 | NIM                      | 3.35% |              |       |
| Fixed Expenses  |        | 20,000,000 | Exposure Amount          |       | -400,000,000 |       |
| Net Income      |        | 6,800,000  | Change in Spread         |       | -4,000,000   |       |
| ROA             | 0.85%  |            | Change in Futures Price  |       | -2.50        |       |
| ROE             | 11.33% |            | Hedge Gain or Loss       |       | 4,000,000    | 1.35% |
|                 |        |            | Change in Spread/ROA/ROE |       | 0            |       |
|                 |        |            | Option Value             |       | 1,600,000    |       |
|                 |        |            | New Net Income/ROA/ROE   |       | 8,400,000    | 1.05% |

| Assets          | Rate   | Income     | Liabilities              | Rate  | Expense      | Prime |
|-----------------|--------|------------|--------------------------|-------|--------------|-------|
| 200,000,000     | 6.50%  | 13,000,000 | 540,000,000              | 3.00% | 16,200,000   | 9.50% |
| 600,000,000     | 11.00% | 66,000,000 | 200,000,000              | 7.00% | 14,000,000   |       |
| Interest Income |        | 79,000,000 | Interest Expense         |       | 30,200,000   |       |
| Net Int. Income |        | 48,800,000 | NIM                      | 6.10% |              |       |
| Fixed Expenses  |        | 20,000,000 | Exposure Amount          |       | -400,000,000 |       |
| Net Income      |        | 28,800,000 | Change in Spread         |       | 18,000,000   |       |
| ROA             | 3.60%  |            | Change in Futures Price  |       | 11.25        |       |
| ROE             | 48.00% |            | Hedge Gain or Loss       |       | -18,000,000  | 1.35% |
|                 |        |            | Change in Spread/ROA/ROE |       | 0            |       |
|                 |        |            | Option Value             |       | -2,400,000   |       |
|                 |        |            | New Net Income/ROA/ROE   |       | 26,400,000   | 3.30% |

| Assets          | Rate  | Income     | Liabilities              | Rate  | Expense      | Prime |
|-----------------|-------|------------|--------------------------|-------|--------------|-------|
| 200,000,000     | 6.50% | 13,000,000 | 540,000,000              | 3.00% | 16,200,000   | 3.00% |
| 600,000,000     | 4.50% | 27,000,000 | 200,000,000              | 0.50% | 1,000,000    |       |
| Interest Income |       | 40,000,000 | Interest Expense         |       | 17,200,000   |       |
| Net Int. Income |       | 22,800,000 | NIM                      | 2.85% |              |       |
| Fixed Expenses  |       | 20,000,000 | Exposure Amount          |       | -400,000,000 |       |
| Net Income      |       | 2,800,000  | Change in Spread         |       | -8,000,000   |       |
| ROA             | 0.35% |            | Change in Futures Price  |       | -5.00        |       |
| ROE             | 4.67% |            | Hedge Gain or Loss       |       | 8,000,000    | 1.35% |
|                 |       |            | Change in Spread/ROA/ROE |       | 0            |       |
|                 |       |            | Option Value             |       | 5,600,000    |       |
|                 |       |            | New Net Income/ROA/ROE   |       | 8,400,000    | 1.05% |

| Based on all 4 - Non Hedge |            |       | Based on all 4 - Option Hedge |                  |        |
|----------------------------|------------|-------|-------------------------------|------------------|--------|
| Average                    |            |       | Average                       |                  |        |
| Income                     | 12,550,000 | 4.07% | Income                        | 13,150,000       | Spread |
| ROA                        | 2.51%      |       | ROA                           | 2.63%            | 4.14   |
| ROE                        | 31.38%     |       | ROE                           | 32.88%           |        |
| Income SD                  | 11,441,882 |       | Income SD                     | 8,845,903        |        |
|                            |            |       |                               |                  |        |
|                            |            |       | 11,800,000                    | 9,400,000        |        |
|                            |            |       | 6,800,000                     | 8,400,000        |        |
|                            |            |       | 28,800,000                    | 26,400,000       |        |
|                            |            |       | 2,800,000                     | 8,400,000        |        |
|                            |            | SD    | <u>11,441,882</u>             | <u>8,845,903</u> |        |

