Financial Risk Management

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Interest Rate Risk

- Interest rate risk is more difficult to manage than the risk arising from market variables such as equity prices, exchange rates, and commodity prices. One complication is that there are many different interest rates in any given currency (Treasury rates, interbank borrowing and lending rates, swap rates, and so on).
- Although these tend to move together, they are not perfectly correlated. Another complication is that we need more than a single number to describe the interest rate environment. We need a function describing the variation of the interest rate with maturity. This is known as the *term structure of interest rates* or the *yield curve*.
- The interest rate considered is usually a *zero-coupon interest rate*, sometimes just referred to as a zero. It is the rate of interest that would apply for the maturity being considered if all interest and principal are paid at the end (i.e., there are no periodic payments such as those that are usually made on bonds).

- Consider, for example, the situation of a U.S. government bond trader. The trader's portfolio is likely to consist of many bonds with different maturities. There is an exposure to movements in the one-year rate, the two-year rate, the three-year rate, and so on. The trader's delta exposure is therefore more complicated than that of the gold trader. He or she must be concerned with all the different ways in which the U.S. Treasury yield curve can change its shape through time.

The management of net interest income

- A key risk management activity for a bank is the management of net interest income. The net interest income is the excess of interest received over interest paid. It is the role of the asset-liability management function within the bank to ensure that the net interest margin, which is net interest income divided by income-producing assets, remains roughly constant through time.

- How can fluctuations in net interest margin occur? Consider a simple situation where a bank offers consumers a one-year and a five-year deposit rate as well as a one-year and five-year mortgage rate. The rates are shown in Table 9.1. We make the simplifying assumption that the expected one-year interest rate for future time periods equals the one-year rate prevailing in the market today. Loosely speaking, this means that market participants consider interest rate increases to be just as likely as interest rate decreases.

- As a result, the rates in Table 9.1 are fair in that they reflect the market's expectations. Investing money for one year and reinvesting for four further one-year periods leads to an uncertain return. But, given our assumptions, the expected overall return is the same as a single five-year investment. Similarly, borrowing money for one year and refinancing each year for the next four years leads to the same expected financing costs as a single five-year loan.

- Suppose you have money to deposit and agree with the prevailing view that interest rate increases are just as likely as interest rate decreases. Would you choose to deposit your money for one year at 3% per annum or for five years at 3% per annum? The chances are that you would choose one year because this gives you more financial flexibility. It ties up your funds for a shorter period of time.
- Now suppose that you want a mortgage. Again you agree with the prevailing view that interest rate increases are just as likely as interest rate decreases. Would you choose a one-year mortgage at 6% or a five-year mortgage at 6%? The chances are that you would choose a five-year mortgage because it fixes your borrowing rate for the next five years and subjects you to less refinancing risk.

- **Table 9.1** Example of Rates Offered by a Bank to Its Customers:

Maturity (years)	Deposit Rate	Mortgage Rate
1	3%	6%
5	3%	6%

- When the bank posts the rates shown in Table 9.1, it is likely to find that the majority of its depositors opt for a one-year maturity and the majority of the customers seeking mortgages opt for a five-year maturity.
- This creates an asset/liability mismatch for the bank and subjects its net interest income to risks. The deposits that are financing the five-year 6% mortgages are rolled over every year. There is no problem if interest rates fall. After one year, the bank will find itself financing the five-year 6% mortgages with deposits that cost less than 3% and net interest income will increase.
- However, if interest rates rise, the deposits that are financing the 6% mortgages will cost more than 3% and net interest income will decline. Suppose that there is a 3% rise in interest rates during the first two years. This would reduce net interest income for the third year to zero.

- It is the job of the asset-liability management group to ensure that this type of interest rate risk is minimized. One way of doing this is to ensure that the maturities of the assets on which interest is earned and the maturities of the liabilities on which interest is paid are matched.
- In our example, the matching can be achieved by increasing the five-year rate on both deposits and mortgages. For example, the bank could move to the situation in Table 9.2 where the five-year deposit rate is 4% and the five-year mortgage rate is 7%. This would make five-year deposits relatively more attractive and one-year mortgages relatively more attractive.
- Some customers who chose one-year deposits when the rates were as in Table 9.1 will choose five-year deposits when rates are as in Table 9.2.

- Some customers who chose five-year mortgages when the rates were as in Table 9.1 will choose one-year mortgages. This may lead to the maturities of assets and liabilities being matched. If there is still an imbalance with depositors tending to choose a one-year maturity and borrowers a five-year maturity, five-year deposit and mortgage rates could be increased even further. Eventually the imbalance will disappear.

- The net result of all banks behaving in the way we have just described is that long-term rates tend to be higher than those predicted by expected future short-term rates. This phenomenon is referred to as *liquidity preference theory*. It leads to long-term rates being higher than short-term rates most of the time. Even when the market expects a small decline in short-term rates, liquidity preference theory is likely to cause long-term rates to be higher than short-term rates. Only when a steep decline in interest rates is expected will long-term rates be lower than short-term rates.

- **Table 9.2** Five-Year Rates Are Increased in an Attempt to Match Maturities of Assets and Liabilities:

Maturity (years)	Deposit Rate	Mortgage Rate
1	3%	6%
5	4%	7%

- Many banks now have sophisticated systems for monitoring the decisions being made by customers so that, when they detect small differences between the maturities of the assets and liabilities being chosen, they can fine-tune the rates they offer.
- Often derivatives such as interest rate swaps are used to manage their exposures. The result of all this is that net interest margin is usually stable. This has not always been the case. In the 1980s in the United States, the failures of savings and loans companies were largely a result of their failure to match maturities for assets and liabilities.

Liquidity

- In addition to eroding net interest margin, a mismatch of assets and liabilities can lead to liquidity problems. A bank that funds long-term loans with short-term deposits has to replace maturing deposits with new deposits on a regular basis.(This is sometimes referred to as *rolling over* the deposits.) If depositors lose confidence in the bank, it might find it difficult to do this.
- A well-known example of a financial institution that failed because of liquidity problems is Northern Rock in the United Kingdom. It chose to finance much of its mortgage portfolio with wholesale deposits, some lasting only three months. Starting in September 2007, the depositors became nervous because of the problems surfacing in the United States. As a result, Northern Rock was unable to finance its assets and was taken over by the UK government in early 2008. In the United States, Bear Stearns and Lehman Brothers experienced similar problems in rolling over their wholesale deposits.

- Many of the problems during the credit crisis that started in 2007 were caused by a shortage of liquidity. As often happens during stressed market conditions, there was a flight to quality where investors looked for very safe investments and were not prepared to take credit risks. Bank regulators have now recognized the need to set liquidity requirements, as well as capital requirements, for banks.