Interest – Rate Risk Management Using Income Gap Analysis

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Because of greater uncertainty in the economic environment, managing financial institutions become latest a very difficult task. Interest rates have become much more volatile, resulting in substantial fluctuations in profits and in the value of assets and liabilities held by financial institutions. All these explains why the financial institutions managers become more concerned about managing the risk their institutions face as result of greater interest-rate fluctuations and defaults by borrowers.
In this article we examine how the managers of financial institutions cope with interest-rate risk, the risk arising from fluctuations in interest rates. Specific we will look at the Income Gap Analysis as a tool for interest-rate risk reduction.
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1 The rate-sensitive assets and liabilities

As the volatility of interest rates increased in the 1980s in U.S., financial institutions managers became more concerned about their exposure to interest-rate risk, the riskiness of earnings and returns that is associated with changes in interest rates. In order to see what interest-rate risk is all about, let's take a look at the balance sheet of the National Bank presented in Table 1.
For the bank manager the first step in assessing interest-rate risk is to decide which assets and liabilities are rate-sensitive, that is, which have interest rates that will be reset (reprised) within the year. Let us note that rate-sensitive assets or liabilities can have interest rates reprised within the year either because the debt instrument matures within the year or because the reprising is done automatically, as with variable-rate mortgages.
For many assets and liabilities, deciding whether they are rate-sensitive is straightforward.

Table 1. In million of USD

National Bank			
Assets		**Liabilities**	
Reserves and cash items	6	Checkable deposits	18
Securities		Money market deposit accounts	6
Less than 1 year	6	Savings deposits	18
1 to 2 years	6	CDs	
Greater than 2 years	12	Variable-rate	12
Residential mortgages		Less than 1 year	18
Variable-rate	12	1 to 2 years	6
Fixed-rate (30 years)	12	Greater than 2 years	6
Commercial loans		Federal funds	6
Less than 1 year	18	Borrowings	
1 to 2 years	12	Less than 1 year	12
Greater than 2 years	30	1 to 2 years	6
Physical capital	6	Greater than 2 years	6
		Bank capital	6

In our example, the obviously rate-sensitive assets are securities with maturities of less than one year ($6 million), variable-rate mortgages ($12 million), and commercial loans with maturities less than one year ($18 million), for a total of $36 million. However, some assets that look like fixed-rate assets whose interest rates are not reprised within the year actually have a component that is rate-sensitive. For example, although fixed-rate residential mortgages may have a maturity of 30 years, homeowners can repay their mortgages early by selling their homes or repaying the mortgage in some other way. This means that within the year, a certain percentage of these fixed-rate mortgages will be paid off, and interest rates on this amount will be reprised. From past experience the bank manager knows that 20% of the fixed-rate residential mortgages are repaid within a year, which means that $2.4 million of these mortgages (20% of $12 million) must be considered rate-sensitive. The bank manager adds this $2.4 million to the $36 million of rate-sensitive assets already calculated, for a total of $38,4 million in rate-sensitive assets.

Using a similar procedure, the bank manager could determine the total amount of rate-sensitive liabilities. The obviously rate-sensitive liabilities are money market deposit accounts ($6 million), variable-rate CD and CDs with less than one year to maturity ($30 million), federal funds ($6 million), and borrowings with maturities of less than one year ($12 million), for a total of $54 million. Checkable deposits and savings deposits often have interest rates that can be changed at any time by the bank, although banks often like to keep their rates fixed for substantial periods. Thus these liabilities are partially, but not fully rate-sensitive. Suppose that the bank manager estimates that 10% of checkable deposits ($1.8 million) and 20% of saving deposits ($3.6 million) should be considered rate-sensitive. Adding the $1.8 million and $3.6 million to the $54 million figure yields a total for rat-sensitive liabilities of $59.4 million.

In this moment the bank manager can analyze what will happen if interest rates rise by 5 percentage points, say, on average from 10% to 15%. The income on the assets rises by $1.92 million (= 5% x $38,4 million of rate-sensitive assets), while the payments on the liabilities rise by $2.97 million (= 5% x $59.4 million of rate-sensitive liabilities). The National Bank's profits now decline by $1.05 million (= $1.92 million - $2.97 million).

Another way of thinking about this situation is with the *net interest margin*, which is interest income minus interest expense divided by bank assets. In this case, the 5% rise in interest rates has resulted in a decline of the net interest margin by 0.875% (= - $1.05 million/$120 million). Conversely, if interest rates fall by 5%, similar reasoning tells us that the National Bank's income rises by $0,9 million and its net interest margin rises by 0.875%. This example illustrates the following point: *If a financial institution has more rate-sensitive liabilities than assets, a rise in interest rates will reduce the net interest margin and income and a decline in interest rates will raise the net interest margin and income.*

2. Income Gap Analysis

The sensitivity of bank income to changes in interest rates can be measured more directly using **gap analysis** (also called **income gap analysis**), in which the amount of rate-sensitive liabilities is subtracted from the amount of rate-sensitive assets. This calculation, called the *gap*, can be written as

$$\boldsymbol{GAP = RSA - RSL} \qquad (1)$$

where *RSA* is rate-sensitive assets and *RSL is* rate-sensitive liabilities.

In previous example, the bank manager calculates *GAP* to be *GAP* = $38.4 million - $59.4 million = - $21 million.

Multiplying *GAP* times the change in the interest rate immediately reveals the effect on bank income:

$$\mathrm{D}\boldsymbol{I} = \boldsymbol{gap \times} \mathrm{D}\boldsymbol{i} \qquad (2)$$

where: *DI* is change in bank income and *DI* is change in interest rates.

For example, when interest rates rise by 5%, the change in income is

DI = -$21 million x 5% = - $1.05 million

This $1.05 million decline in bank income is the same as we found earlier.

The analysis we just conducted is known as *basic gap analysis*, and it suffers from problem that many of the assets and liabilities that are not classified as rate-sensitive have different maturities. One refinement to deal with this problem, the *maturity bucket approach*, is to measure the gap for several maturity subintervals, called *maturity buckets*, so that effects of interest-rate changes over a multiyear period can be considered and calculated.

Looking at the balance sheet for the National Bank in Table 1, the bank manager produces a more refined maturity bucket, not only by calculating the gap for less than one year as before, but also by estimating an income gap for the subinterval from one to two years. Rate-sensitive assets in this period consist of $6 million of securities maturing in one to two years, $12 million of commercial loans maturing in one two years, and an additional $2.4 million (20% of fixed-rate mortgages) that the bank manager expects to be repaid in that period. Rate-sensitive assets in the *one- to two-year bucket* are thus estimated at $20.4 million. Rate-sensitive liabilities in this period consist of $6 million of one- to two-year CDs, $6 million of one- to two-year borrowings, an additional $1.8 million of checkable deposits (the 10% of checkable deposits that the bank manager estimates are rate-sensitive in this period), and an additional $3.6 million of savings deposits (the 20% estimate of savings deposits). So the bank manager estimates the rate-sensitive liabilities at $17.4 million.

The gap calculation for the one- to two-year period is thus $3 million (= $20.4 million - $17.4 million). If interest rates remain 5% higher, then in the second year, income will improve by $150,000 (= 5% x $3 million). By using the more refined maturity bucket approach, the bank manager can figure out what will happen to bank income over the next several years when there is a change in interest rates.

The income gap analysis we have examined in this article focuses on the effect of interest rate changes on financial institution's income. Obvious, owners and managers of financial institutions care also about the effect of the changes in interest rates on the market value of the net worth of the financial institutions. In order to examine the sensitivity of the market value of the financial institution's net worth to changes in interest rates, we could use an alternative method for measuring interest-rate risk, called *duration gap analysis*. This analysis is based on Macaulay's concept of *duration*, which measures the average lifetime of a security's stream of payments [4].

References

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