

# Integrated Bank Risk Management

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# Chapter 1: Interest Rate Risk in the Banking Book

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**In this chapter, we focus on how banks manage the interest rate risk in their banking book, i.e. the risk related to non-traded assets and liabilities such as loans and deposits.** The interest rate risk in the banking book differs from credit or default risk: it relates to the impact interest rate changes may have on the value of the loans and deposits, and by extension, the overall earnings and the value of the bank.

We begin with an overview of asset and liability management (ALM), which includes interest rate risk in the banking book and liquidity risk management, the latter of which is covered in Chapter 2. Bank capital management is also sometimes considered part of treasury risk, but it can also fall in the strategic planning area. This topic is discussed in detail in Chapter 3.

On completion of this chapter the reader will have a basic understanding of:

- The role of the treasury function in different types of banks
- Types of treasury risk
- The importance of asset and liability management (ALM) in banks
- The objectives of an ALM program
- The nature of interest rate risk in the banking book: net interest income and bank equity
- How interest rate risk is measured and managed in the banking book
- Strengths and weaknesses of models used to manage ALM market risk

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## 1.1 THE ROLE OF THE TREASURY

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The Treasury function plays a significant role in managing a bank's assets and liabilities, its liquidity and its capital. The Treasury can also play many different roles in a bank; the exact roles vary significantly depending on the business model adopted by the bank.

Most treasury functions take an active role in managing the bank's balance sheet capital—the debt and equity the bank has raised to finance its assets. Capital can either be equity capital or debt, and thus has multiple meanings. For instance, accounting equity capital is the equity capital the

bank has raised from shareholders and from its earnings. Typically, equity capital satisfies regulatory capital, but there may be other types of capital than equity capital that are eligible to meet regulatory capital requirements. Additionally, the financing sources may also include debt, both long-term borrowings and deposits.

Some capital requires no interest payments (such as equity and reserves), but most capital comes in the form of interest-bearing deposits, interbank loans and securities. The collective capital is invested to generate a cash return, the risk of which depends on how the capital is allocated to different types of interest-bearing assets. This gives the bank an interest “net position” (it earns interest on the assets and pays interest on the funding) that must be managed to avoid volatile profit and losses as interest rates move. This is one type of interest rate risk the bank bears. Fluctuations in interest rates also create “equity risk” for the bank as the value of its assets and liabilities change.

While the bank treasury performs standard corporate treasury functions, such as security issuance, cash forecasting and management, financial decision-making and insurance, for example, the role of the Treasury in a bank is greater because of the large number of financial functions in the bank. While every bank has slightly different functions, a large number fit into one of two models: a commercial/retail model, or a commercial/retail with investment banking model. The typical function of the treasury in these two bank types is described below.

### 1.1.1

#### A Commercial/Retail Only Bank Model

A typical commercial/retail bank model focuses its asset strategy on commercial and retail loans, and funds the loans using a combination of equity, retained earnings, deposits, publicly issued bonds and interbank loans. It may seem that a bank of this type would focus on its underwriting risk, and as long there were not too many commercial or retail defaults, the bank would perform well. This simplification is incorrect. It is possible that the bank could have an extremely good underwriting department but could still lose a great deal of money due to fluctuations in interest rates. Interest rates could affect its income adversely and could also affect its balance sheet adversely.

# Chapter 1: Interest Rate Risk in the Banking Book

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As an example of income effects, suppose the bank had entered into a number of long-term commercial and retail loans at fixed rates prevailing at the time the loans were originated. If interest rates subsequently rose, the bank would have to pay higher interest rates to its depositors and would have to pay higher rates on its debt to the extent the debt interest rate was linked to floating indices, or to the extent the debt used to fund the loans was of a shorter maturity than the loans. If rates rose, a bank could actually end up in a negative cash flow position even in the absence of defaults.

As an example of balance sheet effect, if rates rose, the same bank would see its fixed rate assets drop in value, although that effect would be offset by a reduction in the value of its fixed rate liabilities. Floating rate assets and liabilities would not change much in value. This affects the value of the equity of the bank, since equity is the difference between assets and liabilities. For that reason, this risk is sometimes called equity risk. If fixed rate assets dominated fixed rate liabilities, as would be the case for most commercial/retail banks, rising interest rates would damage the bank's equity value.

Treasuries in commercial/retail banks are likely to manage the net interest rate risk in their banking book directly with market counterparties by operating a derivatives trading desk. In the bank described above, to protect against rising interest rates, the bank would enter interest rate swaps where it paid fixed rates and received floating rates to offset the risk of its fixed rate assets (see Chapter 3). The objective, as explained later in this section, is to manage the interest margin of the bank: the return the bank earns on its assets such as loans and investments, and the funding cost of these, such as the interest paid on deposits.

International commercial/retail banks have foreign exchange risk in their operations due to foreign operating expenses such as salaries and property leases. In these cases, the management of the attendant foreign exchange exposure will often fall to the treasury as well.

Some banks treat their treasury unit as a cost center that primarily focuses on managing interest rate and foreign exchange risk. Others run their Treasury function as a profit-

making business unit. This particularly holds true in developed markets, while in emerging and developing markets, the Treasury supports the overall activities of the bank. Larger banks in the emerging and developing markets may task their Treasury function with managing their foreign currency exposure.

For instance, if a bank has substantial commercial and retail business, and the currency in which it primarily operates is not a major currency, then the Treasury may manage the interest rate risk positions for profit. The constant business coming from the lending and deposit gathering of the bank's commercial and retail business results in its being well positioned to exploit its commercial position in domestic currency interest rate risk markets. When the same commercial position results in the bank executing significant orders from its customers for foreign currency transactions, the Treasury may in fact run complex trading operations.

Banks may operate in a heavily traded currency where there are substantial institutional counterparties, including investment banks and hedge funds. In this situation it is likely that a commercial and retail bank's treasury operations will primarily be focused on ensuring that the risks generated by the bank's businesses are covered in the market. Such treasury operations are commonly known as cover operations. They make sure that the profits generated by the customer business are not damaged by the failure to manage the inherent market risk, e.g. the interest rate or foreign exchange risk in the banking book.

## 1.1.2

### **A Commercial/Retail Bank with an Investment Banking Operation Business Model**

For banks with an investment banking operation actively engaged in traded market risk and managing it for profit, the Treasury function is likely to be primarily concerned with the effective transfer of interest rate risk in the banking book to the investment bank at a fair transfer price. Here a central Treasury function serves other parts of the bank and provides a support function to those commercial and investment banking operations that are more directly client focused.

# Chapter 1: Interest Rate Risk in the Banking Book

The central Treasury may be responsible for managing the retail market risk function of a commercial/retail bank with an investment banking operation. However, some banks with investment banking operations permit their commercial and retail businesses to manage their individual banking book risks directly with the investment banking operation. In this business model the Treasury takes on the role of monitoring and regulating the management of interest rate risk in the banking book, while retaining its group-wide liquidity and capital management activities.

Ensuring the smooth flow of such business will require 'running'/taking on trading positions to manage these risks. However, such risks are likely to be of a limited nature.

In general terms, this is the model followed by JPMorgan Chase, as described in their 2007 Annual Report. Most other banks that do not have the same size and strategic breadth as JPMorgan Chase tend to follow the first approach—the commercial/retail banking approach.

## 1.2 TREASURY RISK

Treasury risk is defined as the risk of loss in the activities of a bank's Treasury. It is also sometimes used to mean ALM risk alone. Since every Treasury operates slightly differently, however, the term "Treasury risk" can be ambiguous. Here is one example of an integrated bank treasury function:

In this text we focus only on:

- Interest rate risk in the banking book (this chapter)
- Liquidity risk, or the management of the balance sheet and its funding (Chapter 2)
- Proprietary trading (Chapter 2)
- Capital management (Chapter 3)

To avoid confusion in the rest of this volume, we will refer to specific treasury functions where applicable and avoid the generalized term "Treasury risk."

## 1.3 ASSET AND LIABILITY MANAGEMENT ACTIVITIES

While the treasury usually manages ALM risk, it often does so under the oversight of an Asset Liability Committee (ALCO) or in some cases the Risk Management Committee. The role of the traditional ALCO is defined by the American Banker:

*A committee, usually comprising senior managers, responsible for managing assets and liabilities to maximize income and safety over the long run. In a financial institution, the ALCO is usually responsible for asset and liability distribution, asset and liability pricing, balance sheet size, funding, spread management, and interest rate sensitivity management.*

Figure 1: Treasury Risk

		Bank treasury functions			
Usual corporate treasury functions	Asset liability management (Risks in the banking book)			Proprietary trading	Capital management
Cash management Financial decisions Security offerings Insurance	Interest Rate	Liquidity	Currency		
	Derivative hedges				

# Chapter 1: Interest Rate Risk in the Banking Book

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In most banks asset and liability management has the primary objective of managing the impact of interest rate risk in the bank's balance sheet and ensuring that the interest rate risk inherent in the bank's underlying business does not disrupt the production of a stable income stream over time. Asset and liability management is not just concerned with managing risk and stabilizing business value. It is also concerned with:

- Maintaining the desired liquidity structure of a bank as seen in the next chapter
- Other factors affecting the structure and composition of a bank's balance sheet
- Circumstances impacting the stability of income the bank generates over time

There are numerous problems due to the need to balance the structure and composition of a bank's balance sheet. Many of these are related to the problems international banks face as they have capital structures dominated by their home currency, but whose earnings and many of their assets and liabilities are in other currencies. This introduces foreign exchange risk (see Chapter 2) into the bank's earnings. For example, the present and future profits from overseas operations may be volatile when translated into the bank's domestic currency due to changes in the exchange rate, which are affected by differences in interest rates. Similarly, domestic currency denominated capital that has been allocated to overseas operations supports an asset structure denominated in a different, foreign, currency. Since exchange rates and profitability can change, the dual effect of these changes introduce volatility into the capital requirements and may reduce the ability to meet regulatory minimum standards.

Asset and liability management is often described as using risk management techniques employed by bond portfolio managers and applying them to the repricing of interest rates on retail assets and liabilities (see Chapter 3). The reason is that the cash flows investments and loans the bank holds on its balance sheet and deposits that the bank finances these assets with can be modeled as cash flows generated by bonds. While in many ways this is true, the asset and liability manager has to recognize the following:

- A bank's balance sheet is a dynamic collection of assets and liabilities because new loans and deposits are continuously being made and others mature
- Repricing of the assets and liabilities on a bank's balance sheet is not all contractual since often there are signifi-

cant timing differences between changes in market rates affecting the pricing of wholesale credit and deposit products and changes in the interest rates on retail credit and deposit products

- There is frequently little or no correlation between retail product and wholesale product rates for pricing assets and liabilities as many retail products are marketing driven and marketing considerations impose restrictions on the repricing of retail products that do not affect wholesale products
- Retail products frequently include embedded options which are often not rationally exercised, such as the right to prepay certain retail credit products without significant penalties, while wholesale products typically carry penalties for repayment or include rights to terminate wholesale contracts on very different terms than are common in retail products

There are several reasons why a bank with a significant number of retail customers may find its balance sheet shape and structure difficult to manage. They include:

- Banks with a wide retail base are often driven by relationship considerations and not simply contractual obligations, i.e. they are customer focused
- Attracting and retaining customers often involves offering retail products whose features are different from wholesale market products, and because of inherent differences in the structure of the different types of products, managing the risk of retail products using tools designed for managing the risk of wholesale products may be difficult
- Pricing of retail products often has more to do with marketing considerations rather than prevailing market price, which drives the pricing of wholesale products
- The way retail customers behave in relation to the retail banking products they hold often results in the apparent contractual obligations of the parties providing a poor description of the actual nature of the obligations. For example it may be contractually possible to withdraw funds from a savings account on 30 days' notice, but customer has a right to leave the money on account the indefinitely. The balance on such accounts may behave more like a three-year deposit account than either a 30-day deposit account or a perpetual account

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## INTEREST RATE RISK IN THE BANKING BOOK

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- **The Role of the Treasury**
  - A Commercial/retail Only Bank Model
  - A Commercial/retail Bank with an Investment Banking Operation Business Model
- **Treasury Risk**
  - Asset and Liability Management Activities
  - Asset and Liability Management (ALM) Risk
- **NII Risk in the Banking Book**
  - Basic NII Risk Model
  - Basic NII Risk Management
  - Critiques of the Basic NII Risk Model
- **Equity Risk in the Banking Book**
  - Hedging Equity Risk
  - Critiques of the Duration Gap Model

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## THE CORE IDEA OF MANAGING THE INTEREST RATE RISK IN THE BANKING BOOK

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- To IRR is human, to forgive may not be in the stockholders', the Board's or the regulators' vocabulary

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## THE ROLE OF THE TREASURY

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- A Commercial/retail Only Bank Model
- A Commercial/retail Bank with an Investment Banking Operation Business Model
- Standard corporate treasury functions
  - Security issuance
- Cash forecasting and management
- Financial decision-making and insurance
- Bank treasury functions
  - Manage bank's assets and liabilities, liquidity and capital
  - The exact roles vary significantly depending on the business model adopted by the bank
  - Most treasury functions take an active role in managing the bank's balance sheet capital

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## USING AND MANAGING BALANCE SHEET CAPITAL

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The collective capital is invested to generate a cash return, the risk of which depends on how the capital is allocated to different types of interest-bearing assets.

- This gives the bank an interest "net position" (it earns interest on the assets and pays interest on the funding) that must be managed to avoid volatile profit and losses as interest rates move
- Fluctuations in interest rates also create "equity risk" for the bank as the value of its assets and liabilities change

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## THE ROLE OF THE TREASURY AT BANKS— COMMERCIAL / RETAIL ONLY MODEL

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- A typical commercial/retail bank model focuses its asset strategy on commercial and retail loans, and funds the loans using a combination of equity, retained earnings, deposits, publicly issued bonds and interbank loans
- While the core risk is credit risk, interest rate fluctuations impact earnings

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## THE INTEREST RATE IN THE BANKING BOOK AFFECTS EQUITY

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- Fluctuating asset and liability values impact the economic and book value of the equity
- For that reason, this risk is sometimes called equity risk
- If fixed rate assets dominated fixed rate liabilities, as would be the case for most commercial/retail banks, rising interest rates would damage the bank's equity value

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## **MANAGING THE INTEREST RATE RISK IN THE BANKING BOOK**

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- The net interest rate risk in their banking book is typically managed directly with market counterparties by operating a derivatives trading desks
- To protect against the effect of interest rates, the bank would enter interest rate swaps

### **Managing the Interest Rate Risk in the Banking Book Managing the risk of increasing interest rates where the assets exceed liabilities**

- Enter swap transaction where the bank pays fixed rates and receives floating rates to offset the risk of its fixed rate assets

### **Managing the risk of decreasing interest rates where the assets exceed liabilities**

- Enter swap transaction where the bank pays floating rates and receives fixed rates to offset the risk of its fixed rate assets