CHAPTER 1

Banking, Bank Business and Financial Statements[1]

Abstract

A bank is an entity that provides loan and deposit products to its customer base. The traditional and still current banking business model uses borrowed funds in the form of customer deposits to leverage its own equity base ("capital") on the balance sheet in order to fund loans; because loans are generally of a longer contractual maturity than deposits, this *maturity transformation* process is a key undertaking of banks and one that generates the other main tenet of the banking business model, the assumption of continuous liquidity provision. Managing liquidity risk, together with the risk associated with a customer not repaying a loan, which is capital risk, are the two main risk exposures that are very important for a bank. The difference between the interest received on loans and the interest paid on deposits, known as the net interest income, is the primary performance measure for banks, and managing this and the related measure of net interest margin are also important for a bank. Banks are part of the global money markets, the interconnected market for short-term wholesale borrowing and lending.

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This chapter was originally intended for newcomers to the market, junior bankers and finance students, but in fact everyone else may wish to read it as a form of refresher course. The purpose of this primer is to introduce all the basics of banking necessary to gain a strategic overview of what banks do and to understand what risk exposures they face. We begin with a definition of banking, and follow with a description of bank cash flows, calculation of return, the key performance metrics net interest income and net interest margin, and finish with an introduction to the risk types faced in banking.

A summary of the bank product line is given in the Appendix at the end of the chapter.

AN INTRODUCTION TO BANKING

Banking has a long and honourable history. Modern banks as we know them date from the 15th century, but forms of commercial transactions that we

1 This chapter was co-authored with Chris Westcott, Head of Faculty at The Certificate of Bank Treasury Risk Management (BTRM).

would recognise as banking have been recorded from as far back as Roman and Babylonian times. Banking operations encompass a wide range of activities worldwide, but ultimately a bank is an entity that provides loans to customers who require funds for various reasons, and accepts deposits from customers who wish to place their own funds in a safe place. This business activity places responsibilities on a bank, and it is these responsibilities that must be borne within a set of principles. Later on in this chapter we will introduce the different types of banking products, and later on in the book we address how a bank should manage the risk associated with handling such products. We will also discuss the very important topic of customer service, the core element amongst the principles of banking.

We can start with Table 1.1, which shows selected banking activities, and the type of risk exposure they represent. The terms used in the table, such as "market risk", are explained later in this book.

TABLE 1.1 Selected banking activities and services.

Service or function	Revenue generated	Risk
Lending		
– Retail	Interest income, fees	Credit, Market
– Commercial	Interest income, fees	Credit, Market
– Mortgage	Interest income, fees	Credit, Market
– Syndicated	Trading, interest income, fees	Credit, Market
Credit cards	Interest income, fees	Credit, Operational
Project finance	Interest income, fees	Credit
Trade finance cash management	Interest income, fees	Credit, Operational
– Processing	Fees	Operational
– Payments	Fees	Credit, Operational
Custodian	Fees	Credit, Operational
Private banking	Commission income, interest income, fees	Operational
Asset management	Fees, performance payments	Credit, Market, Operational
Capital markets		
– Investment banking	Fees	Credit, Market
– Corporate finance	Fees	Credit, Market
– Equities	Trading income, fees	Credit, Market
– Bonds	Trading income, interest income, fees	Credit, Market
– Foreign exchange	Trading income, fees	Credit, Market
– Derivatives	Trading income, fees	Credit, Market

But we are running ahead of ourselves. We need to define "banking" first. Here is the author's definition of banking:

> *Banking is the art of making loans to individual and/or corporate customers, whilst simultaneously accepting deposits from individual and/or corporate customers, and of retaining and managing these transactions on the bank's balance sheet.*

That's pretty much it.[2] We haven't said anything about digital banking, about branches, about mobile apps, about decentralised finance, about cryptocurrency (or indeed fiat currency), the future of money, the future of finance, or a whole host of related subjects, mainly because none of them impinges on our definition. We can, however, expand on our defining statement, and add that the act of banking involves maturity transformation and the art of managing the risks associated with holding customer assets and liabilities on the balance sheet – that's for later.

Some people define "banking" in wider terms, possibly because there is an understanding or expectation that banks will offer more than just the two services of loans and deposits to their customers. For example, many banks in many countries provide a mobile smartphone "app" for their customers to use when accessing banking services. In some cases, this app enables customers to access a wider consumer marketplace; for example, the customer may be able to undertake their supermarket shopping, book a holiday or purchase a refrigerator on the same app. Some banks have implemented an algorithm, often based on a machine learning system, that recommends products to the customer via the app, both financial services and other consumer products, in a way similar to how Amazon or YouTube recommend purchases or videos to their customers.

Does this mean a bank is now an entity that offers their customers a full marketplace of products? No, it does not. If a particular bank wishes, for marketing, customer service and/or revenue reasons, to offer a wider product range beyond banking products (generally by partnering with a supermarket, travel company or white goods manufacturer, and so on) then of course that is its choice. But none of that is "banking", not as we define it in this book. And none of that is what a bank necessarily needs to do.

Now that we have defined banking, we are almost ready to proceed with the rest of the book. Almost, but not quite. We have to make sure we are completely clear on this definition bit. To help us with that, let's quote from a highly regarded text, *The Future of Money: How the Digital*

2 Although please consider also the definitions of banking from other sources quoted in the Appendix to this chapter.

Revolution Is Transforming Currencies and Finance, by Professor Eswar Prasad. Here is an extract from Professor Prasad's book:

> Money is created not just by a nation's central bank but by the private sector as well. When a commercial bank approves a loan to a household or a business and then credits that amount to the borrower's account, it has created money in the form of a bank deposit. . .inside money is created by entities within the private sector and circulates among private businesses and households.
>
> This conception of inside money – that banks can create money from scratch – is different from the popular but outmoded notion that banks must receive deposits before they can make loans using that money.
>
> *(Prasad, 2021)*

There's quite a lot in just those few sentences, but let's tackle the easiest point first. Far from being "outmoded", the notion that banks must receive deposits before they can make loans is very much still in mode today. True, the loan does not *necessarily* have to be funded by the deposits that the bank receives, but the vast majority of loans made by the vast majority of the world's banks are funded in exactly this way: by raising deposits and then using those deposits to fund loans. The author was involved as an employee with a bank that was doing just this in 1992, and as a director with another bank doing exactly the same thing 30 years later. This concept is not "outmoded", it is the very bread-and-butter of banking.

Every loan has to be funded, whether by customer deposits, or by the bank's own capital base (its shareholders' equity), or by funds borrowed from the wholesale markets, or by a secured loan facility (another form of borrowing) in which the loan that is originated to the customer is itself put up as security to the funding provider. A bank that does not have funding, of one or more of the types we've described here, cannot lend money to anyone. This is an absolute fact.[3]

Now let's address the rest of Professor Prasad's statement. When a bank approves a loan to a household or company and credits the loan amount to the customer's bank account, it has lent money to the customer. The

3 To our list of funding sources we would also add now "the central bank". In a number of jurisdictions around the world, since the bank crash of 2008 central banks have set up secured funding facilities that commercial banks now use for "business as usual", not emergency, purposes. These borrowed funds are used to on-lend to the bank's borrowing customers.

customer has accepted the funds into their bank account. But the lending bank has to transfer these funds to the customer's bank account, and here is the crucial bit for us bank managers: if it doesn't have those funds already, or hasn't been promised them for value that same day from another party, or can't borrow those funds from another bank same day, then it cannot transfer any funds to the other bank account.

So has the lending bank "created" money? At the individual bank level no, clearly not. For someone observing the world from Mars, equally clearly at the global level yes, because every loan is matched exactly by a deposit. One person's loan is by definition another person's deposit. So from a global perspective money might be said to have been "created" every time a loan is originated. This is what is behind the concept of "fractional reserve" banking – that every time a bank makes a loan it is "creating" money. And from an accounting perspective, every time a loan is originated, the amount is recorded as an "asset" on the bank's balance sheet, and the exact same amount is recorded as a "liability" on the balance sheet. So that fits in with the money creation concept (and is the marvellous thing about balance sheets, they balance). Of course the balancing item is the bank's own funds, its capital (also called equity), and that most definitely hasn't been created out of thin air.

Does fractional reserve banking and money creating have any relevance at the individual bank operating level, the level that this book is concerned about? No, it has precisely no relevance at the individual bank level. And in fact at the operating level the quite dangerous idea that every time a bank lends money to someone the loan can somehow magically fund itself because the bank has created money was one of the (many) reasons that a number of banks failed in 2008 – they had assumed that they would always be able to raise funding, from customers or from wholesale markets or both, at any time and instantly on request. That one or two of them could not do so, leading to their demise, tells us everything we need to know about fractional reserve as a concept at the individual bank level, and also explains why international banking supervision rules published since 2008 compel every bank to hold a buffer of liquid assets that can be turned instantly to cash – precisely to enable banks to maintain funding of the loans they have made up to then, at all times and under all conditions.

To reiterate then, we are concerned in this book with the principles of banking, as practised (or should be practised) at the individual bank level. As the reader, you need not be concerned with what other banks are doing, except to the extent that what they are doing may impact your own viability. Your concern is with what is going on in the bank *you* are working in. Other market practitioners, such as central bankers and monetary policy theorists,

will be interested in what every bank is doing, and they may wish to access other texts that are relevant in this space.[4]

The reality for the individual banker remains that before one can originate a loan one has to know where the funding is going to come from, and have the funding in place. To reiterate: this funding can be the bank's own money (its equity base). Or it can be borrowed money. Or both. But it has to be in place: the bank cannot just magic up the money out of thin air by entering into a loan agreement with a customer.

Here is more from Professor Prasad's book:

> Competition keeps banks from creating money recklessly; banks that don't make profits or risk losses from excessive lending would not survive for long.
>
> *(Prasad, 2021)*

The first part of this statement sounds logical, and one might assume that that's what banks do (we'll get to that), but the second part doesn't necessarily follow from the first, and in fact we should consider these points separately. If banks do indeed create money every time they make a loan, one supposes that they would do this continuously and "recklessly", simply because they can. But it isn't "competition" that stops banks from "creating money" (read: lending money) recklessly: the story behind the failures of Citigroup, HBOS and Royal Bank of Scotland clearly proves that. The period 2000–2007 was one of strong competition amongst banks in the Western world, but that didn't stop some of them from entering into what, in hindsight, was clearly reckless lending growth.[5] It is usually a combination of supply and demand, regulatory rules and, crucially, balance sheet constraints in the form of capital and liquidity limits, that stop banks from lending recklessly. Observation of banking activity during the period leading to the events of 2008 shows quite clearly that competition did not keep banks from "creating" money recklessly. Competition may play a part, but if it does it's a very small part.

4 Of course, this does not mean that central bankers or regulators or monetary policy theorists may not be interested in, or benefit from reading, the contents of this book as well. Ultimately the market is made up of individual banks.

5 The author was employed in the London-based structured finance arm of JP-Morgan Chase during 2000–2003, and then at the London-based investment banking arm of KBC Bank during 2003–2008, and can attest personally to the intense competition amongst investment banks (more usually the investment banking divisions of commercial banks) during this time, and how every mandate received from a client was celebrated precisely because it had been won in the face of strong competition. This was a time of strong competition in Western banking markets and considerable lending volume growth. The presence of competition palpably did not stop banks from "creating [*sic*] money recklessly".

The second part of Professor Prasad's statement is a truism: any corporate entity, in any industry, that doesn't make profits or risks losses from excessive business growth will not survive in the long run. But it isn't "excessive lending" *per se* that leads inevitably to losses and negative profit. It is excess lending combined with a number of other factors that can lead to ruin. In and of itself it may be a sustainable policy for many years, certainly long enough for the architects of the original loan strategy to retire to their yachts. In reality, in today's industry it is an onerous and prescriptive regulatory regime that ensures that banks lend only as much as their own balance sheet resources – under even extreme downturn market conditions – will allow them to. It has little or nothing to do with an ability to create money being constrained because the bank fears losses and/or competition.

A final quote from Professor Prasad and then we are ready to proceed:

> One main function of banks, which makes them simultaneously useful and vulnerable, is maturity transformation.
>
> *(Prasad, 2021)*

This is indeed an accurate statement that goes to the heart of what banks do. They lend money to households and corporates, and they fund a large part of this lending with deposits from households and corporates. Many loans have a long maturity date (think of your car loan or mortgage) and many deposits have a short maturity date (think of your current or "checking" account or savings deposit account). Undertaking maturity transformation is the key that unlocks the door to economic growth in every country. For a bank, this mismatch of maturity (or *tenor*) is the very definition of banking and also a balance sheet vulnerability that needs to be managed by the bank. Thanks to regulation rules, today there is very little chance of a bank not managing this risk properly, but that does not mean that a bank can afford to not be vigilant in this regard.

Now that we are clear on the definition of banking, we can proceed!

BANK BUSINESS MODEL

To understand banking is to understand banking cash flows that arise out of the ordinary course of business and the risks associated with conducting this business, the principal one of which is credit risk (although there are a large number of additional risk types to manage!). But even before any of that we should be familiar with the five pillars of modern banking, which are unchanged for over 500 years.

The Conventional Bank Business Model

Figure 1.1 is a neat representation of a bank and its interactions (read: cash flows) with its loan and deposit customers and with other banks.

In essence, banking is based on the following five key concepts:

- **Capital and leverage**: the capital of any corporation is defined as the difference between the firm's assets and its liabilities. For a bank it also includes capital set aside to cover expected loan losses, as well as certain types of long-dated debt. A bank's capital is the pool of funds that are its own funds: shareholders' funds. For this reason it is also called the *capital buffer*. In banking, a small capital base is levered up to fund an asset pool that can be 10, 20 or even 30 times greater than the capital base. This is a much higher leverage ratio than is observed in corporate entities in other industries. What this means is that the bank doesn't use its own equity when lending money (although it can do); instead it

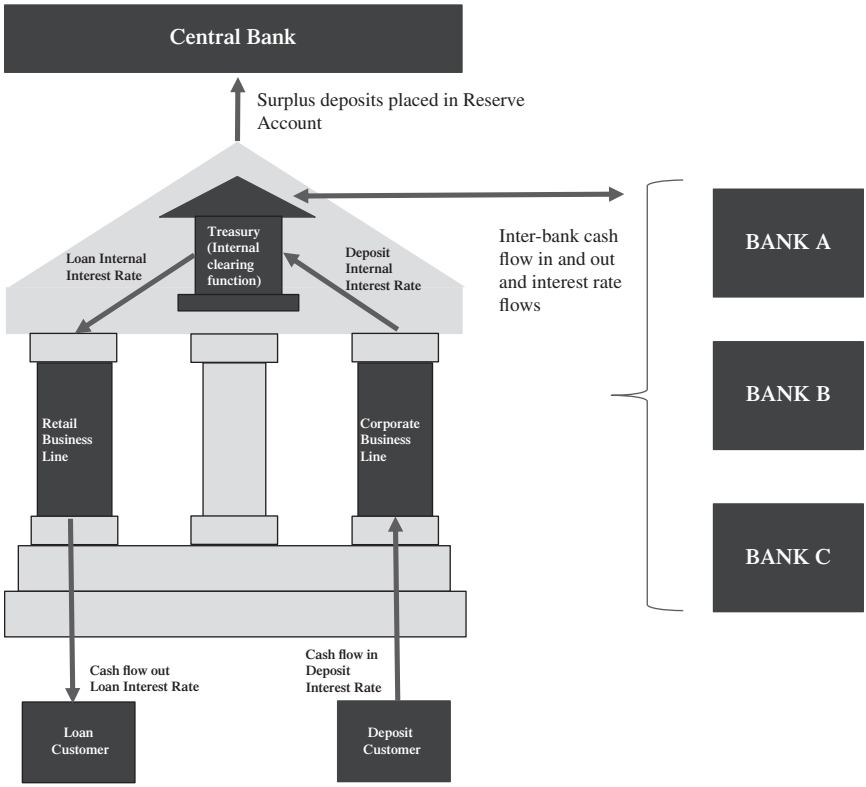


FIGURE 1.1 A bank and its customer and market cash flows.

borrows money from other customers in the form of deposits or from other wholesale counterparties, and lends those funds. The equity base of a bank, that is, the bank's own funds, is only a small element of the total liabilities on the balance sheet, perhaps 15% to 20% on average. It therefore forms only a small share of the bank's total funding. In the author's view, good practice dictates that the capital itself is not actually used to lend to customers (not unless they are credit risk-free customers! More about this later), so that it remains available to absorb *unexpected* losses. The balance of the balance sheet is made up of borrowed cash, which is then lent out to customers to generate revenue. If we imagine a 10% equity capital base of £10 as an example, for a bank that is levered 10 times on this amount, the balance of 90 is borrowed and lent out. Whenever a customer defaults on a loan, the loss is a negative hit to the bank's capital base. Managing the capital base to ensure that it is always of a sufficient level to enable the bank to remain a viable going concern, and controlling the level of leverage, are vital to the well-being of a bank.

- **The "gap"**: this is the difference in maturity between the legal contractual maturity of the assets and the legal contractual maturity of the liabilities. In simple terms, it is *funding short* to *lend long*. This is known as *maturity transformation*: the practice is taking in short-dated funds (deposits) and using them to make long-dated loans. Consider a financial institution with a simple business model, such as a UK building society. Such a firm will have two main businesses, lending funds in the form of residential mortgages to retail customers (private individuals), and accepting deposits from retail customers. The legal final maturity of a residential mortgage might be 20 or 25 years, whereas deposits can be very short notice indeed, and unlikely to exceed five years in contractual maturity. This is the basic business of banking. One can see immediately that the only way anyone would be prepared to lend money for 25 years that had been given to it for only one day is making a very big assumption: the assumption of continuous liquidity. That is, one must assume that one can always borrow money at any time and in size if one is prepared to undertake maturity transformation business. Sometimes this is a strong assumption. It is this very act of banking itself that produces the key risk exposure of banking – liquidity risk. A bank that advances a mortgage must ensure that it can find the funds to match the loan for the entire life of the transaction; failure to do so will result in the bank being deemed insolvent, which is potentially fatal and would lead to dissolution of the bank. So one can see how understanding the gap,[6] and meeting its needs, is the cornerstone of banking risk management.

6 In continental Europe they do not use the term "gap". They appear to prefer the term "mismatch" instead. The terms are synonymous. The author prefers "gap".

- **The yield curve**: the gap, which arises naturally as a result of banking business, produces an extreme reliance on a positively sloping yield curve to help generate much of the bank's profits. This is because the shorter end of the yield curve, at which tenor the bank borrows money, has a lower interest rate than the longer end, at which tenor it lends money. So an understanding of yield curve risks is important.
- **Liquidity**: as we note above, the business of maturity transformation contains an implicit, and explicit, assumption that one will always be able to rollover funding as it becomes due. Without this assumption, no bank would ever advance a 25-year loan. Therefore the business of banking assumes continuous liquidity. One can see immediately that managing the liquidity risk of the bank is vital, no less than a matter of life or death for the bank.
- **Risk management**: an understanding of customer default risk. Advancing a loan to a customer – any customer – carries with it the risk that the customer will default on the loan. An understanding of the credit risk presented by all customers is crucial to the survival of the bank, because excess defaults will erode the bank's capital and finish it as a going concern. Of equal importance to understanding customer default risk is the maintenance of loan origination standards. If these standards, which govern how creditworthy a customer must be before being eligible for a loan, are allowed to deteriorate, the bank will find itself sitting on a larger pool of poor-quality loans than is prudent.

These are the essential cornerstones of banking. The reader is correct in thinking that they do not appear excessively complex. The art of banking is not technically difficult, it simply requires good judgement and common sense. Successful management of a financial institution does not require a professional qualification in banking, let alone a PhD in mathematics or physics.[7]

BANKING BUSINESS AND CAPITAL

We introduced the different types of banking business at the beginning of this chapter. For the largest banks these aspects are widely varying in nature. For our purposes we may group them together in the form shown in Figure 1.2. Put simply, "retail" or "commercial" banking covers the more traditional lending and trust activities, while "investment" banking covers trading activity and fee-based income such as stock exchange listing and mergers and acquisitions (M&A). The one common objective of all banking

7 Or in econometrics . . .

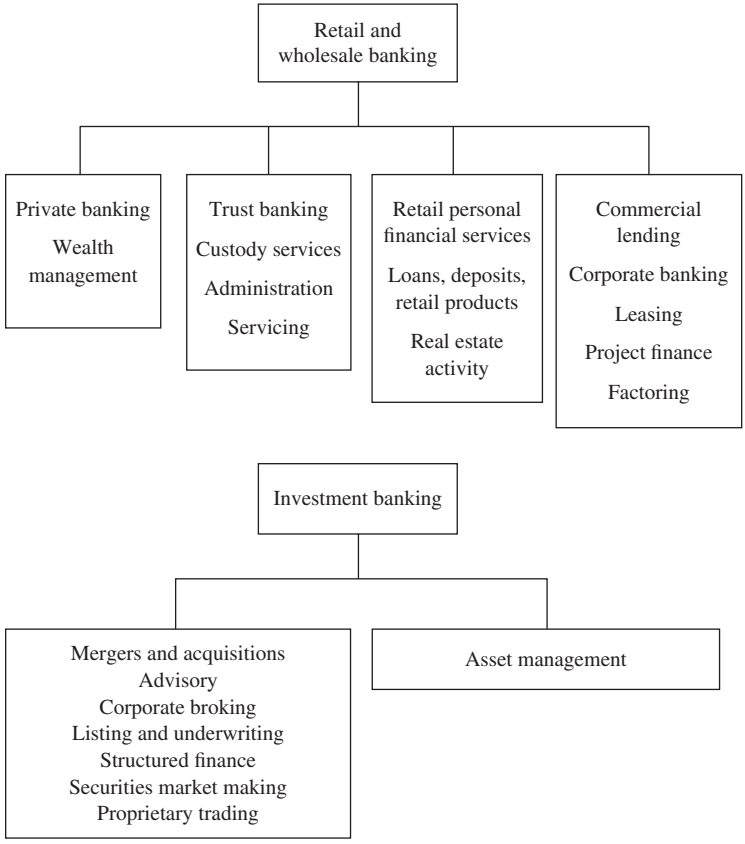


FIGURE 1.2 Scope of banking activities.

activity is return on capital. Depending on the degree of risk it represents, a particular activity will be required to achieve a specified return on the capital it uses. The issue of banking capital is vital to an appreciation of the banking business; entire new business lines (such as securitisation) have been originated in response to a need to generate more efficient use of capital.

We see the scope of banking business in Figure 1.2. There is a vast literature on all these activities, so we do not need to cover them here. However, it is important to have good knowledge of the main products.

For capital management purposes a bank's business is organised into a "banking book" and a "trading book"; these are accounting concepts. We consider them next; first, though, a word on bank capital.

Capital

Bank capital is the equity of the bank; in other words, its own shareholders' funds. It is important as it is the cushion that absorbs any unexpected losses that the bank incurs. By acting as this cushion, it enables the bank to continue operating *as a going concern* and thus avoid insolvency or bankruptcy during periods of market correction or economic downturn. When the bank suffers a loss or writes off a lossmaking or otherwise economically untenable activity, its capital base absorbs the loss. This can be done by eating into reserves, freezing dividend payments or (in more extreme scenarios) writing down equity capital. In the capital structure, the rights of capital creditors, including equity holders, are subordinated to senior creditors and deposit holders. A capital base that is not sufficient to absorb losses and still maintain the viability of the bank as a going concern is inadequate and not fit for purpose.

Banks occupy a vital and pivotal position in any economy, as suppliers of credit and financial liquidity, so bank capital is important. As such, banks are heavily regulated by central monetary authorities, and their capital is subject to regulatory rules at national level that are based on guidance published by the Bank for International Settlements (BIS), based in Basel, Switzerland. For this reason these regulatory capital rules are often called the Basel rules. We have a whole separate chapter on Basel (the BIS guidance, not the town in Switzerland) – see Chapter 3.

Banking and Trading Books

Banks and financial institutions make a distinction between their activities for capital management, including regulatory capital, purposes. Activities are split into the "banking book" and the "trading book". Put simply, the banking book holds the more traditional banking activities such as commercial banking – for example, loans and deposits. This would cover lending to individuals as well as corporates and other banks, and so will interact with investment banking business.[8] The trading book records wholesale market transactions, such as market making and proprietary trading in bonds and derivatives. Again, speaking simply, the primary difference between the two books is that the overriding principle of the banking book is one of "buy and hold"; that is, a long-term acquisition. Assets may be held on the book for up to 30 years or longer. The trading book is just that, it employs a trading

8 For a start, there will be a commonality of clients. A corporate client will borrow from a bank, and may also retain the bank's underwriting or structured finance departments to arrange a share issue or securitisation for it, as well as arrange interest-rate risk hedging via the bank's derivatives desk.

philosophy so that assets may be held for very short terms, less than one day in some cases, and usually no longer than 6 months. The regulatory capital and accounting treatment of each book is quite different. The primary difference is that the trading book employs the "mark-to-market" approach to "fair value" assets and liabilities at their current price, and hence record profit and loss (P&L). This is what the daily "marking" of an asset to its fair market value means. An increase or decrease in the mark on the previous day's mark is recorded as an unrealised profit or loss on the book: on disposal of the asset, the realised profit or loss is the change in the mark at disposal compared to its mark at purchase.

The Banking Book

Traditional banking activity such as deposits and loans is recorded in the banking book. Accounting treatment for the banking book follows the accrual concept, which accrues interest cash flows as they occur. There is no mark-to-market. The banking book holds assets for which both corporate and retail counterparties as well as banking counterparties are represented. So it is the type of business activity that dictates whether it is placed in the banking book, not the type of counterparty or which department of the bank is conducting it. Assets and liabilities in the banking book generate interest-rate and credit-risk exposure for the bank. They also create liquidity and term mismatch ("gap") risks. Liquidity refers to the ease with which an asset can be transformed into cash, as well as to the ease with which funds can be raised in the market. So we see that "liquidity risk" actually refers to two related but separate issues.

The Trading Book

Wholesale market activity, including market making and proprietary trading, is recorded in the trading book. Assets on the trading book can be expected to have a high turnover, although not necessarily so, and are usually subject to a "churn" rule, which means they must be sold after a period of 180 days on the book. Assets are marked-to-market daily. The counterparties to this trading activity can include other banks and financial institutions such as hedge funds, corporates and central banks. Trading book activity generates the same risk exposure as that on the banking book, including market risk, credit risk and liquidity risk. It also creates a need for cash management. Much trading book activity involves derivative instruments, as opposed to "cash" products. Derivatives include futures, swaps and options. These can be equity, interest-rate, credit, commodity, foreign exchange (FX), weather and other derivatives. Derivatives are known as

"off-balance sheet" instruments because they are recorded off the (cash) balance sheet.

Off-balance sheet transactions refer to "contingent liabilities", which are so-called because they refer to a future exposure contracted now. These are not only derivatives contracts, such as interest-rate swaps or writing an option, but include guarantees such as a credit line to a third-party customer or a group subsidiary company. These represent a liability for the bank that may be required to be honoured at some future date. In most cases they do not generate cash inflow or outflow at inception, unlike a cash transaction, but represent future exposure. If a credit line is drawn on, it represents a cash outflow and that transaction is then recorded on the balance sheet. However, it is risk-managed as if a current exposure.

BANK PRODUCTS AND NET INTEREST MARGIN MANAGEMENT

Small banks and new market entrants often offer a narrow range of products and services. For example, in July 2021 the UK bank Tesco Bank product offering was focused upon personal credit cards and loans, and a variety of personal savings and insurance products. Bigger, well-established universal banks, such as the UK bank Barclays plc, have a much broader range of products and services. Universal banks span retail and commercial banking, wealth management and investment banking.

Although it is not intended to be a complete list, Table 1.2 summarises many of the products and services offered by universal banks to their customers.

TABLE 1.2 Banking products.

Bank product	Description
Alternative Investments (e.g., hedge funds)	Any investment outside the three traditional asset classes of stocks, bonds or cash.
Asset Finance	A type of finance used by businesses to obtain the equipment they need to grow. It usually involves paying a regular charge for use of the asset over an agreed period of time, thus avoiding the full cost of buying outright. The most common types of asset finance are leasing and hire purchase.
Asset Management	A financial services company can provide asset management by co-ordinating and overseeing a client's financial portfolio. Asset managers are often hired by institutional investors like pension funds, corporations and financial intermediaries, as well as high net worth individuals.

Bank product	Description
Broking (Securities Intermediation)	Executing buy and sell orders for financial assets on behalf of clients in exchange for a fee or commission.
Corporate Finance	In the UK, the term tends to be associated with transactions in which capital is raised to create, develop, grow or acquire a business. It is often associated with a degree of change ownership in a business, connected to a corporate transaction that leads to the creation of a new equity structure or shareholder base, and the related issue, underwriting, purchase or exchange of equity or debt.
Credit Cards	Plastic cards that can be used to pay for goods or services up to a predetermined credit limit. There is a set period during which no interest is charged (20–55 days). After that, if the balance is not paid in full, interest is added to the account.
Current Accounts	An account with a bank or building society from which money may be withdrawn without notice, typically an active account catering for frequent deposits and withdrawals.
Custody Services (Global Custody)	Involves processing trades in securities, keeping financial assets safe and servicing the associated portfolios.
Derivatives	Contracts based on underlying assets, such as bonds, commodities and market indices, provided by banks, to enable clients to protect or hedge their financial exposures.
Factoring – Receivables Finance	A transaction in which a business sells its accounts receivable or invoices to a third party commercial financial company or bank, so that the business can receive cash more quickly than it would by waiting 30 to 60 days for a customer payment.
Financial Advisory	An advice service provided by banks and other financial institutions, generally to corporates on areas such as M&A transactions, restructurings and capital raising.
Fixed Rate Bonds	A fixed term savings account offering a fixed rate of interest for a specified period of time. They can be for a number of years, typically ranging from one to five and will mature at the end of the term.
Foreign Exchange	A service provided by banks and other financial institutions enabling clients to purchase and sell foreign currencies, remit funds across international borders and protect themselves against currency fluctuations.
Instant Access Savings Accounts	A flexible savings account, carrying a rate of interest, which gives the depositor access to their money at any time without loss of interest.

(*continued*)

TABLE 1.2 (*continued*)

Bank product	Description
Insurance	An arrangement by which a company undertakes to provide a guarantee of compensation for specified loss, damage, illness or death, in return for payment of a specified premium.
Investment Management	The professional asset management of various securities and other assets (e.g., real estate) to meet specified investment goals for the benefit of investors.
Leasing	See Asset Finance.
Leveraged Loans	Loans, which are generally floating rate, made by a bank to a heavily indebted corporate entity, secured by specific assets, such as plant property or equipment.
Mortgages	A legal agreement that conveys the conditional right of ownership on an asset or property by its owner (the mortgagor) to a lender (the mortgagee) as security for a loan. In the case of residential property, the lender's security interest will be recorded in the register of title documents and will be voided when the loan is repaid in full.
Notice Deposit Accounts	A savings account on which the account holder is required to give a notice of withdrawal a specified number of days before making the withdrawal to avoid penalties.
Overdrafts	If customers withdraw more money than they have in their bank accounts, the extra money taken out after the bank balance reaches zero is called an overdraft. Overdrafts are usually for an agreed amount of money that the bank is prepared to lend a customer for a relatively short term.
Packaged Accounts	Current accounts that come with a package of extra features, such as mobile phone and travel insurance, to better rates on overdrafts and loans.
Personal Loans	Loans that a bank or other lender makes that are not secured against any asset such as property.
Project Finance	Project Finance is a method of funding in which the lender looks primarily to the revenues generated by a single project, both as a source of repayment and as security for the exposure.
Structured Finance	The provision of complex financial instruments to large financial institutions or companies whose needs cannot be met with conventional financial products. Examples include leveraged loans and securitisations.
Syndicated Loans	A loan offered by a group of lenders that work together to provide funds for a single borrower. The borrower could be a corporation, a large project or a sovereign.

Bank product	Description
Term Loans	A loan from a bank for a specific amount that has a specified repayment schedule and a fixed or floating interest rate.
Trade Finance	Trade finance is the financing of international trade flows. It exists to mitigate or reduce the risks involved in an international trade transaction. Typical products include letters of credit, supply chain finance and export and agency finance.
Trusts and Estate Planning	A trust is a fiduciary arrangement that allows a third party, or trustee, to hold assets on behalf of a beneficiary. Estate Planning involves following an individual's wishes and minimising the amount of taxes due on their estate after they die.
Wealth Solutions and Financial Planning	An advice service provided to high net worth individuals to help them grow and protect their wealth.

Net Interest Income (NII)

Banks earn their income from three main sources: net interest income (NII), fees and commissions and other non-interest income. The sum of the three items represents total income. The products and services in Table 1.2 will provide a bank with an opportunity to earn income from one or more of these sources.

A sample of some of these products is shown in Figure 1.3, which helpfully places a "tick" against those products that contribute to NII, and those that do not but which will contribute to fees and commission or trading income. Remember that NII is the difference between the interest received on a bank's interest-earning assets, such as loans and debt securities, and the funding cost of a bank's liabilities, such as deposits and term debt.

Although it may appear to be insignificant, interest-earning assets are all assets that are capable of earning interest, rather than those that are actually earning interest. Non-performing assets would be in the first, but not the second category. The reason for this distinction will become clearer when we consider profitability metrics.

Excluding minor adjustments, the net profit attributable to shareholders is calculated by subtracting operating expenses, charges for impairment and the tax charge from total income. The net profit attributable to shareholders is either paid out to shareholders in the form of dividends or reinvested in the business.

Table 1.3 shows the components of a UK retail bank's income statement.

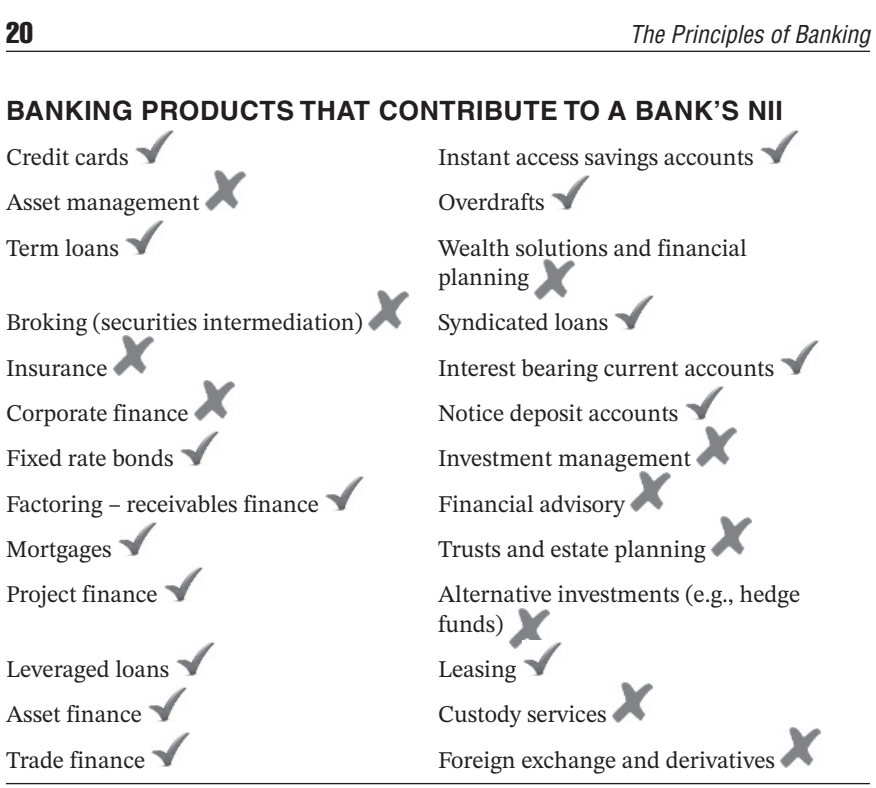


FIGURE 1.3 Banking products contributing to NII or fees and other income.

The composition of earnings varies widely among different institutions. Figure 1.4 shows the breakdown for a UK building society and the UK branch of a US investment bank in 2017, as reported in their financial accounts for that year.

The traditional source of revenue for retail banks, NII, remains as such today (see Figure 1.4). NII is driven by lending and interest-earning asset volumes, and the net yield available on these assets after taking into account the cost of funding. While the main focus is on the loan book, the ALM desk will also concentrate on the bank's investment portfolio. The latter will include coupon receipts from money market and bond market assets, and dividends received from any equity holdings.

The cost of funding is the key variable in generating overall NII. For a retail bank the cheapest source of funds is deposits, especially non-interest bearing deposits such as cheque accounts.[9] Even in an era of high-street competition, the interest payable on short-term liabilities such as instant

9 These are referred to as NIBLs (non-interest bearing liabilities).

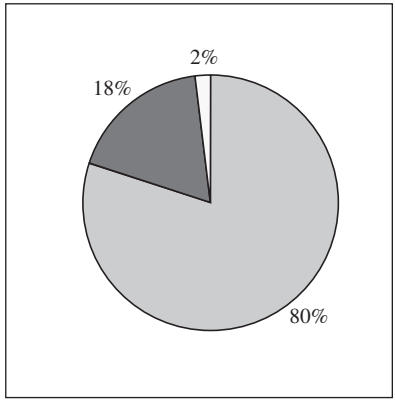
TABLE 1.3 Components of a bank income statement, typical structure for a retail bank.

	%	Expressed as percentage of
Core operating income	100	
Net interest income	64	/core operating income
Commissions and fee income	31	/core operating income
Trading income	8	/core operating income
+ Net other operating income	8	/core operating income
– Operating expenses	61	/revenues
Personnel	38	/revenues
Other, depreciation		
– Loan loss provisions	23	/pre-provision net income
= Net operating income		
+ Other non-operating income		
= Profit before tax		
– Tax		
= Net income		
– Minority interest		
= Attributable income		

Source: Adapted from Royal Bank of Scotland published annual report and accounts, 2019; Nationwide BS published annual report and accounts, 2019.

UK building society, core earnings split 2017

Net interest income	80%
Fee income	18%
Trading profit	2%



UK branch, US investment bank, core earnings split 2017

Net interest income	22%
Fee income	52%
Trading profit	26%

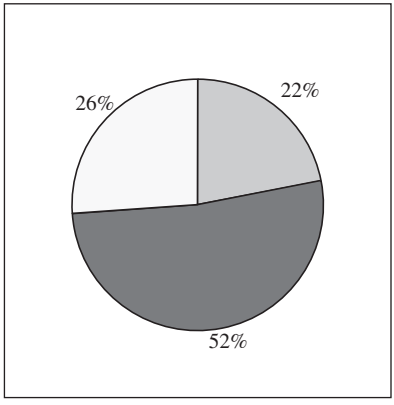


FIGURE 1.4 Composition of earnings.
Source: Bank financial statements.

access deposits is far below the wholesale market interest rate. This is a funding advantage for retail banks when compared to investment banks, which generally do not have a retail deposit base. Other funding sources include capital markets (senior debt), wholesale markets (the inter-bank money market), securitised markets and covered bonds. The overall composition of funding affects significantly net interest margin, and if constrained, can reduce the activities of the bank.

The risk profile of the asset classes that generate yields for the bank should lead to a range of net interest margins being reported across the sector, such that a bank with a strong unsecured lending franchise should seek significantly higher yields than one investing in secured mortgage loans; this reflects the different risk profiles of the assets. The proportion of non-interest bearing liabilities (NIBLs), which usually includes very low-interest bearing deposits, will also have a significant impact on the net interest margin of the institution. While a high net interest margin is desirable, it should also be an adequate return for the risk incurred in holding the assets.

Bank NII is sensitive to changes in market-wide interest rates, particularly if the cost of funding is not fixed (that is, it is variable). Interest income is sensitive to changes in interest rates and the maturity profile of the balance sheet. Banks that have assets that mature earlier than their funding liabilities will gain from an environment of rising interest rates. The opposite applies where the asset book has a maturity profile that is longer dated than the liability book. Note that in a declining or low interest-rate environment, banks may suffer from negative NII irrespective of their asset–liability maturity profile, as it becomes more and more difficult to pass on interest-rate cuts to depositors.

Market risk, which we will look at later, is essentially interest-rate risk for loans and deposits (it is also foreign exchange risk). Interest-rate risk will be driven by the maturity structure of the loan book, as well as the match (or mismatch) between the maturity of the loans against the maturity of the funding. This is known as the interest-rate gap.

While investment banks are less sensitive to changes in rates, as their overall NII expectations are low due to their lower reliance on NII itself, their trading book will also be sensitive to changes in interest rates, because it is funded with either secured or unsecured borrowing, and the borrowing rate moves with changes in the market rate.

Whether NII is 40% or 80% of a bank's total income, it is clearly an important component of the Statement of Profit and Loss, and needs to be managed.

That the universe of banks encompasses many different forms is evident from the way they earn their money.

The Net Interest Margin (NIM) and the Net Interest Spread

The net interest margin (NIM) is defined as: interest income minus interest expense (i.e., NII) divided by a measure of average assets. There is no one universal way to calculate NIM. UK and US banks use average interest earning assets, whilst banks in the eurozone usually use average total assets. Average NIMs for banks in the UK, US and eurozone during 2011–2021 typically fell in the range between 1% and 2.5%.

Both NII and the NIM are calculated for a specific period, such as a month, a quarter or a year. However, whilst NII is expressed as a currency amount, NIM is reported as a percentage. Also, even if calculated for a month or a quarter, the NIM is normally quoted on an annualised basis. So, if a NIM was calculated at 0.2% for the month of January, it would be shown as a figure closer to 2.40% (whether simply multiplied by 12 or using a day-count approach (× 365/31).

Notwithstanding movements in the underlying level of interest rates, the NIM tends to be relatively stable over time. This is primarily due to a combination of customer inertia (not switching to more attractively priced products in the market when they are available) and bank management of the risks to their income arising from interest-rate movements.

NIM is a key profitability measure, monitored very closely by bank finance directors and investment analysts. In a competitive banking environment, improvements in a bank's ratio are hard won and declines are difficult to reverse. Hence, when a bank is being valued by an analyst, trends in the NIM can be projected many years into the future with a certain degree of certainty, assuming stable market conditions.

Although rarely published by banks these days, and more likely to be discussed by bank analysts, one may come across a measure called the net interest spread ("spread"). In the UK, this is normally defined as the difference between the average interest rate received on a bank's average interest earning assets and the average interest rate paid on average interest-bearing liabilities. The NIM and the spread will be the same if average interest-earning assets are the same as average interest-bearing liabilities. However, those banks funding a material proportion of their lending from either or both of their equity capital or non-interest-bearing current accounts will typically have a higher NIM than spread.

Having identified that the NIM is a key measure of bank profitability, a key question is whether or not there is a particular level that banks should aspire to? The answer is, "No, there is not." As highlighted in Table 1.4, the level of a bank's NIM is a function of the structure of the balance sheet and

TABLE 1.4 Factors affecting the size of a bank's NIM.

Factor	Impact
The amount of equity capital	Equity capital pays dividends rather than interest. Banks with a high equity base will have less interest-bearing liabilities, which will tend to boost their NIIMs.
The level of credit and interest-rate risk	High credit risk will normally result in a higher NIM. High interest-rate risk will result in a more volatile NIM.
The proportion of non-interest-bearing current accounts	As with equity capital, high non-interest-bearing liability balances will result in less interest-bearing liabilities, which will tend to increase the NIM. However, there will be other issues to consider, such as the expense of attracting this type of transaction account, the cost of handling complaints, etc.
The relative size of retail and SME business versus corporate and wholesale business	Due to the risk profile, margins on non-mortgage retail and SME lending will tend to be higher than those on corporate and wholesale lending. So, more of the former will generally produce a higher NIM.
The amount of residential mortgage lending	A very low risk activity associated with a low NIM. For example, the published NIM for the Nationwide Building Society in its 2021 full year results was just 1.21%.

the bank's attitude to risk; for these reasons direct comparisons between banks are not valid and should not be made by bankers themselves, although this does not stop equity analysts and board members from so doing. A bank with a NIM of 3% is not necessarily performing better than a bank with a NIM of 2%. This can only be judged when other factors are taken into account, like their respective cost bases and the factors considered in Table 1.4.

Rather than obtaining the highest NIM in the industry, really the objective for all banks should be to preserve and maximise whatever NIM they have within the constraints of their individual balance sheets.

At the end of this chapter we present a hypothetical "case study", in the form of a simple balance sheet simulation exercise, to show how a bank's NIM might be influenced in a variety of different scenarios.

FINANCIAL STATEMENTS AND RATIOS

A key information tool for bank analysis is the financial statement, which is comprised of the balance sheet and the P&L account. Assets on the balance sheet should equal the assets on a bank's ALM report, while receipt of revenue (such as interest and fees income) and payout of costs during a specified period is recorded in the P&L report or income statement.

The Balance Sheet

The balance sheet is a statement of a company's assets and liabilities as determined by accounting rules. It is a snapshot of a particular point in time, and so by the time it is produced it is already out of date. However, it is an important information statement. A number of management information ratios are used when analysing the balance sheet and these are shown in Table 1.5.

For a bank there are usually five parts to a balance sheet, as it is split to show separately:

- lending and deposits, or traditional bank business;
- trading assets;
- Treasury and inter-bank assets;
- off-balance sheet assets;
- long-term assets, including fixed assets, shares in subsidiary companies, together with equity and Tier 2 capital.

This is illustrated in Table 1.5.

TABLE 1.5 Components of a bank balance sheet.

Assets	Liabilities
Cash	Short-term liabilities
Loans	Deposits
Financial instruments (long)	Financial instruments (short)
Fixed assets	Long-dated debt
Off-balance sheet (receivables)	Equity
	Off-balance sheet (liabilities)

Profit and Loss (P&L) Report

The income statement for a bank is the P&L report. It records all the income, and losses, during a specified period of time. A bank income statement will show revenues that can be accounted for as either NII fees and commissions, and trading income. The precise mix of these sources will reflect the type of banking institution and the business lines it operates in. Revenue is offset by operating (non-interest) expenses, loan loss provisions, trading losses and tax expense.

Fee and Commission Income

Fee revenue is generated from the sale and provision of financial services to customers. The level of fees and commissions will be communicated in advance to customers. Fee income, separate from trading income and known as non-interest income, is desirable for banks because it represents a stable source of revenue that is not exposed to market risk. It is also attractive because it provides an opportunity for the bank to cross-sell new products and services to existing customers, and the provision of these services does not expose the bank to additional credit or market risk. Fee income represents diversification in a bank's revenue base.

Note that although fee-based business may not expose the bank to market risk directly, it does bring with it other risks, and these can include indirect exposure to market risk.[10] In addition, an ability to provide fee-based financial services may require significant investment in infrastructure and human resources.

Trading Income

Trading income arises from the capital gain earned from buying and selling financial instruments. These instruments include both cash and derivative (off-balance sheet) instruments, and can arise from undertaking market-making business, which in theory is undertaken to meet client demands, and

10 For example, a strategy pursued by banks in the 1990s was to merge with or acquire insurance companies, so-called *bancassurance* groups. Although much insurance business is fee-based, the acquisition of insurance portfolios brought with it added market risk to the banking group.

from proprietary business for the bank's own trading book. Note that interest income earned while holding assets on the trading book should really be considered as NII and not trading income, but sometimes this is not stripped out from the overall trading book P&L. There is no uniformity of approach among banks in this regard.

Trading income is the most volatile form of bank revenue. Even a record of consistent profit in trading over a long period is no guarantee of future losses arising out of market corrections or simply making the wrong bet on financial markets.

Operating Expenses

Banking operating costs typically contain the human resources costs (remuneration and other personnel-related expenses), together with other operating costs such as premises and infrastructure costs, depreciation charges and goodwill.[11] Cost is generally measured as a proportion of revenue. A number of cost–income ratios are used by analysts, some of which are given in Table 1.6.

The return on equity (RoE) measure is probably the most commonly encountered, and is usually integrated into bank strategy, with a target RoE level stated explicitly in management objectives. Note that there is a difference between the accounting RoE and the market return on equity; the latter is calculated as a price return, rather like a standard P&L calculation, which is taken as the difference between market prices between two dates. The RoE target needs to reflect the relative risk of different business activity.

The return on assets (RoA) is another common measure of performance, and for a number of reasons a better measure to employ. This is calculated as follows:

$$\frac{\text{Current income}\left(\text{Interest income} + \text{Fees}\right)}{\text{Asset value}}$$

Both financial statement P&L reports and measures such as RoE and RoA are bland calculations of absolute values. They do not make any adjustment for relative risk exposure so cannot stand too much comparison with the equivalent figures of another institution. This is because the risk

11 These are accounting terms common to all corporate entities, and are not solely used to describe bank operating costs.

TABLE 1.6 Common bank cost–income ratios.

Ratio	Calculation	Notes
Pre-tax RoE	Pre-tax income/Average shareholders' equity	Measures the pre-tax return on equity. A measure above 20% is viewed as above average and strong
RoE	Attributable net income/ Average shareholders' equity	Measures return on equity. A measure above 10% is considered strong
RoA	Net income/Average assets	Measures return on assets. A measure above 1% is considered strong
Cost-income ratio	Non-interest costs/Total net revenues	Non-interest costs minus non-cash items such as goodwill or depreciation of intangible assets. The cost to produce one unit of net interest and non-interest income. The lower the ratio, the more efficient the bank
Net interest margin	Net interest income/ Average earning assets	The difference between tax-equivalent yield on earning assets and the rate paid on funds to support those assets, divided by average earning assets
Loan loss provision	Loan-loss provision/ Pre-provision, pre-tax income	The proportion of pre-tax income that is being absorbed by loan losses. This is the credit cost of conducting the business
Non-interest income	Non-interest income/Net revenues	Non-interest income includes service charges on deposits, trust fees, advisory fees, servicing fees, net trading profits from trading books, and commissions and fees from off-balance sheet items. Generally, the higher the ratio, the greater the bank's sensitivity to changes in interest rates

exposure, not to mention the specific type of business activity, will differ from one bank to another. However, there are general approximate values that serve as benchmarks for certain sectors, such as the 15% RoE level for investment banks.

Provisions

Banks expect a percentage of loan assets, and other assets, to suffer loss or become unrecoverable completely. Provisions are set aside out of reserves to

cover for these losses each year, and are a charge against the loan revenues of the bank. The size of the provision taken is a function of what write-offs may be required against the loan portfolio in the current portfolio in the current period and in the future, and the size and adequacy of loan loss reserves currently available. In some jurisdictions there are regulatory requirements that dictate the minimum size of the provision. Provisions fund the bank's loan loss reserve, and the reserve will grow in size when the bank provides more for expected credit losses than the actual amount that is written off. If the bank believes subsequently that the size of the reserve built up is in excess of what is currently required, it may write back a percentage of it.

Measuring Return

Elsewhere in this book we will discuss the importance of a coherent, articulate strategy being in place at any bank, and the need for this strategy to target an explicit RoE or return on capital (RoC). To clarify exactly what we are referring to, we illustrate with a simple example.

Table 1.7 shows a hypothetical bank income statement and balance sheet. Using the values in these simplified statements, we can calculate the following:

Return on equity: 18.4/100	= 18.4%
Return on capital: 18.4/120	= 15.3%
Return on assets: 18.4/1200	= 1.53%
Earnings on assets: (120 + 65 – 12)/1200	= 14.4%
Leverage ratio: 1080/100	= 10.8
Average cost of debt: 90/1080	= 8.3%
Operating expenses: 60/1200	= 5%
Operating margin: 14.4% – 8.3%	= 6.1%
Taxation rate: 4.6/23	= 20%

A glance at the above ratios shows that they are all related. All of the six variables below the RoE/RoC ratio will impact the final RoE number, so it is possible to generate higher return by altering only one of them (the taxation variable is outside the control of the bank of course). We see also that higher leverage produces a higher RoE, so it can become tempting for senior management to gear up ever higher, with more and more debt, in an effort to generate higher shareholder returns. This is of course a risky strategy, because in a market downturn a high level of borrowing causes debt-servicing problems. It is also why we recommend targeting return on assets (RoA) as another measure.

TABLE 1.7 Hypothetical bank income statement and balance sheet.

Income statement EUR m		Balance sheet Assets		Liabilities	
Interest income	120	Loans	1200	Deposits	1080
Fees and services	65			Equity	100
				Retained profits	20
Interest expense	(90)				
Expenses	(60)				
Loss provisions	(12)				
Operating profit	23				
Taxation	(4.6)				
Profit after tax	18.4				

The above would be sufficient analysis if the bank consisted of just one line of business. Most banks have more than one business line, and so finance directors like to calculate returns adjusted for the amount of risk exposure each business line creates, and the amount of capital it uses. The standard calculation is the risk-adjusted return on capital, or RAROC, which is given by:

RAROC = business line profit / business line equity allocation.

Using RAROC enables senior management to compare the genuine value-added of each business line. By definition the RAROC achieved by each business should exceed the bank's cost of equity. If it does not, that is an unsustainable business.

Bank Balance Sheet and P&L Statement: Illustration

We show a near real-world example of bank financial statements for the hypothetical ChoudWest Bank in Figures 1.5 and 1.6. The reader is invited to calculate the various metrics and ratios we have described up to now from the values in these statements. Note also the entries referring to different types of loan and deposit product (assets and liabilities). Finally, the reader may be puzzled by the columns labelled "LCR Outflow" and "Total Outflow". These will be understood easily enough once the reader has become familiar with the liquidity metrics chapter (Chapter 12).

ChoudWest Bank Balance Sheet
as at 31 December 2021

HQLA		Notes	£,000 **2021**		
	Assets			**LCR Outflow %**	**Total Outflow**
Level 1	Cash and balances at central banks		**3,698**	0%	0
	Financial assets held for trading				0
	Fixed Income Instruments		**8**	0%	0
	Trading derivative assets	5	**143**	0%	0
Level 1	Available for Sale financial assets (HQLA)	1	**1,103**	0%	0
	Available for Sale financial assets	1	**1,000**	0%	0
	Loans and Receivables				0
	Loans and receivables to credit institutions	2	**505**	0%	0
	Of which Stand by Liquidity Facilities		**45**	100%	45
	Reverse repo agreements with credit institutions		**14**	0%	0
	Loans and advances to retail / SME customers	3	**16,815**	0%	0
	Of which Stand by Liquidity Facilities		**4,204**	10%	420.38
	Loans and advances to corporate customers	4	**8,949**	0%	0
	Of which Stand by Liquidity Facilities		**471**	20%	94.2
	Fair value adjustment for portfolio hedged risk		**1**	0%	0
	Hedging derivative assets		**104**	0%	0
	Items in course of collection from banks		**213**	0%	0
	Current tax assets		**2**	0%	0
	Deferred tax assets		**99**	0%	0
	Property, plant and equipment		**168**	0%	0
	Other assets		**685**	0%	0
	Total assets		**38,227**		**560**
	Liabilities			**Outflow %**	**Total Outflow**
	Financial liabilities held for trading				
	Trading derivative liabilities	5	**97**	100%	97
	Financial liabilities at amortised cost				0
	Deposits from credit institutions		**49**	100%	49
	Repo agreements with credit institutions		**751**	0%	0
	Retail / SME customer deposits	6	**25,450**	5%	1272.5
	Corporate customer deposits	7	**5,933**	10%	593.3
	Senior unsecured debt securities in issue		**1,940**	0%	0
	Subordinated liabilities		**413**	0%	0
	Fair value adjustment for portfolio hedged risk		**70**	0%	0
	Hedging derivative liabilities		**529**	100%	529
	Items in course of transmission to banks		**176**	100%	176
	Current tax liabilities		**14**	0%	0
	Other liabilities		**246**	0%	0
	Total liabilities		**35,668**		**2,717**

FIGURE 1.5 ChoudWest Bank Balance Sheet. (*continued*)

Equity	
Share capital	**5**
Share premium	**965**
Capital reserve	**410**
Retained profits	**1,173**
Valuation adjustments	
Available for sale reserve	**5**
Cashflow hedging reserve	**1**
Shareholders equity	**2,559**
Total equity and liabilities	**38,227**

LCR = stock of high quality liquid assets / stressed net cash outflows over a 30 day time period = $\frac{4{,}801}{\mathbf{3{,}276}}$ = **146.5%**

NOTES

1 These are fixed coupon and floating coupon Eurobonds held in the FVOCI portfolio
2 Inter-bank deposits placed with bank counterparties
3 Customer loans. This number breaks down into Retail, plus SME customers across different sectors. Can further break down into companies with <3 and >3 years trading history. Number also breaks down by product type
4 Same as 3
5 Interest rate swaps (both assets and liabilities)
6 Customer deposits break down as per 3 above
7 Same as 6

THE MONEY MARKETS

The money markets are part of the global financial system. The various markets that make up this system are all, in one form or another, channels through which funds flow between the users and the suppliers of capital move. This flow of funds takes place in different markets, depending on the characteristics of the funds themselves and the needs of the market participants. The money market is where transactions in short-term funds take place. This is the borrowing and lending of funds that have a repayment date of within 12 months of the loan start date. However, the money market is not just made up of loans or cash products. There is a wide range of instruments used in the market, both cash and derivative, and it is these products and the uses to which they are put that are a significant focus of this book.

ChoudWest Bank Income Statement
for the year ended 31 Dec 2021

	Notes	**£,000** 2021	£,000 2020
Income statement:			
Interest and similar income		**1,097**	967
Interest and similar expense		**(243)**	(201)
Net interest income		**854**	766
Fee and commission income		**197**	198
Fee and commission expense		**(97)**	(81)
Net fee and commission income		**100**	117
Other operating income		**50**	8
Other income		**150**	125
Total income		**1,004**	891
Total operating expenses		**(734)**	(740)
Operating profit before impairment losses and taxation		**270**	151
Impairment losses on loans and advances to Retail / SME customers		**(71)**	(70)
Impairment losses on loans and advances to Corporate customers		**(16)**	(12)
Profit before taxation		**183**	69
Taxation		**(54)**	21
Profit for the year		**129**	90
Other expense / income:			
Change in FVOCI portfolio reserve			
Change in fair value		**(14)**	22
Taxation thereon		**4**	(6)
		(10)	16
Change in cash flow hedging reserve			
Change in fair value of derivatives in cash flow hedges		**48**	14
Transfer to income statement on hedged assets/liabilities		**(47)**	(15)
Taxation thereon		**1**	(1)
		2	−2
Other expense / income for the year, net of taxation		**(8)**	14
Total income for the year		**121**	104

FIGURE 1.6 ChoudWest Bank P&L statement.

So, the money market is the centre in which market participants – which can be governments, banks, other corporate institutions, fund managers or individuals – meet to transform a short-term shortage (or surplus) of funds into a surplus (or shortage). As such, the money market enables market participants to manage their liquidity positions.

The suppliers of funds in financial systems worldwide are generally commercial banks, as well as savings institutions such as money market mutual funds. Other institutions such as local authorities and corporations are also long of cash at certain times. The borrowers of funds include the government, banks (again), local authorities and corporations (also, again).

Although the money market has traditionally been defined as the market for instruments maturing in one year or less, sometimes the money market desks of banks trade instruments with maturities of up to 2 or 3 years, both cash and off-balance sheet.[12] In addition to the cash instruments that go to make up the market, the money markets also consist of a wide range of over-the-counter (OTC) off-balance sheet derivative instruments. These instruments are used mainly to establish future borrowing and lending rates, and to hedge or change existing interest-rate exposure. This activity is carried out by both banks, central banks and corporates. The main derivatives are short-term interest rate futures, forward rate agreements, and short-dated interest rate swaps. Other derivatives such as total return swaps are also used.

A detailed description of the money markets can be found in the first edition of *The Principles of Banking* (Choudhry, 2012) and in the accompanying website for this second edition.

12 The author has personal experience in market making on a desk that combined cash and derivative instruments of up to 2 years' maturity, as well as government bonds of up to 3 years' maturity. In his capacity on other bank Treasury desks the longest maturity of trades in cash and derivatives varied between 18 and 36 months, including products such as loans and deposits and overnight index swaps of up to 18 months' maturity, medium-term notes (MTNs) of up to 24 months' maturity and liquidity portfolios of up to 5 years' maturity. That was all a very long time ago though. . .

REFERENCE RATES

The rates of interest actually paid or received by customers are linked to the yield curve through the use of reference rates. A reference rate is a market standard interest rate that can be used to calculate the interest payable or receivable on a financial instrument, or used to determine another interest rate. Typically, the customer rate on a loan will be a standard money market interest rate plus a margin to cover credit risk, a liquidity premium, operating expenses and a profit margin for the bank. Examples of reference rates include SONIA (Sterling Overnight Index Average) in the UK and SOFR (Secured Overnight Financing Rate) in the USA, which may be averaged over a period, such as 3 months, in a financial contract. In some jurisdictions the reference rate used continues to be based on the London Inter-bank Offered Rate (Libor) approach that was phased out in certain countries at the end of 2021; these days the expression Inter-bank Offered Rate (Ibor) is used instead for these references. Figure 1.7 summarises the reference rates that replaced LIBOR in five currencies.

The way that one calculates interest on loans or other financial instruments that references an overnight reference rate is summarised in Appendix 1.2.

Banks also use internal managed rate benchmarks as reference rates. Common examples in the UK include central bank base rates and standard variable mortgage rates. The latter is an interest rate basis that is linked explicitly to the central bank base rate but is an internal or "administered" rate that is set by the bank itself. It is linked indirectly to an external reference rate (RFR) to a certain extent.

The key point to understand with overnight index average interest rates is that they compound every day, so the interest paid for a specified period where the rate is an overnight RFR is not known for certainty until just before the interest payment date.

Euribor

The official euro fixing is known as Euribor, which is set in Brussels at 11:00 hours local time each euro business day. The fixing operates in the same way as Libor used to, with a panel of Euribor banks contributing their rates each morning, but these rates are based on actual rates transacted in the market. The average rate of all contributions is taken as the fix.

(*continued*)

					
Preferred rate	Secured Overnight Financing Rate (SOFR)	Sterling Overnight Index Average (SONIA)	Euro Short Term Rate (€STR)	Swiss Average Overnight Rate (SARON)	Tokyo Overnight Average Rate (TONA)
Administrator	NY Federal Reserve	Bank of England	European Central Bank	Six Exchange	Bank of Japan
Publication time	08:00 ET, t+1	09:00 GMT, t+1	09:00 CET, t+1	18:00 CET, t+0	10:00 JST, t+1
Secured	Yes	No	No	Yes	No
Overnight	Yes	Yes	Yes	Yes	Yes
Non-bank counterparties	Yes	Yes	Yes	No	Yes
Term rate	Term SOFR (restricted use cases)	Term SONIA (restricted use cases)	Under consideration EURIBOR an alternative	No	TORF TIBOR an alternative
Synthetic LIBOR	Not applicable	31 December 2021 for 1M, 3M and 6M (unknown duration)	Not applicable	Not applicable	31 December 2021 for 1M, 3M and 6M (for only 1 year)
New LIBOR issuance deadline	31 December 2021	31 March 2021 (for contracts maturing beyond 2021)	31 December 2021	31 December 2021	31 December 2021

FIGURE 1.7 RFR.
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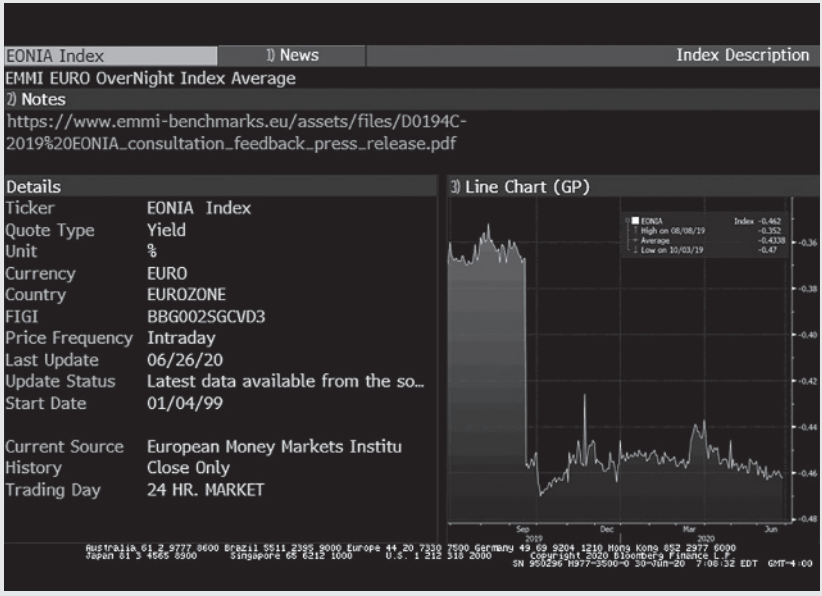


FIGURE 1.8 Euribor and EONIA rates fix page, 22 June 2020.
Source: © 2020 Bloomberg L.P. All rights reserved. Reproduced with permission.

The EONIA fix is the euro overnight interest rate.[13] This is shown in Figure 1.8.

SOFR

The replacement for USD Libor is the Secured Overnight Financing Rate (SOFR), which is an overnight interest rate based on overnight loans that are secured by US Treasury securities.

SONIA

The replacement for GBP Libor is sterling overnight index average (SONIA) which is an overnight rate that is based on the average rate of overnight money market transactions conducted the day before. Similar to SOFR, the interest payable for a specified period on a loan that is quoted as a percentage spread over the SONIA is not known with certainty until just before the payment date, because interest accrues, and is compounded, daily during the interest period.

13 EONIA was the rate used with regard to an overnight index swap (OIS), which we discuss in Chapter 8.

LOAN VALUATION

Setting the interest rate on a customer loan should follow, in the first instance, a traditional approach to valuation that is based on orthodox corporate finance principles. That said, most banks are "price takers" in the sense that they need to be setting interest rates – for loans as well as deposits – in line with their peer banks otherwise they may struggle to attract customer business. But the principles we discuss here should be the baseline approach.

The concept of shareholder value-added arises the instant one sets a target RoE at the strategy level. Holding all else equal, the bank shareholder will not continue to hold shares in the bank unless its target return is met. This target therefore drives strategy. All business undertaken by the bank must meet this target, otherwise it is not creating value. Thus the target RoE, together with the other variables introduced in the previous section, drives loan pricing. This is shown in the simple illustration at Example 1.1. Economic value-added, with respect to the capital employed, must be the guiding principle of all bank business.[14] In other words, the business must generate a return that exceeds the target RoE. If it does not, then it is creating zero value, which means the shareholder would not rationally embark upon it.

EXAMPLE 1.1 LOAN PRICING ILLUSTRATION

Asset		**Liability**	
Loan	100	Deposit	90
		Equity	10

The equity base of the bank is exclusively "Tier 1" capital (equity and retained profits)

14 Beware of arguments advanced along the lines of "in the real world, it is not as simple as that". Thus we observe "loss leader" products, we observe loss-making overseas subsidiaries being maintained because the bank's competitors are based there, we observe loss-making businesses retained for a tax write-off advantage. We observe a myriad of businesses being maintained in existence that, far from creating value, actively destroy it. Ultimately, this is nonsense. Any business line that destroys value must be discontinued. It really is as simple as that. That said, a customer initiative that imposes a cost but generates some non-monetary (such as marketing or perception) benefit may still, quite legitimately, be presented as a valid business line to retain.

Assumptions

Loan maturity =	1 year
The customer deposit pay rate =	5%
The target RoE =	10%
The corporate tax rate =	20%
Loan interest rate =	*X*%

The main principle is that the business, in this case the loan, must create value that exceeds the RoE target of equity invested.

We set the following relationship, which equates the capital employed with the after-tax discounted cash flow of the business:

$$10 = [(1 - 20\%) * ((X * 100) - (5\% * 90))] + 100 - 90/1.10$$

Equity — Tax rate — Revenue on loan — Funding cost — Target RoE

Rearranging for *X* we obtain an interest rate of 5.75%. The interpretation of this is as follows: by setting an interest rate of 5.75%, the present value of the revenue earned on the loan, after tax, is equal to 10, which is the capital set aside for the loan.

Therefore the loan interest rate must be set above 5.75%. At this rate or below, there is zero value creation.

Note that the break-even loan rate of 5.75% is 75 bps (basis points) above the funding rate of 5%. This is the break-even margin.

Following naturally from this illustration in Example 1.1, we see that a bank should calculate the break-even interest rate charge on business as a function of its funding rate, the break-even margin, as well as its RoE and the corporate tax rate. This is of course a very simple example that ignores all other operating costs, but these additional expenses can be incorporated in the analysis easily enough.

Note that the break-even margin is what is required to create shareholder value. For business lines that do not require any risk capital to support them, for example AAA-rated government bonds, the margin can be lower. In our simple example, the loan is backed with the full capital base. In reality, the amount of capital required will depend on the "risk weighting" of the asset (loan). We will discuss this later. But the essential principle remains the same.

Let us now make the illustration a bit closer to the real world (see Example 1.2).

EXAMPLE 1.2 LOAN PRICING INCORPORATING DEFAULT RISK

Asset		Liability	
Loan	100	Deposit	90
		Equity	10

The equity base of the bank is exclusively Tier 1 (equity and retained profits)

Assumptions

Loan maturity =	2 years (annual interest)
Customer deposit pay rate =	5% (fixed for two years)
Target RoE =	10%
Corporate tax rate =	20%
Loan default probability (Year 1) =	0%
Loan default probability (Year 2) =	5%
Recovery rate =	40%
Loan interest rate	X%

The same principle is applied again, whereby the break-even loan rate of X% must be set such that the present value of the expected cash flow of the loan, after tax, equates the value of the equity used to back the loan. Thus we have:

$$10 = [(X * 100) - (90 * 5\%) * (1 - 0.2) / 1.10$$ ← Year 1 cash flow present value (zero default probability)

Year 2 cash flow present value (incorporates default probability)

plus

$$95\% * [(1 - 0.2) * X * 100 + 100] + 5\% * [40 + (0.2 * 60)] / 1.10^2$$

Allowing for no default (95% probability) — Allowing for default (5% probability)

minus

$$90 * 5\% * (1 - 0.2) + 90 / 1.10^2$$ ← Year 2 funding cost

Rearranging for X we obtain an interest rate of 11.1%. This is the break-even loan rate that must be applied to the loan.

In Example 1.2 we allow for the possibility of default by the borrower in Year 2 of the two-year loan. There are now two parameters to allow for in addition to the equity backing the loan, and these are the default probability of the loan and the amount of recovery in the event of default (called the "recovery rate" (RR) here – given the author's previous experiences in the credit derivatives market – but also known as "loss given default", which is the notional amount minus RR). Should default occur, the bank will recover 40 cents on the dollar. We also allow for a tax recovery on the amount that is lost in the event of default, which is the tax rate of 20% multiplied by the loss amount of 60 cents on the dollar.

We see then that in setting the loan rate at a level that creates value, we need to adjust the expected cash flows for the possibility of customer default, and the amount we expect to recover should there be a default. From this point on, we have introduced an element of subjectivity in the calculation: the recovery rate is an *assumed* value (we have no firm idea what we will recover in the event of a customer going into bankruptcy) and the default probability of any customer can never be known with certainty, although one can infer it from observing the prices (yields) of loans and bonds in the market.[15] But one sees see how once one enters the real world, pricing loans to create shareholder value and allow for credit risk becomes as much an art as a science.

This example also highlights the issue of setting aside part of each year's profit to cover for future loan defaults. This is known as loan provisioning; it is the method by which a proportion of bank capital is earmarked as a buffer to enable the bank to withstand losses arising from customer default in the future. In this process, part of the profit generated by the loan at the end of Year 1, which is essentially the interest income minus the funding cost and expenses, after tax, is not recorded as profit but is instead set aside as a loan loss provision for the following year. In other words, loan provisions reduce the after-tax profit of the business.

What should the amount of loss provision be? The answer to this is based on the amount of "expected loss" on the loan portfolio. The calculation of this amount again uses the default probability and recovery rate parameters (which may have changed from the time the loan was originated). We illustrate this in Example 1.3.

15 See pp. 815–18 of the author's book *Bank Asset and Liability Management* (2007) for a detailed look from first principles on how to extract default probabilities from bond market prices. The process is also described in his book *Structured Credit Products* (2010b).

EXAMPLE 1.3 LOAN LOSS PROVISION

Net loan value:

$$0.95 * \left[100 + (11.1) * (1 - 0.2)\right] + 0.05 * \left[40 + (0.2 * 60)\right] / 1.10$$
$$- \left[90 * 0.05 * (1 - 0.2)) + 90\right] / 1.10$$
$$= 9.305$$

Interest margin after tax:

$$(1 - 0.2) * [11.1\% * 100) - (5\% * 90)]$$
$$= 5.28$$

Attributable profit:

$$= 5.28 - 0.695$$
$$= 4.585$$

We see that the net loan value is now 9.305. At loan origination the loan value was 10, so the loan has fallen in value by [10 – 9.305] or 0.695.

The fall in the net value of the loan at the end of the year is used to calculate the amount of interest income from it that can be attributed as profit, and what should be set aside as a loan provision. This is given as:

Attributable profit = Post-tax interest margin – fall in loan value.

This is shown in the second half of Example 1.3. The balance of the interest income not assigned to attributable profit is set aside as a credit provision.

We see then that to arrive at a sensible lending rate for any type of business that it undertakes, a bank must have a good idea of its cost base as well as a good idea of what the expected frequency of bad loans will be in the following 12 months. It also needs to have a target RoE to aim for. The interest rate on a loan is then set as a spread over the bank's funding cost, being calculated as a function of the target RoE, a credit spread to cover anticipated loan losses, and any additional spread to cover its operating expenses.

In Example 1.4 we describe a real-world pricing model, in order to show the various inputs that may be used in a loan pricing model. Not every bank uses every one of these inputs as factors in its loan pricing process (for example, the cost of maintaining part of the balance sheet assets as risk-free sovereign securities – the so-called high quality liquid assets buffer or HQLA – can be covered elsewhere and not necessarily in the customer loan pricing model) but the example serves to show inputs that are used commonly.

EXAMPLE 1.4 CHOUDWEST BANK PRICING MODEL REVIEW ILLUSTRATION

ChoudWest Bank pricing model uses the following inputs in its customer loan pricing process. These and their rationale are described in Table 1.8.

TABLE 1.8 Customer loan pricing inputs.

LOAN PRICING MODEL Key model assumptions		Current	Last quarter
Pricing component	**Basis of pricing input**	**Rate in use**	**Rate in use**
Target rate of return	The rate given by [(*X* – CoF)/P1 capital allocation) that delivers 12% or more where *X* is the gross lending absent any other add-on and 12% is current estimated cost of capital	12%	12%
Benchmark rate	Central bank base rate	0.50%	0.10%
Core funding cost (CoF)	Instant access deposit rate	0.65%	0.45%
Term liquidity premium (TLP)	Ave. cost of contractual 1-year funding	170 bps	120 bps
HQLA premium (net carry cost)	HQLA share of balance sheet	75 bps	60 bps

(*continued*)

TABLE 1.8 (*continued*)

LOAN PRICING MODEL Key model assumptions		Current	Last quarter
Pricing component	**Basis of pricing input**	**Rate in use**	**Rate in use**
Credit risk margin	Borrower risk-weighting by internal credit grading	x	x
Security	Collateral / over-collateralisation / LTV		
	Calculation: basis points	x	x
Operating costs	Not applied		
Deposit guarantee scheme levy	Not applied	x	x
Fixed-rate lending hedge cost	Hedge spread 1–4 year	11 bps	8 bps
	5 year	20 bps	12 bps
	6–10 year	35 bps	22 bps
Variation margin	Not currently applied		
FX risk hedging cost	FX FWD spread	x	x
Total capital ratio		10.5%	10.5%

As well as enabling loan pricing, the model is set such that the bank may determine specific product profitability, assess hedging costs and ensure that the term liquidity premium (TLP) is accounted for in pricing.

The model incorporates the bank's "Target Rate of Return Floor Rate (TRR)", which acts as a control mechanism to ensure that the cost of capital hurdle is observed for all lending. The bank's asset–liability committee (ALCO) is delegated by the Board to authorise any lending below this rate.

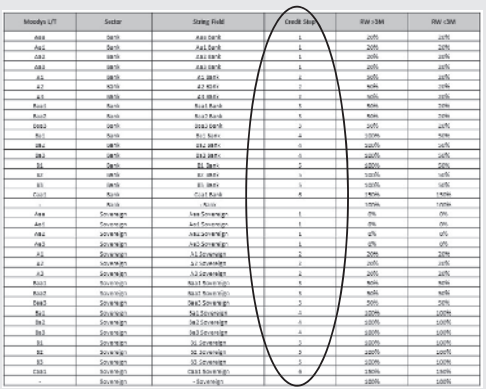
Model inputs

The input components are set out in the table. Proposed updates to the agreed approach are shown as follows:

Loan pricing input	Definition	Approach adopted
Target rate of return	The baseline rate for all lending.	This rate given by: – loan rate (X) minus CoF as numerator – the estimated Pillar 1 capital allocation as denominator X must be set as the rate that generates a TRR of 12%. The bank's assumed cost of capital is set at 12% (reviewed at least annually).
(a) Core funding cost (CoF)	The cost of funding from all funding sources (customer and wholesale) that is deemed "core" (stable) across all products. The bank uses core funding cost as an input to pricing loan products.	A core cost of funding (CoF) is used for all products uniformly. Cost of retail deposits uses the current average funding cost. This is reviewed every quarter (or more frequently during periods of market volatility as required.). There is flexibility to adjust this using a view on future cost of funds for longer-dated lending (over 5-year tenor). This input is a spread over the "benchmark" or risk-free rate, which is taken as the central bank base rate.
(b) Term liquidity premium (TLP)	The costs of holding additional term funding of contractual tenor over 1 year. This recognises that the bank funds part of its balance sheet with long-dated funds at all times, and that this premium should therefore be incorporated in loan pricing.	The TLP is given by the average cost of term funding (defined as all funds on the balance sheet that is contractual tenor over 1 year), minus the CoF. This rate is reviewed every quarter.

(*continued*)

Loan pricing input	Definition	Approach adopted
(c) HQLA premium	The bank is required to hold an HQLA buffer at all times at a minimum level given by the LCR ratio. This portfolio exhibits a negative net carry cost, which is therefore included in the loan pricing.	This rate is estimated every quarter as the average return of the portfolio minus the average CoF. This number is always negative, and added as input to loan pricing.
(d) Credit risk margin	The bank applies an orthodox (Moody's KMV) credit model to determine credit risk grading of the obligor at time of loan origination. A credit spread is added based on internal credit grading as follows: Credit step 3: 150 bps Credit step 4: 175 bps Credit step 5–6: 200 bps The pricing model will price for the different risks of these products or on renewal business.	Internal credit grading is mapped to the Moody's KMV credit quality step. The credit risk add-on is reviewed every quarter.



Loan pricing input	Definition	Approach adopted
(e) **Security (collateral)**	Loan-to-value (LTV) 100%: –15bps 120%: –20bps 150% or higher: –35bps	There is a negative add-on depending on the amount of collateralisation / over-collateralisation. This is reviewed every quarter and based on recovery rates as estimated by published data per loan product type.
(f) **Fixed-rate lending hedge cost**	Hedging costs associated with managing interest rate risk, basis risk and/or currency FX risk arising from the loans (including settlement and clearing house initial and/or variation margin costs, and cost of collateral funding based on TLP for term funding)	Hedging costs are allocated to fixed rate lending on a product-by-product basis based on the pricing at the time of origination. The bank lends fixed-rate product up to 10-year contractual tenor. When fixed-rate lending is hedged using interest-rate swaps the bank will pay fixed rate and receive floating rate linked to the relevant RFR. Collateral funding cost used the TLP rate on the amount of initial margin. Currency risk: where the bank originates fixed-rate loans denominated in a currency other than GBP and hedges this with cross-currency swap, the forward FX premium for 1 year is added to cover hedge cost.

(*continued*)

The key model assumptions as updated for the financial year 2021/22 are shown below:

PRICING MODEL Key model assumptions			Feb-21	Feb-22	
Assumption ref	**Component of pricing**	**Basis of pricing by Bank**	**Rate in use**	**Rate in use**	
1	Benchmark rate	Bank of England base rate	0.10%	0.50%	
2	Cost of core funding	Cost of Instant Access Deposit Account	0.64%	0.84%	
3	Liquidity holding premium	Liquidity proportion of balance sheet	22.4%	17.0%	
		Marginal return on liquidity	0.10%	0.50%	
4	Cost of credit	Collective loss provision	£128,000	£268,000	
		Mortgage balances	£262,986,000	£329,725,000	
		Calculation: basis points	4.87%	8.13%	
		Allocation:			
		Buy to let	0.06	0.06	
		Core residential	0.04	0.04	
		First-time buyer	0.05	0.05	
5	Operating cost	Management expense ratio	1.61 1.14	1.54 1.18	New Retained
6	FSCS levy	Planned charge for the year	£10,000	£0	
7	Pipeline liquidity cost	Planned mortgage pipeline	£29,000,000	£30,000,000	
8	Hedge spread	2-year fixed leg	0.08%	1.61%	
		3-year fixed leg	0.13%	1.64%	
		5-year fixed leg	0.25%	1.55%	
		SONIA	0.05%	0.44%	
9	Variation margin	Not currently applicable	N/A	N/A	
10	Currency risk	Not currently applicable	N/A	N/A	
11	TCR		12%	12%	
12	Reserves (£'000)		£23,434	£24,212	
13	HLC	Less than 90% LTV	3.92	4.25	
		90% and over LTV	4.76	5.5	

RISK EXPOSURES IN BANKING

We need to be familiar with the risks inherent in the business of banking. The obvious ones are better known, but all risks need to be adequately managed, and the direction for this risk management must come from the top, at Board level. In Chapter 18 we provide a detailed look at the ideal bank governance structure, which should allow for an effective risk management framework. And in Part V we discuss the entire topic of "risk management in banking" in detail. For now we will simply introduce the key risk exposures in banking that must be measured, maintained within "appetite" and mitigated.

The Main Bank Risks

Any transaction or undertaking with an element of uncertainty as to its future outcome carries an element of risk: risk can be thought of as uncertainty. To associate particular assets such as equities, bonds or corporate cash flows with types of risk, we need to define "risk" itself. It is useful to define it in terms of a risk *horizon,* the point at which an asset will be realised, or turned into cash. All market participants, including speculators, have a horizon. Essentially, then, the horizon is the time period within which risk is being considered.

Once we have established a notion of horizon, a working definition of risk is *the uncertainty of the future total cash value of an investment on the investor's horizon date*. This uncertainty arises from many sources. For participants in the financial markets risk is essentially a measure of the volatility of asset returns, although it has a broader definition as being any type of uncertainty as to future outcomes. The types of risk that a bank is exposed to as part of its operations in the loan and debt capital markets are described as follows.

Credit Risk

This is the primary risk in banking. It is the risk that a customer will default on a loan. It is also the risk, short of default, that the credit quality of the obligor will deteriorate, which affects book value because there is an increased probability of default. Credit risk exists in the banking portfolio and trading portfolio.

Credit risk is described by exposure, or notional value at risk, probability of default, and loss in event of default. The most common measure of credit risk is the formal credit rating. However, all banks will rate their customers according to their own internal rating methodology, which is part of their credit analysis process. An internal rating scale is essential in a bank

because most bank customers (in the case of small and medium-size corporates, or SMEs, virtually all bank customers) will not have a formal public credit rating.

Market Risk

This is risk of loss arising from movements in prices in financial markets. Examples include FX risk, interest-rate risk and basis risk. In banks the key market risk is interest-rate risk, and it is sometimes measured and reported separately to other market risk.

Liquidity Risk

This refers to two different but related issues: for a Treasury or money markets person, it is the risk that a bank has insufficient funding to meet commitments as they arise. That is, the risk that funds cannot be raised in the market as and when required. This is also known as *rollover risk,* for obvious reasons. Funding risk can be affected by events in the market, affecting all but the most creditworthy of banks, or by events specific to the individual bank. So, in August 2007 the UK bank Northern Rock plc found that it was unable to access inter-bank lines as these had been withdrawn from it, and was forced to go to the Bank of England for funding. Once this fact became public, a run on the bank sealed its fate. In September 2008 the collapse of the US investment bank Lehman Brothers resulted in a general drying up of liquidity in the inter-bank market, so that even large AA-rated banks were forced to pay substantially over Libor to secure term inter-bank money.

For a securities or derivatives trader, liquidity risk is the risk that the market for assets becomes too thin to enable fair and efficient trading to take place. This is the risk that assets cannot be sold or bought as and when required – in other words, the risk that an asset, once purchased, becomes illiquid and cannot be sold. Of course, many bank assets are illiquid at the start; for example, an SME loan. Therefore, it becomes important to fund such assets with a secure source of funds. It is also imperative, as we shall see later, that a sufficient share of the bank's balance sheet is held in liquid assets that may be easily realised whenever needed.

Operational Risk

This is the risk of loss associated with non-financial matters such as fraud, system failure, accidents and ethics. Operational risk can be mitigated by defining strict procedures for all aspects of a bank's business functions, from front to back office, and ensuring adherence to them. The bank's risk management function should assign a dedicated person or team to managing

operational risk and each department of the bank should appoint an operational risk liaison who will work as the primary contact for the head of operational risk.

The Risk Management Function

While there is some variety in the way a bank risk management function is organised, the following may be taken as being business best-practice:

- having an independent department responsible for drawing up and explicitly stating the bank's approach to risk, and defining trading limits and the areas of the market that the firm can have exposure to;
- having the head of the risk function report to an independent senior manager, who is a member of the Executive Board. This person is usually styled as the chief risk officer (CRO);
- monitoring the separation of duties between front, middle and back office, often in conjunction with an internal audit function;
- reporting to senior management, including the firm's overall exposure and adherence of the front office to the firm's overall risk strategy;
- communicating risks and risk strategy to shareholders.

The risk management function is more likely to deliver effective results when there are clear lines of responsibility and accountability. It is also imperative that the department interacts closely with other areas of the front and back office.

We will look much closer at the overall risk management framework of a bank in Part V of the book.

EXAMPLE 1.5 NET INTEREST INCOME AND NET INTEREST MARGIN SENSITIVITY ANALYSIS: CASE STUDY

Introduction (see Figure 1.9)

ChoudWest Bank is an hypothetical commercial bank. Its balance sheet (see Figure 1.9) is primarily comprised of deposit taking and lending to retail, small business and corporate customers. The bank has a small presence in the wholesale markets.

For the purposes of the example, the general level of interest rates is assumed to be 5% and it is anticipated that they will remain at this level for the next 12 months.

(*continued*)

WestChoud Bank - Balance Sheet

5% Rate Environment (flat yield curve - same at all tenors)

	Assets				Liabilities		
	£m	**Rate**	**Interest Income (£m)**		**£m**	**Rate**	**Interest Expense (£m)**
Cash	100	-	-	Deposits by Banks	2,000	4.80%	
Central Bank Deposits	250	1.00%					
Loans to Banks	1,000	5.00%		Customer Accounts			
				Retail Non-Interest Bearing Current Accounts	3,000	0.00%	
Loans and Advances to Customers				*Retail Instant Access Deposit Accounts*	2,000	2.50%	
Credit Cards	1,000	12.00%		*Retail Notice Accounts*	500	3.50%	
Personal Loans(Fixed Rate)	1,500	8.00%		*Retail Fixed Rate Bonds*	1,000	4.50%	
Retail Overdrafts	500	9.00%		*Corporate/Small Business Non-Interest Bearing Current Accounts*	2,000	0.00%	
Fixed Rate Mortgages	5,000	5.25%		*Corporate Variable Rate Savings Accounts*	1,000	2.00%	
Variable Rate Mortgages	2,500	5.50%		*Small Business Variable Rate Savings Accounts*	800	1.00%	
Small Business Loans and Overdrafts	500	7.50%					
Corporate Loans and Overdrafts	2,000	6.50%		Debt Securities in Issue (floating rate)	1,000	7.50%	
Bad debts net of provisions	250	0.00%		Subordinated Liabilities (fixed rate)	2,000	10.00%	
Debt Securities	1,500	4.50%		Accruals and Deferred Income	200	-	
Equity Shares	500	-					
				Equity Capital	2,000	-	
Fixed Assets	400	-					
Goodwill/Intangible Assets	300	-					
Prepayments and Accrued Income	200	-					
Total	**17,500**		**0.00**		**17,500**		**0.00**

	£m
Interest Income	0.00
Interest Expense	0.00
Interest Earning Assets	0.00
Net Interest Income	0.00
NIM	0.00%

FIGURE 1.9 ChoudWest Bank Balance Sheet.

Each item on the balance sheet is expected to remain constant for the next 12 months. There is assumed to be no repayment or prepayment on fixed rate products, nor any new business written (otherwise it would unnecessarily complicate the example!).

ChoudWest Bank does not operate a funds transfer pricing process, as this could alter the recognition of interest income and expense across assets and liabilities.

As a further simplification, the yield curve is assumed to be flat across all tenors.

Base Scenario (see Figure 1.10)

Interest income for the year is calculated by multiplying each product balance on the asset side of the balance sheet, by its relevant interest rate, then summing the result of all the calculations.

Total interest income is **£972.5m.**

Assets such as: cash, equity shares, fixed assets, goodwill and intangible assets and prepayments and accrued income are not interest bearing, so are excluded from the calculation.

Bad debts, net of provisions, are included in the calculation because items in this category are capable of earning interest. Although this may not appear relevant, as any balance multiplied by 0.0% gives an answer of £0.00, it is of significance for the calculation of the net interest margin. If non-performing assets were to be excluded, we would not be getting a true picture of profitability.

Interest earning assets comprise all assets capable of earning interest (**£16.0bn**).

Interest expense for the year is calculated by multiplying each product balance on the liability side of the balance sheet, by its relevant interest rate, then summing the result of all the calculations.

Total interest expense is **£511.5m.**

Accruals and deferred income and equity capital do not pay interest (although the latter may yield a dividend), so are excluded from the calculation.

Net interest income (NII) is calculated by subtracting interest expense from interest income (**£972.5m – £511.5m = £461.0m**).

Net interest margin (NIM) is generated by dividing NII by interest earning assets (**£461.0m/£16.0bn = 2.88%**).

We will now consider what might happen to the NII and NIM of ChoudWest Bank in five different scenarios.

(*continued*)

WestChoud Bank - Balance Sheet

5% Rate Environment (flat yield curve - same at all tenors)

Assets	£m	Rate	Interest Income (£m)	Liabilities	£m	Rate	Interest Expense (£m)
Cash	100	-	-	Deposits by Banks	2,000	4.80%	96.00
Central Bank Deposits	250	1.00%	2.50				
Loans to Banks	1,000	5.00%	50.00	Customer Accounts			
				Retail Non-Interest Bearing Current Accounts	3,000	0.00%	0.00
Loans and Advances to Customers				*Retail Instant Access Deposit Accounts*	2,000	2.50%	50.00
Credit Cards	1,000	12.00%	120.00	*Retail Notice Accounts*	500	3.50%	17.50
Personal Loans(Fixed Rate)	1,500	8.00%	120.00	*Retail Fixed Rate Bonds*	1,000	4.50%	45.00
Retail Overdrafts	500	9.00%	45.00	*Corporate/Small Business Non-Interest Bearing Current Accounts*	2,000	0.00%	0.00
Fixed Rate Mortgages	5,000	5.25%	262.50	*Corporate Variable Rate Savings Accounts*	1,000	2.00%	20.00
Variable Rate Mortgages	2,500	5.50%	137.50	*Small Business Variable Rate Savings Accounts*	800	1.00%	8.00
Small Business Loans and Overdrafts	500	7.50%	37.50				
Corporate Loans and Overdrafts	2,000	6.50%	130.00	Debt Securities in Issue (floating rate)	1,000	7.50%	75.00
Bad debts net of provisions	250	0.00%	0.00	Subordinated Liabilities (fixed rate)	2,000	10.00%	200.00
Debt Securities	1,500	4.50%	67.50	Accruals and Deferred Income	200	-	-
Equity Shares	500	-	-				
				Equity Capital	2,000	-	-
Fixed Assets	400	-	-				
Goodwill/Intangible Assets	300	-	-				
Prepayments and Accrued Income	200	-	-				
Total	**17,500**		**972.50**		**17,500**		**511.50**

	£m
Interest Income	972.50
Interest Expense	511.50
Interest Earning Assets	16,000
Net Interest Income	461.00
NIM	2.88%

FIGURE 1.10 ChoudWest Bank Base Scenario.

Scenario 1 - Interest Rates Rise (by 3%) (see Figure 1.11)

A rise in interest rates would affect the interest rates paid and received on interest-earning assets and interest-bearing liabilities in one of three ways:

- ***The interest rate attached to the product would remain unchanged.*** This will be the case for fixed rate products (such as personal loans, fixed rate mortgages, fixed rate deposits and fixed rate subordinated liabilities) and zero-rate products (such as non-interest-bearing current accounts and bad debts) on both the asset and liability side of the balance sheet.
- ***The interest rate on the product would increase by the same amount as the underlying change in the general level of interest rates.*** Some products may be contractually linked to an underlying benchmark interest rate and will, therefore, re-price in line with movements in the benchmark. For example, the re-pricing of loans to and deposits from banks and both variable (or floating) rate debt securities and debt securities in issue will be directly linked to short-term money market (SONIA) rates. Variable-rate mortgages and retail, small business and corporate overdrafts will be linked to a bank's "Base Rate", a rate managed by each bank, which also tends to re-price in line with short-term money market rates.
- ***The interest rate on the product would increase by either more or less than the underlying change in the general level of interest rates.*** Products with a high interest rate, such as credit cards, will tend to re-price infrequently, but may re-price by much more than the underlying benchmark when there is a movement in short-term market interest rates or Base Rate. Although not part of this example, the converse can be true for low-interest bearing deposit products, such as obsolete accounts, which tend to re-price by much less than the movement in the underlying benchmark.

Note, although theoretically possible, it is unusual for product interest rates to fall in a situation where the general level of interest rates is rising. It could happen, though, if a bank wishes to gain publicity from a loss-leading asset, but is unlikely on a deposit product, due to the damaging reputational consequences arising from the adverse publicity that would likely follow such a move.

(*continued*)

WestChoud Bank - Balance Sheet

Scenario 1: Interest Rates rise and there is an increased incidence of bad debts. No Funds Transfer Pricing Process. NIM increases from base scenario 8% Rate Environment (flat yield curve - same at all tenors)

	Assets				**Liabilities**		
	£m	**Rate**	**Interest Income (£m)**		**£m**	**Rate**	**Interest Expense (£m)**
Cash	100	-	-	Deposits by Banks	2,000	7.80%	156.00
Central Bank Deposits	250	4.00%	10.00				
Loans to Banks	1,000	8.00%	80.00	Customer Accounts			
				Retail Non-Interest Bearing Current Accounts	3,000	0.00%	0.00
Loans and Advances to Customers				*Retail Instant Access Deposit Accounts*	2,000	5.50%	110.00
Credit Cards	990	18.00%	178.20	*Retail Notice Accounts*	500	6.50%	32.50
Personal Loans(Fixed Rate)	1,475	8.00%	118.00	*Retail Fixed Rate Bonds*	1,000	4.50%	45.00
Retail Overdrafts	485	12.00%	58.20	*Corporate/Small Business Non-Interest Bearing Current Accounts*	2,000	0.00%	0.00
Fixed Rate Mortgages	4,975	5.25%	261.19	*Corporate Variable Rate Savings Accounts*	1,000	5.00%	50.00
Variable Rate Mortgages	2,475	8.50%	210.38	*Small Business Variable Rate Savings Accounts*	800	4.00%	32.00
Small Business Loans and Overdrafts	450	10.50%	47.25				
Corporate Loans and Overdrafts	1,900	9.50%	180.50	Debt Securities in Issue (floating rate)	1,000	10.50%	105.00
Bad debts net of provisions	500	0.00%	0.00	Subordinated Liabilities (fixed rate)	2,000	10.00%	200.00
Debt Securities	1,500	7.50%	112.50	Accruals and Deferred Income	200	-	-
Equity Shares	500	-	-				
				Equity Capital	2,000	-	-
Fixed Assets	400	-	-				
Goodwill/Intangible Assets	300	-	-				
Prepayments and Accrued Income	200	-	-				
Total	**17,500**		**1,256.21**		**17,500**		**730.50**

	£m
Interest Income	1,256.21
Interest Expense	730.50
Interest Earning Assets	16,000
Net Interest Income	525.71
versus Base Scenario	64.71 ↑
NIM	3.29%
versus Base Scenario	0.40% ↑

FIGURE 1.11 ChoudWest Bank – Scenario 1.

An additional feature of the example is the increased incidence of bad debts. As interest rates increase, more individuals and companies are likely to get into financial difficulty. In this example, there is a migration of £250m of performing customer loans and advances to the non-performing or bad debt category.

The income and profitability (e.g., NIM) measures are calculated in the same way as for the "Base Case" scenario.

Total interest income is **£1,256.2m** (up £283.7m) and interest expense is **£730.5m** (up £219.0m), resulting in an increase in NII to **£525.7m** (up £64.7m).

The extent to which the NII changes between the "Base Case" and the "Interest Rate Rise" scenario gives an indication of the sensitivity of the bank's income to interest rate movements. In this case, the NII increases by £64.7m or 14% to a 3% upward movement in the general level of interest rates. In aggregate, more of the assets are re-pricing than the liabilities, which is helping to generate the income growth. The greater the change, the greater the level of interest-rate risk being run by ChoudWest Bank. Although the extra interest income may sound good, we should be concerned with what might happen were there to be a fall in market interest rates (Scenario 3)!

As interest earning assets remain constant at **£16.0bn**, and NII has risen, the NIM also increases (by 0.41% to **3.29%**).

Scenario 2 - Liquidity Buffer Strengthened (see Figure 1.12)

In this scenario, ChoudWest Bank has invested an additional £1.5bn in debt securities to boost its liquidity buffer. To ensure that the liquidity position of the bank is strengthened, the additional liquid assets are funded long-term by variable-rate subordinated liabilities.

Typically, a bank's liquidity buffer will be made up of government and other assets with a higher rating than the bank itself. As a result, the yield on the assets in the liquidity buffer tends to be less than the bank's cost of long-term funds. In this instance, the net cost of carry is 3% (7.5% cost of funds less 4.5% yield on assets in the liquidity buffer).

Total interest income rises to **£1,040m** (up £67.5m), but interest expense increases by a greater amount to **£624m** (up £112.5m). Interest earning assets have grown by £1.5bn to **£17.5bn**, so both the NII (**£416m**, down £45m) and NIM (**2.38%**, down 0.50%) fall relative to the Base Scenario.

(*continued*)

WestChoud Bank - Balance Sheet

Scenario 2: Liquidity buffer doubled, funded by a senior debt issue. No Funds Transfer Pricing Process. NIM declines from base scenario 5% Rate Environment (flat yield curve - same at all tenors)

	Assets				**Liabilities**		
	£m	**Rate**	**Interest Income (£m)**		**£m**	**Rate**	**Interest Expense (£m)**
Cash	100	-	-	Deposits by Banks	2,000	4.80%	96.00
Central Bank Deposits	250	1.00%	2.50				
Loans to Banks	1,000	5.00%	50.00	Customer Accounts			
				Retail Non-Interest Bearing Current Accounts	3,000	0.00%	0.00
Loans and Advances to Customers				*Retail Instant Access Deposit Accounts*	2,000	2.50%	50.00
Credit Cards	1,000	12.00%	120.00	*Retail Notice Accounts*	500	3.50%	17.50
Personal Loans(Fixed Rate)	1,500	8.00%	120.00	*Retail Fixed Rate Bonds*	1,000	4.50%	45.00
Retail Overdrafts	500	9.00%	45.00	*Corporate/Small Business Non-Interest Bearing Current Accounts*	2,000	0.00%	0.00
Fixed Rate Mortgages	5,000	5.25%	262.50	*Corporate Variable Rate Savings Accounts*	1,000	2.00%	20.00
Variable Rate Mortgages	2,500	5.50%	137.50	*Small Business Variable Rate Savings Accounts*	800	1.00%	8.00
Small Business Loans and Overdrafts	500	7.50%	37.50				
Corporate Loans and Overdrafts	2,000	6.50%	130.00	Debt Securities in Issue (floating rate)	2,500	7.50%	187.50
Bad debts net of provisions	250	0.00%	0.00	Subordinated Liabilities (fixed rate)	2,000	10.00%	200.00
Debt Securities	3,000	4.50%	135.00	Accruals and Deferred Income	200	-	-
Equity Shares	500	-	-				
				Equity Capital	2,000	-	-
Fixed Assets	400	-	-				
Goodwill/Intangible Assets	300	-	-				
Prepayments and Accrued Income	200	-	-				
Total	**19,000**		**1040.00**		**19,000**		**624.00**

	£m
Interest Income	1040.00
Interest Expense	624.00
Interest Earning Assets	17,500
Net Interest Income	416.00
versus Base Scenario	-45.00 ↓
NIM	2.38%
versus Base Scenario	-0.50% ↓

FIGURE 1.12 ChoudWest Bank – Scenario 2.

Not surprisingly, the action by ChoudWest Bank to reduce its liquidity risk has a negative impact on both the absolute level of earnings and (interest) profitability of the bank.

Scenario 3 - Interest Rate Fall (to 4%) (see Figure 1.13)

The impact of a 1% drop in the general level of interest rates is almost the opposite of the interest rate rise scenario, though as the interest rate change is small, the amount of bad debts remains constant in the example. As noted previously, more assets than liabilities are sensitive to interest-rate movements, so ChoudWest's balance sheet is exposed to a decline in the general level of interest rates.

Total interest income falls to **£870m** (down £102.5m) and interest expense reduces by a lesser amount to **£438.5m** (down £73.0m). Interest earning assets have remained constant at **£16.0bn**, so both the NII (**£431.5m**, down £29.5m) and NIM (**2.70%**, down 0.18%) fall relative to the Base Scenario.

Scenario 4 - Instant Access Deposit Account Re-launch (see Figure 1.14)

Scenario 4 involves the simultaneous launch of a new 0% credit card (for balance transfers), designed to increase ChoudWest Bank's market share and fee income, and the relaunch of an instant access deposit account, with a more attractive rate (up to 3.50% from 2.50%).

There is a range of income dynamics affecting both NII and the NIM:

- A higher rate is being paid to attract new liability balances of £1bn.
- The new rate is being offered to existing customers as well. Whilst, from a legal perspective, a bank is not forced to adopt this approach, failing to do so may have adverse reputational consequences. Although excluded from this example, there could, in practice, also be "cannibalisation" (movement of balances) from other ChoudWest retail accounts to the relaunched product.
- Interest earning assets are increasing, due to the launch of the new 0% credit card account, but this is using up balance sheet resources without delivering additional interest income.
- As the increase in instant access balances is greater than the amount lent on the 0% credit card, the bank is able to repay £500m of expensive inter-bank borrowing.

(*continued*)

WestChoud Bank - Balance Sheet

Scenario 3: Interest Rates fall. No Funds Transfer Pricing Process. NIM declines from base scenario

4% Rate Environment (flat yield curve - same at all tenors)

	Assets				**Liabilities**		
	£m	**Rate**	**Interest Income (£m)**		**£m**	**Rate**	**Interest Expense (£m)**
Cash	100	-	-	Deposits by Banks	2,000	3.80%	76.00
Central Bank Deposits	250	0.00%	0.00				
Loans to Banks	1,000	4.00%	40.00	Customer Accounts			
				Retail Non-Interest Bearing Current Accounts	3,000	0.00%	0.00
Loans and Advances to Customers				*Retail Instant Access Deposit Accounts*	2,000	1.50%	30.00
Credit Cards	1,000	10.00%	100.00	*Retail Notice Accounts*	500	2.50%	12.50
Personal Loans(Fixed Rate)	1,500	8.00%	120.00	*Retail Fixed Rate Bonds*	1,000	4.50%	45.00
Retail Overdrafts	500	8.00%	40.00	*Corporate/Small Business Non-Interest Bearing Current Accounts*	2,000	0.00%	0.00
Fixed Rate Mortgages	5,000	5.25%	262.50	*Corporate Variable Rate Savings Accounts*	1,000	1.00%	10.00
Variable Rate Mortgages	2,500	4.50%	112.50	*Small Business Variable Rate Savings Accounts*	800	0.00%	0.00
Small Business Loans and Overdrafts	500	6.50%	32.50				
Corporate Loans and Overdrafts	2,000	5.50%	110.00	Debt Securities in Issue (floating rate)	1,000	6.50%	65.00
Bad debts net of provisions	250	0.00%	0.00	Subordinated Liabilities (fixed rate)	2,000	10.00%	200.00
Debt Securities	1,500	3.50%	52.50	Accruals and Deferred Income	200	-	-
Equity Shares	500	-	-				
				Equity Capital	2,000	-	-
Fixed Assets	400	-	-				
Goodwill/Intangible Assets	300	-	-				
Prepayments and Accrued Income	200	-	-				
Total	**17,500**		**870.00**		**17,500**		**438.50**

	£m
Interest Income	870.00
Interest Expense	438.50
Interest Earning Assets	16,000
Net Interest Income	431.50
versus Base Scenario	-29.50 ↓
NIM	2.70%
versus Base Scenario	-0.18% ↓

FIGURE 1.13 ChoudWest Bank – Scenario 3.

WestChoud Bank - Balance Sheet

Scenario 4: Instant Access Product re-launched at a higher rate and new 0% credit card introduced for balance transfers leading to growth in the balance sheet and pay-down of Deposits by Banks. No Funds Transfer Pricing Process. Marginal decline in NIM from Base Scenario

5% Rate Environment (flat yield curve - same at all tenors)

	Assets				**Liabilities**		
	£m	**Rate**	**Interest Income (£m)**		**£m**	**Rate**	**Interest Expense (£m)**
Cash	100	-	-	Deposits by Banks	1,500	4.80%	72.00
Central Bank Deposits	250	1.00%	2.50				
Loans to Banks	1,000	5.00%	50.00	Customer Accounts			
				Retail Non-Interest Bearing Current Accounts	3,000	0.00%	0.00
Loans and Advances to Customers				*Retail Instant Access Deposit Accounts*	3,000	3.50%	105.00
0% Credit Cards for Balance Transfers	500	0.00%	0.00	*Retail Notice Accounts*	500	3.50%	17.50
Credit Cards	1,000	12.00%	120.00	*Retail Fixed Rate Bonds*	1,000	4.50%	45.00
Personal Loans(Fixed Rate)	1,500	8.00%	120.00	*Corporate/Small Business Non-Interest Bearing Current Accounts*	2,000	0.00%	0.00
Retail Overdrafts	500	9.00%	45.00	*Corporate Variable Rate Savings Accounts*	1,000	2.00%	20.00
Fixed Rate Mortgages	5,000	5.25%	262.50	*Small Business Variable Rate Savings Accounts*	800	1.00%	8.00
Variable Rate Mortgages	2,500	5.50%	137.50				
Small Business Loans and Overdrafts	500	7.50%	37.50	Debt Securities in Issue (floating rate)	1,000	7.50%	75.00
Corporate Loans and Overdrafts	2,000	6.50%	130.00	Subordinated Liabilities (fixed rate)	2,000	10.00%	200.00
Bad debts net of provisions	250	0.00%	0.00				
				Accruals and Deferred Income	200	-	-
Debt Securities	1,500	4.50%	67.50				
Equity Shares	500	-	-	Equity Capital	2,000	-	-
Fixed Assets	400	-	-				
Goodwill/Intangible Assets	300	-	-				
Prepayments and Accrued Income	200	-	-				
Total	**18,000**		**972.50**		**18,000**		**542.50**

	£m
Interest Income	972.50
Interest Expense	542.50
Interest Earning Assets	16,500
Net Interest Income	430.00
versus Base Scenario	-31.00 ↓
NIM	2.61%
versus Base Scenario	-0.28% ↓

FIGURE 1.14 ChoudWest Bank – Scenario 4.

(continued)

WestChoud Bank - Balance Sheet

Scenario 5: Mortgage growth funded by Deposits by Banks and a Fixed Rate Bond Issue. No Funds Transfer Pricing Process. NIM declines from base scenario although NII increases

5% Rate Environment (flat yield curve - same at all tenors)

	Assets				Liabilities		
	£m	**Rate**	**Interest Income (£m)**		**£m**	**Rate**	**Interest Expense (£m)**
Cash	100	-	-	Deposits by Banks	3,000	4.80%	144.00
Central Bank Deposits	250	1.00%	2.50				
Loans to Banks	1,000	5.00%	50.00	Customer Accounts			
				Retail Non-Interest Bearing Current Accounts	3,000	0.00%	0.00
Loans and Advances to Customers				*Retail Instant Access Deposit Accounts*	2,000	2.50%	50.00
Credit Cards	1,000	12.00%	120.00	*Retail Notice Accounts*	500	3.50%	17.50
Personal Loans(Fixed Rate)	1,500	8.00%	120.00	*Retail Fixed Rate Bonds*	1,500	4.50%	67.50
Retail Overdrafts	500	9.00%	45.00	*Corporate/Small Business Non-Interest Bearing Current Accounts*	2,000	0.00%	0.00
Fixed Rate Mortgages	6,000	5.25%	315.00	*Corporate Variable Rate Savings Accounts*	1,000	2.00%	20.00
Variable Rate Mortgages	3,000	5.50%	165.00	*Small Business Variable Rate Savings Accounts*	800	1.00%	8.00
Small Business Loans and Overdrafts	500	7.50%	37.50				
Corporate Loans and Overdrafts	2,000	6.50%	130.00	Debt Securities in Issue (floating rate)	1,000	7.50%	75.00
Bad debts net of provisions	250	0.00%	0.00	Subordinated Liabilities (fixed rate)	2,000	10.00%	200.00
Debt Securities	1,500	4.50%	67.50	Accruals and Deferred Income	200	-	-
Equity Shares	500	-	-				
				Equity Capital	2,000	-	-
Fixed Assets	400	-	-				
Goodwill/Intangible Assets	300	-	-				
Prepayments and Accrued Income	200	-	-				
Total	**19,000**		**1,052.50**		**19,000**		**582.00**

	£m
Interest Income	1,052.50
Interest Expense	582.00
Interest Earning Assets	17,500
Net Interest Income	470.50
versus Base Scenario	9.50 ↑
NIM	2.69%
versus Base Scenario	-0.19% ↓

FIGURE 1.15 ChoudWest Bank – Scenario 5.

In aggregate, in common with many initiatives designed to boost market share, ChoudWest suffers from both an NII and NIM perspective.

Total interest income remains constant at **£972.5m**, but interest expense increases to **£542.5m** (up £31.0m). Interest earning assets have risen to **£16.5bn**, so both NII (**£430.0m**, down £31.0m) and NIM (**2.61%**, down 0.28%) fall relative to the Base Scenario.

Scenario 5 - Mortgage Growth (see Figure 1.15)

In this scenario, ChoudWest Bank is aggressively marketing its fixed and variable-rate mortgage products to boost market share. The new lending is funded by a combination of new fixed rate retail deposits and short-term inter-bank deposits. As mortgages are generally low risk, the strategy is likely to boost the overall asset quality of the balance sheet. Whilst the new assets generate a return that is higher than the cost of the additional borrowing, and therefore boost overall income, the NIM is dragged down as the new business is not as profitable as the existing business in the Base Scenario.

Total interest income rises to **£1,052.5m** (up £80.0m) and interest expense increases to **£582.0m** (up £70.5m). Interest earning assets have grown to **£17.50bn**, so although NII is up to **£470.5m** (up £9.5m), NIM at **2.69%** is down 0.19% relative to the Base Scenario.

	Base Scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Net Interest Income	£461m	£526m ↑	£416m ↓	£432m ↓	£430m ↓	£471m ↑
NIM	2.88%	3.29% ↑	2.38% ↓	2.70% ↓	2.61% ↓	2.69% ↓

FIGURE 1.16 ChoudWest Bank – Summary of scenario results.

NII and NIM Sensitivity

The main conclusions we can draw from the case study in Example 1.5 are that NII and NIM could be affected by movements in the general level of interest rates and changes in the composition of the balance sheet (the results are summarised in Figure 1.16). Focusing on the former, the reason why movements in interest rates affect the calculation of NII and NIM is because the assets and liabilities in ChoudWest's balance sheet are re-pricing at different times. The term "re-pricing" refers to the time when the interest

rate applicable on an asset or liability changes. For example, if the interest rate on a 5-year loan is linked to the 3-month average of the overnight rate in the money markets (referred to as SONIA for GBP), then the loan would re-price every 3 months. In the ChoudWest Bank example, the interest rate on variable-rate products is changing as soon as there is a movement in the general level of market rates, whilst the interest rate on fixed rate products remains the same until the fixed rate products mature or are repaid.

Another way of describing the behaviour of the assets and liabilities in the ChoudWest Bank balance sheet is to say they are re-pricing off different points in the yield curve. In Chapter 4 we discuss yield curves in detail, but for this discussion we can describe a yield curve as a representation of the interest rates at which a given borrower is able to borrow funds or transact business, at a point in time, across a range of different maturities, in a given currency, for example, the £ sterling yield curve for the British Government or the £ sterling yield curve for a given bank. The yield curve is sometimes referred to as the "term structure of interest rates", but strictly speaking the terms are not synonymous as the latter expression should be used to describe only a zero-coupon yield curve.

Figure 1.17 shows a selection of yield curves for UK banks, taken as a collective, during 2017–2021. We notice that the level and shape of the yield curve changes over time.

Economists have devised a variety of theories to explain the shape of the yield curve, which is typically, but not always, upward sloping from left to

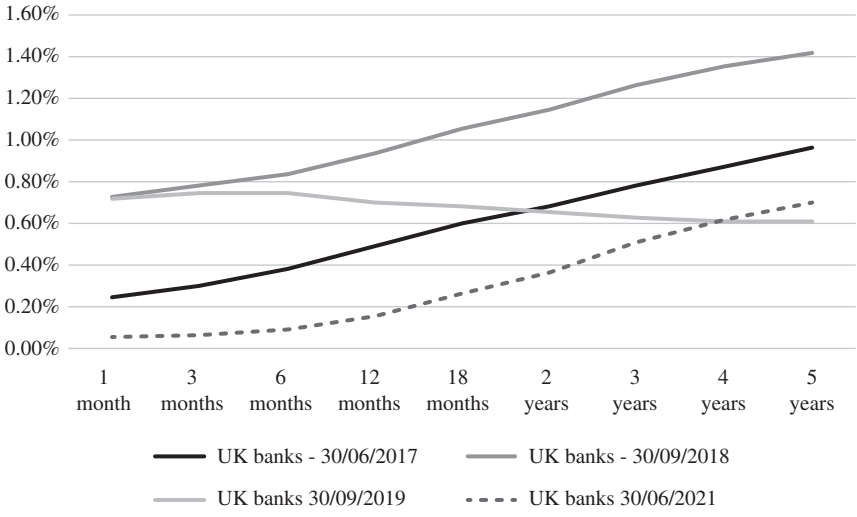


FIGURE 1.17 UK bank yield curves, 2017–2021.
Source: Bank of England.

TABLE 1.9 Traditional theories explaining the shape of the yield curve.

Theory	Explanation
Market expectation	The shape of the yield curve is based upon the market's view of future interest rates.
Liquidity preference	It is riskier for lenders to commit funds for longer, so they need to be compensated with higher returns for doing so.
Market segmentation	Borrowers, lenders and investors have differing financial needs and time frames according to their business, cash flows and goals, leading to differing supply and demand at different points along the yield curve. For example, pension funds and infrastructure lending create supply and demand in the long end, while trade finance and cash surpluses influence the short end of the yield curve.
Preference habitat	An extension of market segmentation. Investors have a preference for a certain investment horizon and demand a premium to commit funds outside this period.

right, such as market expectation theory, liquidity preference theory, market segmentation theory and preference habitat theory. These are discussed further in Chapter 4; we summarise them in Table 1.9.

The shape of the yield curve is important to banks, as it provides a guide to the rate at which existing business will re-price and new business will be written. If assets and liabilities don't do this at exactly the same time, in the same volumes, then the bank in question will have an NII and a NIM sensitivity to movements in interest rates, as we have seen in the ChoudWest Bank case study. As a simple example, if a 5-year fixed rate loan for £10,000 on which the customer is charged an interest rate of 10% is funded by a 1-month deposit on which the bank pays 2%, the annualised income to the bank would be £800. However, if the level of interest rates were to increase so that the bank had to pay 4% for a 1-month deposit, the bank's annualised NII would fall to £600, when the existing 1-month deposit matures and is replaced but the fixed rate loan remains. Interest-rate sensitivity arises because the deposit and the loan are not re-pricing at the same time. The management of this exposure, otherwise known as Interest Rate Risk in the Banking Book (IRRBB) is one of the roles of the Asset and Liability Management desk and is discussed further in Chapter 7.

Managing the NIM

In Table 1.4 we discussed the factors influencing the level of a bank's NIM. Banks can take actions to protect their NIMs or seek to increase them. Examples of a range of possible initiatives are shown in Table 1.10.

TABLE 1.10 Examples of actions that can be taken to manage or protect a bank's NIM.

Initiative	Potential NIM outcome
Increase the proportion of riskier assets in the balance sheet, e.g., sell government bonds buy corporate bonds.	The riskier assets will yield a higher interest rate, which may boost NIM in the short term (but maybe not in the longer term due to potential increased credit losses).
Distribute bank products to match the interest rate characteristics of assets/liabilities already on the balance sheet. For example, sell 2-year fixed rate deposits alongside 2-year fixed rate mortgages.	This action would reduce NII sensitivity and therefore protect the NIM.
Consciously engineer a mismatch in the re-pricing maturities of assets and liabilities.	As the yield curve is typically upward sloping, banks can often boost the NIM by borrowing for a shorter term and lending for a slightly longer term. However, as such an action would increase a bank's interest-rate risk, it would need to be taken within an approved risk appetite.
Enter into interest-rate derivative contracts, such as interest-rate swaps.	Derivatives can be employed to create synthetic assets and liabilities to achieve the outcomes discussed in the two examples earlier.
Increase non-interest-bearing liabilities	Engineering an increase in the level of non-interest-bearing current accounts, or retained earnings or equity through a rights issue would all tend to boost a bank's NIM.
Reduce non-interest-earning assets	Any action to reduce the level of non-interest -earning assets, such as cash balances, in the balance sheet will likely lead to an increase in the NIM through reduced funding costs and interest expense.

Forecasting NII and the NIM

If we accept that NII/NIM is an important aspect of a bank's P&L, it makes sense to generate forecasts of what it will be in future years to:

- understand likely trends (e.g., to inform trading updates on likely performance by public companies to the market);

- consider what management actions (tactical or strategic initiatives) are possible/necessary to improve the position, if income levels are expected to decline (or not grow as quickly as competitors);
- provide a sound base from which to conduct scenario analysis and stress testing activity.

Forecasts can be developed using either a top-down approach or a granular bottom-up model, depending upon the size and sophistication of the bank. In a top-down model, forecasts will be based upon an assessment of recent trends at an aggregate level, for example, for each product.

Banks pursuing such an approach would not normally have integrated systems to manage, forecast and stress test NIM. Instead, they would rely upon off-line calculations/spreadsheets by divisions and business units.

Account level information would normally be used in a granular bottom-up model. Although most of the required data is available from transaction systems (and from business plan assumptions), it is a substantial task to organise it. A hypothetical example of (some of) the data attributes required at account level is shown in Figure 1.18.

In simple terms, a granular NII or NIM forecasting model works by identifying key attributes for each asset and liability in the balance sheet – such as amount, margin to reference rate, anticipated repayment profile and maturity – then using a forecast of key reference rates to generate expected future interest income or expense for each asset or liability in the existing book. The same information is collated for anticipated new business volumes, which enables NII for new business to be calculated. Combining the two elements produces a forecast of NII. Stressing the interest rates and re-performing all the calculations (possibly with different repayment and new business assumptions) enables NII sensitivity to interest rate movements to be assessed.

The key challenges are generally: establishing data feeds of account level attributes from transaction systems to the NIM model and the quality of the account level data.

CHAPTER SUMMARY

We defined banking as the act of accepting deposits, to be held in safe keeping and in some instances attracting interest, and of originating loans (all of which do accrue interest) to customers. Customers come in many different shapes and sizes, ranging from private individuals to governments and groups of countries.

The act of undertaking creates a balance sheet of loans (assets) and deposits (liabilities), and the non-customer share of the liabilities side of the balance sheet is the bank's own funds, called equity or capital. This

Asset or Liability		Amount		Product Type		Currency	
Asset		Account Value		Overdraft		Sterling	
Liability				Business Loan		US$	
				Credit Card		Euro	
				Personal Loan		Other	
				Residential Mortgage			
				Commercial Mortgage			
				Current Account			
				Instant Access Deposit			
				Notice Account			
				Fixed Term Bond			
	2		1		10		4
Reference Rate		**Margin to Reference Rate**		**Contractual Maturity ***		**Repayment Type**	
Non-Interest Bearing		-3.00%		1 month		Interest Only	
SONIA		-2.50%		2 months		Capital and Interest	
Base Rate		-2.00%		3 months			
Standard Variable Rate		-1.50%		4 months			
Finance House Base Rate		-1.00%		5 months			
Fixed Rate - 1 Year		-0.50%		6 months			
Fixed Rate - 2 Year		0.00%		……			
Fixed Rate - 3 Year		0.50%		5 years			2
Fixed Rate - 4 Year		1.00%					
Fixed Rate - 5 Year		1.50%				**Repayment Holiday**	
		2.00%				No Holiday	
		2.50%				Capital and Interest Holiday	
		3.00%				Interest Holiday	
	10		13		60		6
* Behavioural Maturity will be dependent upon the level of interest rates so will be the subject of a separate set of assumptions							

FIGURE 1.18 Example account level data attributes required for a NIM model.

balance sheet must be managed continuously to ensure that the various risks it faces – be it risks to capital, profit, liquidity and so on – do not render the bank unviable, as a going concern, at any time. A familiarity with balance sheets and the items on the bank's income statement, or P&L statement, is a prerequisite to understanding managing balance sheet risk.

Banks are part of the global money markets, the market in short-term borrowing and lending, as well as the capital markets.

The process of setting the interest rate on a customer loan follows orthodox principles of corporate finance, but there are variations on how loans are priced in different banks. The pricing inputs used in loan pricing are not universal.

We reviewed the products offered by banks and considered whether they generate NII, fee and commission or other income. NII, calculated as the interest income received on lending less the interest expense paid on liabilities, has been shown to be a key element of bank profits, typically accounting for 40–80% of total income.

The NIM, which is defined as NII divided by a measure of average assets, represents an important contributor to bank profitability. In the UK, Europe and USA, average bank NIMs range between 1% and 2.5% on an annualised basis. There is no optimal level for NIM, as it will depend upon the composition of individual bank balance sheets. However, the measure is key to valuations performed by bank analysts, so banks should aim to preserve and maximise whatever NIM they have.

APPENDIX 1.1 SUMMARY OVERVIEW OF BANK PRODUCT LINE

DEFINITION OF BANKING

A definition of banking is available in a number of textbooks. For example, an accessible one is *Modern Banking* by Shelagh Heffernan (2005). The following are just two of many hundreds of definitions on the Internet:

> *Engaging in the business of keeping money for savings and checking accounts or for exchange or for issuing loans and credit, etc.*
> *www.wordnetweb.princeton.edu/perl/webwn*

> *A bank is a financial institution that accepts deposits and channels those deposits into lending activities. Banks primarily provide financial services to customers while enriching investors.*

Government restrictions on financial activities by banks vary over time and location.
www.en.wikipedia.org/wiki/Banking

The author kept his definition of banking brief, as we noted on page 4.

PRODUCT LINE

A summary of the main product types offered by banks can be found in the first edition (Choudhry, 2012), which is also reproduced on the accompanying website for the second edition. Not all banks offer all these products, but these instruments are available in virtually every banking market. More detailed information is available in the following books by the author: *The Money Markets Handbook* (Choudhry, 2005), *Fixed Income Markets, Second edition* (Choudhry, 2014) and *Bank Asset and Liability Management* (Choudhry, 2007).

APPENDIX 1.2 OVERNIGHT REFERENCE RATES (RFR)[16]

The following exhibits illustrate the mechanics of overnight average interest rates.

Unlike LIBOR (that has term fixings), future payments for RFRs are not available until almost the end (except for term RFR)

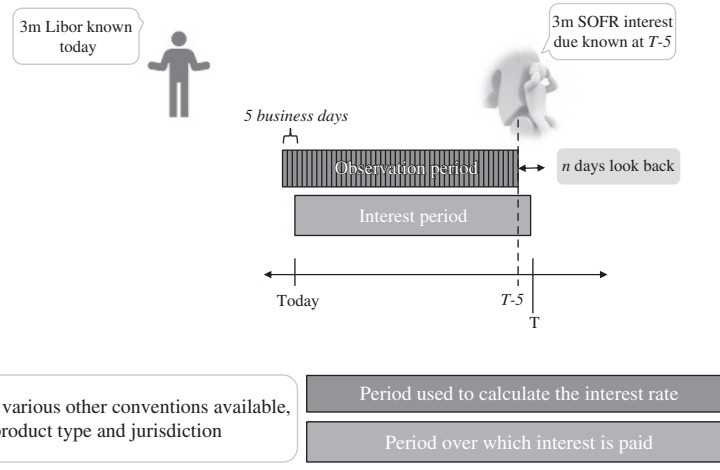


FIGURE A1.1 Future interest payments using RFRs.

16 This section was authored by Periklis Thivaios.

Interest compounding options

Simple and compound averages reflect a technical difference in how interest is accrued

Simple (arithmetic) interest

- The additional amount of interest owed each day is calculated by applying the daily rate of interest to the principal borrowed, and the payment due at the end of the period is the sum of those amounts
- Does not take into account unpaid interest that needs to be capitalised on the principal

Compound (geometric) interest

- The additional amount of interest owed is calculated by compounding the daily RFR to produce a compounded rate for the period, and applying the compounded rate to the principal

$$Compound\ Interest\ Formula = \left[\prod_{i=1}^{d_b}\left(1+\frac{r_i \cdot n_i}{N}\right)-1\right]\times\frac{N}{d_c}$$

$$Simple\ Interest\ Formula = \left[\sum_{i=1}^{d_b}\left(\frac{r_i \cdot n_i}{N}\right)\right]\times\frac{N}{d_c}$$

Where

d_b = the number of *business days* in the interest period
d_c = the number of *calendar days* in the interest period
r_i = the interest rate applicable on business day i
n_i = the number of calendar days for which rate r_i applies (normally n_i=1 for Monday to Thursday, n_i=3 on Friday, n_i=2 before a holiday)
N = the market convention for quoting number of days (US – N=360; UK – N=365)

Practically

- The difference between the two approaches is typically quite small, especially at lower interest rates and over short periods of time

FIGURE A1.2 Interest compounding options.
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SIMPLE VERSUS COMPOUND AVERAGING – A WORKED EXAMPLE

Simple interest

Day	SOFR (%, annualised)	# days rate is applied	Effective Rate (not annualised) (A)	Principal amount (B)	Principal + Accumulated Interest	Interest Charge for next Business Day (A * B)
Mon 7 Jan 2019	2.41	1	1 * 0.0241/360 = 0.006694%	$1,000,000.00	$1,000,000.00	$66.94
Tue 8 Jan 2019	2.42	1	1 * 0.0242/360 = 0.006722%	$1,000,000.00	$1,000,066.94	$67.22
Wed 9 Jan 2019	2.45	1	1 * 0.0245/360 = 0.006806%	$1,000,000.00	$1,000,134.16	$68.06
Thu 10 Jan 2019	2.43	1	1 * 0.0243/360 = 0.006750%	$1,000,000.00	$1,000,202.22	$67.50
Fri 11 Jan 2019	2.41	3	3 * 0.0241/360 = 0.020083%	$1,000,000.00	$1,000,269.72	$200.83
Mon 14 Jan 2019	. . .	. . .	. . .	$1,000,000.00	$1,000,470.55	

Payment due Monday 14 Jan 2019 = $1,000,470.55

Annualised Simple Rate of Interest: $\left(\frac{360}{7}\right)\times\left[\frac{0.0241}{360}+\frac{0.0242}{360}+\frac{0.0245}{360}+\frac{0.0243}{360}+3\times\frac{0.0241}{360}\right]=\left(\frac{360}{7}\right)\times\left(0.047056\%\right)=2.4200\%$

Compound interest

Day	SOFR (%, annualised)	# days rate is applied	Effective Rate (not annualised) (A)	Principal amount (B)	Principal + Accum'd Interest (C)	Interest Charge for next Business Day (A * C)
Mon 7 Jan 2019	2.41	1	1 * 0.0241/360 = 0.006694%	$1,000,000.00	$1,000,000.00	$66.94
Tue 8 Jan 2019	2.42	1	1 * 0.0242/360 = 0.006722%	$1,000,000.00	$1,000,066.94	$67.23
Wed 9 Jan 2019	2.45	1	1 * 0.0245/360 = 0.006806%	$1,000,000.00	$1,000,134.17	$68.06
Thu 10 Jan 2019	2.43	1	1 * 0.0243/360 = 0.006750%	$1,000,000.00	$1,000,202.23	$67.51
Fri 11 Jan 2019	2.41	3	3 * 0.0241/360 = 0.020083%	$1,000,000.00	$1,000,269.74	$200.89
Mon 14 Jan 2019	. . .	. . .	. . .	$1,000,000.00	$1,000,470.63	

Payment due Monday 14 Jan 2019 = $1,000,470.63

Annualised Simple Rate of Interest:

$$\left(\frac{360}{7}\right)\times\left[\left(1+\frac{0.0241}{360}\right)\left(1+\frac{0.0242}{360}\right)\left(1+\frac{0.0245}{360}\right)\left(1+\frac{0.0243}{360}\right)\left(1+\left(3\times\frac{0.0241}{360}\right)\right)-1\right]=\left(\frac{360}{7}\right)\times\left(0.047064\%\right)=2.4204\%$$

FIGURE A1.3 Simple versus compound averaging worked example.
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Lookback without observation shift (lag) and lookback with observation shift

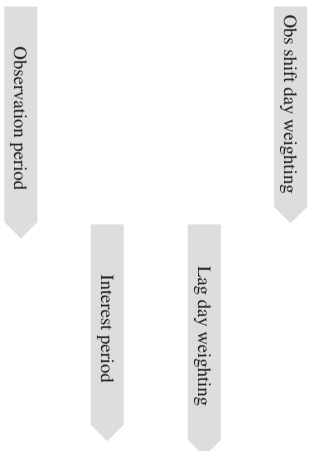

Illustration for SOFR Compounding
Notional: $1m
Start: 28 May
End: 5 June
Day lag: 5 days

Date	SOFR	Weight	Without shift (lag)	Backward shift
Mon 20 May	2.39	1		
Tue 21 May	2.38	1		
Wed 22 May	2.37	1		
Thu 23 May	2.37	1		
Fri 24 May	2.37	4		
Sat 25 May		-		
Sun 26 May		-		
Mon 27 May (holiday)		-		
Tue 28 May	2.41	1	1.000066389	1.000066389
Wed 29 May	2.40	1	1.000066111	1.000066111
Thu 30 May	2.40	1	1.000065833	1.000065833
Fri 31 May	2.49	3	1.000197500	1.000065833
Sat 01 Jun		-		
Sun 02 Jun		-		
Mon 03 Jun	2.40	1	1.000065833	1.000263333
Tue 04 Jun	2.39	1	1.000066944	1.000066944
Wed 05 Jun	2.40	1		
Thu 06 Jun	2.40	1		
Fri 07 Jun	2.39	3		
Sat 08 Jun		-		
Sun 09 Jun		-		
Rate %			**2.3792**	**2.3783**
Amount $			**528.71**	**528.51**

FIGURE A1.4 Lookback without observation shift (lag) and lookback with observation shift.
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REFERENCES AND FURTHER READING

Choudhry, M. (2005), *The Money Markets Handbook,* Singapore: John Wiley & Sons (Asia) Pte. Ltd.

Choudhry, M., Moskovic, D. and Wong, M. (2014), *Fixed Income Markets,* 2nd edition, Singapore: John Wiley & Sons (Asia) Pte. Ltd.

Choudhry, M. (2007), *Bank Asset and Liability Management*, Chichester: John Wiley & Sons.

Choudhry, M. (2010a), *An Introduction to Value-at-Risk,* 5th edition, Chichester: John Wiley & Sons.

Choudhry, M. (2010b), *Structured Credit Products: Credit Derivatives and Synthetic Securitisation,* 2nd edition, Singapore: John Wiley & Sons (Asia) Pte. Ltd.

Choudhry, M. (2012), *The Principles of Banking*, 1st edition, Chichester: John Wiley & Sons.

Choudhry, M. (2018), *An Introduction to Banking,* 2nd edition, Chichester: John Wiley & Sons.

Choudhry, M., Turner, S., Landuyt, G. and Butt, K. (2009), "Modern Portfolio Theory and the Myth of Diversification", *World Commerce Review,* 3(1).

Heffernan, S. (2005), *Modern Banking*, Chichester: John Wiley & Sons.

Higson C. (1995), *Business Finance,* 2nd edition, Oxford: Butterworth.

Prasad, E. (2021) *The Future of Money: How the Digital Revolution Is Transforming Currencies and Finance*, Cambridge, MA: Belknap Press of Harvard University Press.