MSC in Finance and International Business

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Fund Transfer Pricing
in a Commercial Bank

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Introduction

This thesis presents the concept of Funds transfer pricing (FTP) - a process of interest income attribution to internal contributors on various levels.

FTP is a crucial element of management accounting income calculation. The basic problem of bank management reporting is the need to calculate profits on different products and divisions in order to make informed business decisions. Interest, the largest component of bank’s profits, is received on loans and paid on deposits. Without FTP it would seem that all deposits generate only costs, whereas they’re the source of funding necessary for giving loans. As a consequence, customers and business units that only deposit funds without taking loans would be deemed unprofitable. FTP solves this problem by setting and internal price that allows estimating the cost of financing a bank faces and assigning it to users of funds.

FTP system allows not only to measure and report profitability in a variety of ways, but also enhances institution’s profits. Studies show that all major banks and most of small ones use some sort of fund transfer pricing system. However, FTP is not always employed by small banks, especially in developing countries. To some extent, it’s a result of lack of literature on this subject. Apart from articles in specialized banking journals and technical manuals of implementation, FTP is not widely presented in literature, especially in a more accessible approach. Academic literature in particular tells very little about fund transfer. Information on FTP in handbooks on banking is brief and cursory, resulting in insufficient understanding of the subject among banking students.

The objective of this thesis is to emphasize the importance of fund transfer system for banks and to present the most common FTP methods. The thesis also aims to answer common questions about FTP:

- Is FTP necessary, or can a bank cope without it? Why is it necessary? What are the dangers of not having an FTP system?
- What are the advantages of using an FTP system? Why are they important? Are there any drawbacks?
- How can it improve results? Can FTP directly increase profits? What is the effect on bank’s profitability and effectiveness?
• How to build an FTP system, is there an easy way to do it? Are there any simple variations of FTP methodology? What are the basic components of a fund transfer system?

• How to develop a perfect FTP system? What are its requirements? What are the issues faced when implementing a complex FTP system?

The research approach used to answer those questions comprises building on academic background on banking, financial markets and risks in order to introduce the theory of fund transfer pricing. First, the role of financial institutions in transformation of financial assets and liabilities is described. Altering maturities, amounts, currency and interest rate characteristics of financial instruments entails various market risks for those institutions. Interest risk, increased by the ever-changing market rates, is the main challenge, followed by issues of liquidity and currency mismatch. Next, the need for FTP is explained and advantages of various methodologies are listed. Attribution of transfer prices to divisions, products, customers and transactions is described. Dilemmas in the use of FTP are answered, such as choosing the relevant FTP method, calculating and assigning transfer prices and liquidity margins and reconciling results through fund transfer division.
1 General framework for Banking and financial risk

This chapter outlines basic concepts in banking to the extent necessary in this thesis. The following definitions and descriptions do not sum up to a complete theoretical introduction to banking. Only the areas necessary to constitute a general theoretical framework for Fund Transfer Pricing (FTP) are presented and further developed in subsequent chapters. Concepts discussed below comprise bank functions and types, including the Central Bank. These concepts are relevant to the thesis not only as a source of basic banking vocabulary. Understanding bank products and services shows the need to employ FTP system. For different types of banks, different models of FTP are suitable. Further on, the central bank, by setting official rates and financial security requirements, largely influences bank transfer prices.

1.1 Financial Intermediaries

Banks are specific financial intermediaries. In general, a financial intermediary is an institution specializing in simultaneously buying and selling financial contracts and securities.¹

Their existence is justified by their intermediation skills, resulting in a number of unique services they can offer to investors.

1.1.1 Transaction costs

Access to financial markets is costly, and requires expertise. Carrying out financial transactions requires spending money and time. Transaction costs comprise monetary costs, search costs and monitoring costs.²

Financial intermediaries are able to reduce transaction costs due to:³

- economies of scope – a company dealing in a wide range of financial instruments and transactions increases its efficiency;
- economies of scale – as the total size of the transactions of an intermediary increases, the costs per unit of transaction are reduced. This is the case when

¹ Freixas X. & Rochet J.C. 1999, Microeconomics of Banking, Massachusetts Institute of Technology, Massachusetts, p. 15.
fixed transaction fees are in use, or when indivisibilities (a minimum size of an operation) take place.

1.1.2 Information asymmetry

Another justification of necessity of financial institutions is the problem of information asymmetry. It is the case when one side of a transaction does not know enough about the other side to make accurate decisions. This unequal knowledge appears before and after the transaction is effected:\(^4\):

- **Adverse selection** materializes before the transaction occurs. It is defined as a tendency of the most risky borrowers (with possibility of large gains and large losses) to be also the ones most actively seeking a loan. This leads to an increasing percentage of loans being bad credit.

- **Moral hazard** appears after the transaction occurs. It is the risk of the borrower engaging in risky activities that diminish the probability of loan being repaid, inclined to do so by the fact, that he does not risk his money.

Financial institutions are more capable of dealing with information asymmetries than individuals, due to large number of transactions and increased expertise.

1.2 Definition of a bank

There are many definitions of a bank and compiling them would result in a statement similar to the following: Banks are financial intermediaries, whose current operations consist of transforming deposits received from the public into loans.

This definition emphasizes the fact, that only banks lend and borrow money at the same time as their main source of income. Moreover, banks’ main source of financing are the deposits of the public, as opposed to financing mostly by issuing debt or equity.\(^5\)

This basic banking function of transforming deposits into loans entails an important problem – how to set prices for those two products? How to decide whether, at a given price, it is still profitable for a bank to offer loans and deposits? These are the very basic questions that FTP aims to answer.


Banks fulfill several basic tasks. Not every bank does all of the following and other financial intermediaries can fulfill some of those functions, however only banks can provide all of them. Banks:

- Ensure access to payment system,
- Guarantee financial liquidity,
- Allow for asset transformation,
- Take, manage and resell financial risk,
- Offer information on risk levels.

### 1.2.1 Access to payment system and financial liquidity

Historically, the initial banking activities were money changing, i.e. exchanging one currency into another, and safekeeping of coins. Money was initially kept in banks for security, not for profit, and was not invested into loans. Certificates were issued by banks to confirm the amount of money stored in vaults. Storing money allowed for facilitation of payments between bank’s customers. If two merchants had coins stored in one bank, it was easier to clear their positions through a bank than to actually move coins, especially at a distance or when large amounts were involved.

Banks allow not only for execution of payments, but also for transfer of payments in time. Credit lines permit postponing cash outflow, while factoring services allow early recognition of cash inflow. Banks can be considered in this aspect as source of liquidity for customers, facilitating transactions, ensuring quick conversion of their savings into goods and allowing them to satisfy their consumption needs by transferring financial resources in time.

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1.2.2 Asset transformation

Banks play an important role as institutions capable of transforming financial resources with regard to time, amount and risk level.\textsuperscript{10}

1.2.2.1 Maturity transformation

Maturity transformation is necessary, because owners of financial resources typically want their money deposited for short term, whereas borrowers would like to receive funding for a longer term. Banks are able to transform short-term deposit into long-term credit. Maturity transformation creates a risk that a bank won’t be able to repay a depositor since his money could be “locked up” in a long term loan. This is a source of liquidity risk.

1.2.2.2 Amount transformation

Amount transformation is the result of lack of size similarity between amount of money deposited by an individual and the sum required by the borrower. Banks can adjust the size of loans of deposits to the needs of their clients. Usually, depositors place small amounts, while borrowers require large sums of money. Also, banks serve as intermediaries between large-amount financial markets and individual retail customers.

1.2.2.3 Information transformation

Information transformation is a result of information asymmetry – when a borrower has better information about the risk of the projects financed by loan than the lender does. Banks have better information on risk of borrowers not repaying a loan than depositors do. Intermediation of a bank increases the safety of funds lend to another party. Banks are able to reduce initial risk of adverse selection by evaluating borrowers and screening their investment projects. The ex-post risk of moral hazard can be controlled by closely monitoring the situation of borrowers, by preventing opportunistic behavior and by auditing the borrower that fails to meet loan obligations.\textsuperscript{11}

\textsuperscript{10} ibidem, pp. 4-5.

1.2.2.4 Risk transformation

Risk transformation comprises of diversifying risk due to a large number of borrowers. The process of risk sharing allows for creating assets with risk characteristics suitable for different customers. This way the exposure of customers to risk can be reduced, since risky credits are turned into safer assets. It is safer for a depositor to allow a bank to lend his money to third parties than to issue loans by himself. Internally, a bank diversifies risk by investing in a portfolio of loans which are less then perfectly correlated, resulting in diminishing the overall risk.  

1.3 Types of banks

The definition given in chapter 1.2. describes a commercial bank. There are however different types of banks, with different scope of activities. Some banks focus only on one side – either loans or deposits. Certain banks don’t deal in regular banking products at all, focusing more on financial markets. Others do the opposite – offering services to small customers only and not dealing in interbank markets. Some banks narrow their scope to a small number of products. Finally, there are international differences in bank types, resulting form local specifics.

Each type of bank has a version of FTP best suited to its products and services. Banks that have access to wholesale financial markets as a source of borrowing set their transfer prices differently than those that can access the market.

1.3.1 Investment banks

Investment banks are not really banks are defined here, that is, they don’t transform deposits into loans. More precisely, investment banking activities are different from regular banking. They provide direct financing on financial markets through debt and capital. In detail, their functions include: private placement, dealing in derivatives, issue broking, underwriting, portfolio management, investment funds, corporate financial advisory, advice on mergers and acquisitions, global custody.

Due to the riskiness of some investment banking activities (especially dealing in derivatives), authorities in most countries tend to separate those functions from regular banking (especially gathering deposits from the public). In USA, the 1933 Glass Steagall Act excluded investment banking activities from commercial banking. In legal

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nomenclature, the disparity between commercial and investment banking is emphasized by using the term “investment firms” (in EU) or “broker dealer (in USA) instead.13

1.3.2 Universal banks

Universal banks combine commercial and investment banking. In many countries, such activities are restricted or discouraged by authorities. In USA, restricted universal banking is allowed by the Gramm Leach Bliley Financial Modernisation (GLB) Act passed in 1999, but only to the extent that US financial holding companies can own commercial banks and investment banks as subsidiaries. In contrast, in Germany banks can offer commercial and investment services under a single firm. In most European countries however, universal banking is discouraged by regulatory authorities.14

Financial holdings are the most common way for a bank to develop abroad. Usually, a bank deals in one country, and international expansion is attained by acquiring or starting up separate subsidiaries in other countries. These subsidiaries act as separate legal entities, whose shares are owned by the holding company.15

1.3.3 Commercial banks

Commercial bank is the most common type, dealing in loans and deposits, and having access to financial markets. They raise funds mostly through deposits (checkable, savings and time deposits) and use them to offer loans (mortgages, consumer and commercial loans) and invest in debt securities (usually government and municipal).

The most common case of a commercial bank is a country-wide bank offering a full range of services, although sometimes small banks are regional. Their existence is supported by regulations, like in USA, where they are obliged by law to invest in the same region where their deposits were gathered. In many European countries, regional banks offer financing to local authorities, who are often their partial owners. Other banks tend to specialise in a selected choice of products, offering them on a national scale. Specialized banks usually focus mostly on one type of loan: mortgages, consumer loans, car loans etc. They can also focus on a customer type, taking deposits and offering loans to consumer or commercial clients.

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14 Ibidem, pp. 24-25.
1.3.4 Para-banks

Para-banks are institutions restricted in some way from being a complete commercial bank. Often those institutions are excluded from some of the regulations that banks have to comply with, as a consequence being refused access to interbank market. There are two main types of those institutions.

1.3.4.1 Savings and loan associations

Historically, the most important feature of savings and loans associations was their ownership structure – every customer needed to buy a share in this institution. These associations focused mostly on consumer loans and residential mortgages and acted regionally. They didn’t have access to financial markets and were exempt from some of banking sector regulations.

Nowadays, savings and loans associations are very similar to commercial banks. Due to regulatory changes, cooperation of groups of associations and commercial banks’ intermediation between them and financial markets, they are able to compete in the same markets as regular banks. Their characteristics vary between countries, but they are present in USA and most European countries (they originated in Germany).\(^{16}\)

1.3.4.2 Credit Unions

Credit unions are formed by a group of people, most often by employees of a company, union members etc. Among themselves, they gather deposits and make small consumer loans. Sometimes the company they work for can support them financially. These are very small financial institutions that don’t offer any services outside a limited group of members. Historically, there were some similarities between credit unions and savings and loans associations, however the latter have significantly evolved, while the former remained the way they initially were.\(^{17}\)

1.4 Central Bank

Central Bank is a special type of bank, unique for each country. To be more precise, there is one central bank in every single monetary area (e.g. the Euro zone). This implies its main function, which is control over a particular currency, including its

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\(^{17}\) Ibidem, pp. 35-36.
amount in the market and its price. Another function of central bank is being a bank of banks for all commercial banks in one country, i.e. offering them loans and taking deposits, as they offer to the public. These functions are described below, to the extent necessary in this thesis.

This chapter describes those elements of Central Bank policy that are strictly relevant to FTP. The construction of commercial banks’ transfer prices is largely influenced by the reserve ratio, since the safety reserve required by authorities decreases the amount of funding available and increases funding costs to the bank. Central bank rates have also a general effect, as they influence market rates that are taken into account by transfer prices.

1.4.1 Monetary policy

 Monetary policy is the set of central bank’s actions that concern the national currency, its supply, the exchange rate and interest rates. In most countries, central banks were originally regular commercial banks that were granted by governments exclusive rights to issue bank notes functioning as legal tender. Central banks became responsible for controlling the supply of national currency they issued, since excessive growth of money supply would result in inflation.18

The main goal of central bank’s monetary policy is the control of inflation. In most developed countries the inflation goal is set at about 2,5% or less. In some countries, central banks have an additional goal of supporting economic growth.

Inflation is a direct result of growth of money supply in economy. Since commercial banks increase amount of money in circulation by lending out deposits, central bank cannot control money supply directly, and it uses a set of methods to influence lending by commercial banks. These methods include: open market operations, reserve ratios and discount rates.19

1.4.1.1 Open market operations

 Central bank can influence lending by banks through trading government securities with commercial banks. If it wants lending (and monetary supply) reduced, it sells securities, thus “blocking” some bank deposits for lending. Buying treasury securities from banks

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has the opposite effect. The securities traded in these operations are short term treasury bills. Sometimes central bank would issue its own bills and sell them to banks to reduce monetary base. Apart from outright sale or purchase, central bank can enter into a repurchase agreement with a commercial bank. Central bank can buy t-bills from a bank, and then sell them back at a specified date (called repo) or do the opposite – sell and buy back (called reverse repo).  

1.4.1.2 Discount rates

Each central bank controls a set of interest rates that are intended to guide rates in the interbank. Increasing rates makes loans more expensive, and reduces money circulation. Usually, a central bank would set three basic rates: reference rate, discount rate and deposit rate:

- Reference rate is a central bank’s main rate, set as the target for short-term interbank rates. In USA, the target rate is the Federal Funds Rate. It is the overnight rate, at which banks lend to each other the funds they have deposited in the Federal Reserve in order to meet the required reserve ratio. In Europe, the main refinancing rate is used for reference. It is the minimum bid rate for refinancing bank loans at Central bank.

- Discount rate is the rate charged to banks when they borrow from central bank. In US, there’s a primary and secondary discount rate, available to banks depending on their credit worthiness. It is set higher than the reference rate, since Central bank prefers that banks borrow from each other instead. By lending funds to commercial banks, central bank exerts its function of lender of last resort. In EU, this rate is called the marginal lending rate.

- Deposit rate (in Eurozone) is the lowest of the three. It’s the rate that banks receive for deposits at the central bank.

Historical ECB and Fed rates are presented in the tables below:

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Some central banks set more interest rates, used for various transactions with banks. The most typical transactions include lending funds to banks with various securities deposited by them as collateral or buying trade bills and other commercial securities from banks at some discount.

Central bank rates usually concern commercial banks only indirectly, as a point of reference for interbank rates. However, in specific market conditions, e.g. when there is a lack of liquidity in money market, banks tend to deal directly with the Central bank, instead of trading among themselves. In these situations, discount rates illustrate real costs of funding and should be included in the calculation of transfer prices.
1.4.1.3 Reserve ratios

In most countries, it is obligatory for commercial banks to hold a specified percentage of their customer deposits and notes as cash or as deposit at the central bank. This percentage is the reserve ratio which can be used by central bank as a tool of monetary policy. Increasing the ratio limits lending by banks, and reduces money supply. There are differences in the use of reserve ratio between countries:

- In USA, the reserve ratio of 10% (3% for smaller or even zero for very small institutions) concerns transaction deposits, while savings accounts and time deposits have no reserve requirements. Beginning October 2008, Fed pays interest on reserve balances. As of 11 February 2009, the interest rate equals 0,25%;

- In UK, there is no required reserve ratio and banks hold a voluntary cash reserve. From 18 May 2006, the Bank is paying interest on commercial bank reserve balances. As of 5 February 2009, the Bank Rate paid on reserves equals 1,0%;

- In the Eurozone, banks keep 2% of specified short-term liabilities at Central bank, and receive interest based on the average rate of one week bills issues, which currently (in February 2009) equals 2%;

- In Poland, the ratio is 3,5%, and pays interest based on one of the Central bank rates (rate at which central bank buys trade bills from commercial banks). The interest paid on reserves currently (from 28 January 2009) equals 4,05%;

- Many central banks (e.g. Bank of Japan) pay no interest on reserve balance, however recently more and more banks have decided to pay for commercial banks’ reserves due to the financial crisis.

The part of deposits that commercial banks need to keep in reserve cannot be used to generate loans. Thus, total gain on a deposit gathered is reduced by the amount needed for safekeeping. Therefore, the reserve ratio is included in the transfer price formula, to reflect that internal income reduction.

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24 [www.bankofengland.co.uk](http://www.bankofengland.co.uk) 2009.II.17, *News Release - Bank of England Reduces Bank Rate*
25 [www.bundesbank.de](http://www.bundesbank.de) 2009.II.17, *Minimum reserves*
26 [www.nbp.pl](http://www.nbp.pl) 2009.II.17, *Basic interest rates*
2 Financial markets and risks

2.1 Financial markets

In general, financial markets are places where various financial instruments are traded. There are many typologies of markets, but the most common classification is by the traded instrument type. Commercial banks are mostly active on markets in order to hedge financial risk they encounter. When financial institutions buy and sell financial instruments among themselves, they usually do it on markets that are wholesale (minimum transaction volume is hundreds of thousand USD or EUR) and OTC (over-the-counter, where the majority of transactions are concluded directly, without a clearing house). The most important instruments traded are: interbank loans and deposits, government bills and bonds, foreign exchange, interest rate and currency derivatives. Most instruments can be traded either in the money market (for securities maturing in less than a year) or in the capital market (for instruments with a life longer than one year). The central bank participates in most of these markets, in order to attain monetary policy goals.

In this chapter the concepts of financial markets and risk management will be discussed. Prices on interbank deposits, treasuries and interest rate derivatives can all be expressed in the form of a rate. This rates show what is the cost or gain of lending and borrowing on wholesale markets as compared to dealing with individual customers. Market rates are used in the construction of transfer prices as a reference point for setting interest on bank products.

The second part of the chapter deals with various types of financial risk, which is relevant to transfer prices in a number of ways. Basically, each risk involved in a customer transaction should be taken into account when pricing products. There are different ways of incorporating risks in FTP system according to its type.

2.1.1 Interbank deposit market

When a bank has excess short term cash it would usually seek a counterparty that needs short term funding (e.g. in order to meet reserve requirement) on the interbank deposit market. This is the main market for bank liquidity management. The lender of funds requires compensation in the form of interest on the capital lent. The interest rate on a particular transaction depends on a number of factors, including: transaction length,
whether the bank is a lender or a depositor, partner’s credit risk, etc. Banks that participate in the market constantly quote interest rates that they offer to depositors (BID) and lenders (ASK), for various maturities. A bank hopes to pay BID rate on funds that other banks deposit with it, receive a higher ASK rate on funds it loaned out, and profit from the BID-ASK spread.

Interbank rates are largely dependant on Central Bank rates, which are meant to set boundaries for interbank trading. In general, interbank rates should vary somewhere in between central bank offer and bid rates. The idea is that depositing money with central bank and borrowing from it should be the least profitable option a commercial bank has on the market.

Financial market rates constitute the basis of each transfer price formula, as they express the opportunity cost of transactions with customers. Market rates set boundaries for lowering rates on loans an increasing interest on deposits offered to the public. A bank should not pay more for customer deposits than it costs to raise funding from other banks. This relation is analogical to the one a bank has with its central bank – trading with central bank is less profitable than with other banks, and trading with other banks is less profitable than dealing with customers.

There are different interbank rates to choose from when building the transfer price equation. The choice should generally depend on actual transactions a bank can make – i.e. it is preferable to use rates from the markets that a bank most often uses for wholesale loan and deposit transactions.

2.1.1.1 Interbank interest rates

Interest rates vary depending on the date on which the transaction is to be concluded. This time structure of interest rates can be represented on a time scale as a curve with either upward or downward slope, showing rates that rise or fall with increasing length of deposit. The difference between short-term and long-term part of the slope is most commonly explained by the expectations theory as the expected change of interest rates in future (e.g. a downward slope predicts falling rates). Another factor influencing the curve is the liquidity preference, meaning that with increasing loan term, the lender requires higher interest due to increased risk (the result would be an upward slope).

The time scale of the curve consists of specific nodes, i.e. lengths of deposits that are most typical for the local interbank market. This set of time knots usually consists of the following lengths:
• O/N – overnight, a deposit starting today and ending tomorrow,
• T/N – tomorrow next, starting tomorrow and ending the day after,
• S/N – spot next, starting the day after tomorrow for one day,
• SW – spot week, starting the day after tomorrow for a week,
• 2W – two weeks, starting on spot date (as all the following do),
• 1M, 2M, 3M, 6M, 9M – one, two, three, six or nine months from spot,
• 1Y – one year is usually the longest term available.

One year is the maximum term on the interbank market, since it is a money market. Apart from the enumerated nods, other lengths are available if parties choose so, since it is an OTC market. In such cases, rates for not standard maturities are set based on linear interpolation of neighboring rates.27

2.1.1.2 LIBOR rates

Rates quoted by a particular bank depend on its liquidity situation – when in need for financing, it would offer higher rates, than when having surplus funds. A small bank, with liquidity issues and a low credit rating would have a lot higher rates than a big, stable bank. The interbank rates differ therefore among banks, usually within limits set by central bank’s deposit and discount rates. In order to have a benchmark rate, independent of individual bank’s conditions, an average rate is calculated. This rate, fixed once a day, is a mean of daily quotes of a few selected contributor banks, usually the largest and most reliable ones in a given market. Everyday, the whole time curve of rates can be calculated. There are separate rates for interbank deposits in each currency, however reference rates on deposits in most important currencies are set in London and called LIBOR rates (London interbank offered rate). There’s LIBOR GBP for pound sterling, but also LIBOR USD for US dollar, LIBOR CHF for Swiss frank, LIBOR JPY for Japanese yen. LIBORs are ASK (offer) quotes, and BID is usually calculated as 10 to 15 b.p. (basis points) less, basing on general market consensus, although in past this spread was significantly wider.28

2.1.1.3 Alternatives to LIBOR

The LIBOR rates are the most common reference rate for various interbank transactions, including derivatives. However, there are alternatives to LIBORs. Since LIBORs are set in London, many countries with strong local financial markets quote their interbank rates domestically. For example, EURIBOR rates for deposits in Euro are set in Frankfurt. Many countries set some sort of domestic rate, e.g. in Poland there’s WIBOR (Warsaw interbank offered rate). The importance of these local market rates depends usually on the amount of deposits traded in local markets. If these local markets are more active than markets for those currencies in London, the local rates become a point of reference for a currency.

A specific situation exists in USA, since LIBOR USD is set abroad and concerns mostly international cross-currency transactions. Domestically, USA banks use overnight federal funds rate as a point of reference, as transactions with central bank are more popular in USA than actual interbank transactions.\(^2^9\)

Another popular rate in the US is the prime rate, which is a consensus rate at which large US banks would lend money to their most favored customers.\(^3^0\)

Another type of a fixing rate is the SONIA (sterling overnight interbank average, there also EONIA for EUR and POLONIA for PLN). It is a mean of rates on actual transactions that took place on a single day. Sometimes it’s a lot better approximation of market conditions than LIBOR, which is a theoretical rate, established under specific conditions, including high credit rating, a limited nominal of transaction, and a straightforward deal. Banks with low ratings, entering a large amount transaction, customized (e.g. a derivative) might find that LIBOR rates are irrelevant as a point of reference for their transaction.

2.1.1.4 Long term interbank rates

LIBOR rates have a serious drawback – they are money market rates, ending at maturity of one year. Fortunately, there are active interbank markets for interest rate derivatives – FRAs and especially IRS. The latter are instruments that allow to exchange a series of LIBOR rate payments for a number of payments based on a fixed IRS rate, during a period from a year to ten and more years. Therefore, IRS rates can be added to the

\(^2^9\) Crouhy M. & Galai D. & Mark R. 2005…, op.cit., pp.125-149.
\(^3^0\) www.bankrate.com 2009.II.18, Wall Street Journal Prime Rate
interbank rates curve for nods above one year. These derivatives will be described in more detail in the chapter on interest rate risk.

The table below presents different interest rates with a term structure for a number of currencies:

### INTEREST RATES - MARKET

<table>
<thead>
<tr>
<th>Feb 16</th>
<th>Overnight</th>
<th>Day</th>
<th>Change Week</th>
<th>Month</th>
<th>One month</th>
<th>Three months</th>
<th>Six months</th>
<th>One year</th>
</tr>
</thead>
<tbody>
<tr>
<td>US$ Libor*</td>
<td>0.30000</td>
<td>-</td>
<td>-0.010</td>
<td>0.183</td>
<td>0.46500</td>
<td>1.24563</td>
<td>1.76438</td>
<td>2.08938</td>
</tr>
<tr>
<td>Euro Libor*</td>
<td>1.13125</td>
<td>-0.014</td>
<td>0.010</td>
<td>-0.918</td>
<td>1.59250</td>
<td>1.92313</td>
<td>2.01750</td>
<td>2.12313</td>
</tr>
<tr>
<td>£ Libor*</td>
<td>1.09375</td>
<td>0.094</td>
<td>0.075</td>
<td>-0.406</td>
<td>1.42688</td>
<td>2.06063</td>
<td>2.22500</td>
<td>2.37750</td>
</tr>
<tr>
<td>Swiss Fr Libor*</td>
<td>0.15000</td>
<td>-</td>
<td>-0.013</td>
<td>-0.038</td>
<td>0.31000</td>
<td>0.49833</td>
<td>0.63833</td>
<td>0.93833</td>
</tr>
<tr>
<td>Yen Libor*</td>
<td>0.17363</td>
<td>-0.001</td>
<td>-0.010</td>
<td>-0.070</td>
<td>0.36988</td>
<td>0.63438</td>
<td>0.78625</td>
<td>0.96088</td>
</tr>
<tr>
<td>Canada Libor*</td>
<td>1.00000</td>
<td>-</td>
<td>-</td>
<td>-0.433</td>
<td>1.22833</td>
<td>1.45000</td>
<td>1.75833</td>
<td>2.21833</td>
</tr>
<tr>
<td>Euro Euribor</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.61</td>
<td>1.93</td>
<td>2.01</td>
<td>2.12</td>
</tr>
<tr>
<td>Sterling CDs</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.42</td>
<td>1.82</td>
<td>1.99</td>
<td>2.41</td>
</tr>
<tr>
<td>US$ CDs</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.45</td>
<td>1.30</td>
<td>1.75</td>
<td>2.20</td>
</tr>
<tr>
<td>Euro CDs</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.50</td>
<td>1.90</td>
<td>1.95</td>
<td>2.10</td>
</tr>
<tr>
<td>US o’night repo</td>
<td>0.40</td>
<td>-</td>
<td>0.050</td>
<td>0.050</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fed Funds eff</td>
<td>0.23</td>
<td>-</td>
<td>-</td>
<td>-0.080</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US 3m Bills</td>
<td>0.30</td>
<td>0.005</td>
<td>0.025</td>
<td>0.195</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDR int rate</td>
<td>0.58</td>
<td>-0.070</td>
<td>-0.070</td>
<td>-0.180</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EONIA</td>
<td>1.24</td>
<td>-</td>
<td>0.044</td>
<td>-0.882</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EURONIA</td>
<td>1.09</td>
<td>0.010</td>
<td>0.015</td>
<td>-0.884</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SONIA</td>
<td>0.83</td>
<td>0.076</td>
<td>-0.165</td>
<td>-0.381</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA 7 Day Notice</td>
<td>1.10-0.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feb 16</th>
<th>One Week</th>
<th>One Month</th>
<th>Three Months</th>
<th>Six Months</th>
<th>One Year</th>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

*Libor rates come from BBA (see www.bba.org.uk) and are fixed at 11am UK time. Other data sources: US $, Euro & CDs: dealers; SDR int rate: IMF; EONIA: ECB; EURONIA & SONIA: WMBA. LA 7 days notice: Tradition (UK).

**Table 3: Current market interest rates, 2009.II.18, [http://markets.ft.com](http://markets.ft.com)**

### 2.1.2 Government debt markets

Apart from dealing in interbank deposit market, commercial banks are active traders of government securities. These papers are issued to finance budget deficit and are sold at auctions, usually at a discount to their nominal value. Later on, these securities are traded on the market, mostly over the counter. At the redemption date, they’re redeemed in full nominal value. Governments issue the following securities:

- bills – with maturities from one to twelve months, paying no coupon, sold and traded at a discount to nominal;

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• notes and bonds – with maturities from two to ten and more years, usually offering a coupon, sold at a price close to nominal, trading according to market prices. Coupons can be fixed or float and are usually paid every six months. Some bonds have no coupon (zero-coupon), similarly to bills.

Government securities prices can be also expressed as yields. Using the internal rate of return methodology, a yield to maturity (YTM) of a bond can be calculated. YTM is the rate of discount that equates all the bond’s cash flows with its current price. A government securities yield curve can be calculated for maturities from 1 month to 10 years, and can be an alternative to the interbank rates curve.\(^{32}\)

However, the instruments underlying those two curves have different purposes – while government securities are a mean of investment, interbank rates are a basis of a multitude of transactions, including derivatives. Securities are used by banks to lend money, not to borrow, although it is somewhat possible through the use of repo (repurchase) deals in the form of Sell-Buy-Back transactions. In general, LIBOR rates are a better point of reference for most bank transactions.

### 2.2 Managing risks

Asset transformation results in various types of financial risk being transferred from customers to the bank. The tree main types of bank risk are:

• Credit risk,

• Interest rate risk,

• Liquidity risk.

• Currency risk.

The latter three are altogether described as the components of market risk. All of the above-mentioned risks are related to FTP.

Interest risk is the one that is estimated by the rate used in the transfer price formula. It is necessary to estimate interest risk profile for all bank products in order to choose the most suitable transfer price equation for each of them.

The effects of interest, currency and liquidity risk on bank’s balance sheet (BS) and profit and loss account (P&L) are singled out by FTP methodology in the management accounting approach, facilitating risk management. Interest and currency risk

\(^{32}\) Ibidem, pp. 102-144.
management includes derivatives. Their introduction in the thesis is necessary, as they are also priced by FTP as any other bank product.

Liquidity risk, interpreted as the risk of funding costs being in excess of market rates, is directly included in transfer prices in the form of additional margin.

Credit risk is generally relevant to FTP, as it needs to be incorporated in prices for products. It shows that, as a way of setting a minimum profitability level for products, transfer prices are not always enough and other factors – like credit risk – should be taken into consideration in the management accounting approach.

### 2.2.1 Credit risk

Credit risk is a result of information transformation function. Incomplete information on borrowers requires appraisal and monitoring of risk of borrowers not repaying their loans. To reduce that risk, banks require collateral on loans. Apart from individual loan security, risk transformation includes risk diversification due to a large number of borrowers.

#### 2.2.1.1 Individual risk

Individual credit risk is the possibility of a counterparty not being able to comply with his contractual obligations, e.g. a borrower not repaying a loan, or delaying principal or interest payments. Different customers generate various risk types: consumer, corporate or country risk, which can be subsequently divided to loan type:

- Individual consumer loan risk is evaluated through the use of credit scoring models. The outcome of such models shows personal risk levels, allowing the bank management to decide whether to give the loan or not, and how to price its risk in the level of interest required. Some consumer loans usually have collateral, e.g. mortgages are secured by property. Collateral is a supporting source of cash in the event of loan being not repaid.  

- Corporate loans risk appraisal resides mostly on ex ante analysis and ex post monitoring. Prior to giving loans, thorough analysis of financial statements, financial ratios and business plans is conducted using advanced models. For large companies, credit ratings are issued by international agencies, facilitating

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the risk assessment process. Loan contracts often include covenants – restrictions put on borrowers’ activities that could increase credit risk, e.g. excessive borrowing. Corporate risks also include the risk of other financial institutions as counterparties in different financial instruments.  

- Country risk is the risk of a government not repurchasing debt securities at their maturity. However, country risk influences also risk of all companies from that country. It is measured by rating agencies.

2.2.1.2 Portfolio risk

Credit risk can be limited by ensuring that the loan portfolio adheres to exposure limitations. Limits include: concentration on a single customer or customer type, geographic limits, economic sector limits, loan category limits, etc.

After the loan is given out, credit risk is managed on the portfolio level. The management comprises monitoring the portfolio characteristics and identification of nonperforming loans. In general, these are loans on which principal or interest payment is overdue for a specified period of time. Also, loans with potential weaknesses are sometimes taken into consideration. There are legal requirements for banks to set up provisions for underperforming loans. The level of these provisions varies according to legal regulations adopted in specific countries. Up till recently, all loans where divided into several categories based on payment delay and debtor’s financial situation, and a specific level of provisions for each category was required:  

- Standard loans with satisfying performance were assigned a 1-2% level of provisions (varying from country to country);
- Watched loans with very little delay or with slightly deteriorating financial situation of the borrower - 5-10%
- Substandard loans – unsettled for less than 90 days with borrower’s cash flows diminishing dangerously – 10-30%
- Doubtful – less than half a year past due, with questionable repayment – 50-75%
- Lost – overdue for more than half a year or considered uncollectible – 100%


Recently, with introduction of new International Accounting Standard in 2005 and with Basel Committee second recommendations, European banks are required to implement models in order to estimate losses from impaired loans (incurred and expected) in the form of discounted value of cash flows from those loans.\textsuperscript{36}

Despite those changes, the basis remains the same – provisions are recognized on a portfolio of loans according to their performance. The total level of provisions, compared to the total portfolio of loans, indicates the total credit risk accounted for by a bank. It can be expressed as a percentage ratio, quantifying the average risk of loans. Therefore, interest rates on various loans should be sufficient to cover probable losses.\textsuperscript{37}

\subsection*{2.2.2 Liquidity risk}

Liquidity risk is the result of maturity transformation. It emerges because loans, in principle, last longer than deposits. Depositors typically require direct access to their funds, meaning that they agree to lend money to the bank for short term, fearing they wouldn’t be able to use their funds when needs arise. In contrary, borrowers need long term funding - for a few years in case of commercial loans, or for a few dozens of years with housing loans. The consequence is the liquidity risk - meaning the maturity mismatch between assets and liabilities. This entails a risk that the bank will not be able to fulfill its current obligations. The maturity mismatch effect on bank’s P&L can by measured using FTP methodology.

Liquidity risk measurement aims to estimate the actual cost of market funding, which can sometimes differ from market rates. This extra liquidity cost can be included in the transfer price formula, in order to reflect current market conditions faced by a bank.

\subsubsection*{2.2.2.1 Measurement of liquidity risk}

Several measures can be used in order to identify liquidity risk. The most basic measure (used by regulators) is the ratio of liquid assets compared to liquid liabilities, which should be greater than one. This static measure can be enhanced by analyzing all assets and liabilities in terms of their time structure. An analysis of contractual payments of interest and principal on loans and deposits, divided on a time scale according to their


\textsuperscript{37} Glantz M. & Mun J. 2008…, op.cit., pp. 8-34
maturity, allows to determine whether at a given moment there is a lack of liquidity. This analysis can be improved by assuming different scenarios of liquidity needs.

2.2.2.2 Short term liquidity management

Liquidity management aims at matching the maturity structure of assets and liabilities. In a perfect situation, there are enough assets in all segments of the liquidity time scale to cover liabilities, however this rarely takes place. The basic management approach is to maintain surplus liquid assets in the form of a marketable securities (preferably treasuries), in order to sell them should unforeseen liquidity needs arise. Regulators favor that method, setting minimum liquidity requirement as a ratio of liquid assets to total assets.

Everyday liquidity management takes the form of short-term money market borrowing. In USA, central bank and security trading are more popular sources of funds than interbank loans, as is the case in Europe. However, financing liquidity needs in the interbank market carries some risk. Although official rates (e.g. LIBOR) are known, the cost of liquidity for a specific bank can differ due to a number of factors. A small bank, with a low standing, having solvency issues can be unable to obtain liabilities at a reasonable price, expressed as a spread to LIBOR rates. In times of market liquidity crisis, funding might be unavailable at all. Central bank, as the lender of last resort, would usually help out in such cases, though at prices significantly higher than the ones prevailing in the interbank market. Taking into account market and individual conditions, a bank needs to determine its specific marginal cost of money market borrowing.  

2.2.2.3 Long term funding management

Due to the potential money market liquidity shortage, long term financing is preferable. In general, financing long lasting assets with liabilities of short maturity causes a risk that rates on deposits will be unfavorably reset, while interest on loans will remain unchanged. While ad hoc liquidity management comprises of selling liquid assets and borrowing on money market, long term liquidity management focuses mostly on

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ensuring stable funding. In a bank, this task is assigned to a committee named ALCO (Asset and Liabilities Management Committee).\textsuperscript{39}

ALCO can manage liquidity through the use of capital markets, either on liabilities side - by borrowing from financial groups, issuing debt securities and increasing capital – or on assets side – by selling or securitizing some loans to free funds. Moreover, ALCO can manage all balance sheet items by altering product pricing. Increasing interest rates on products offered to customers affects the level of sales, resulting in restricting loan expansion and encouraging growth of deposits if necessary. To do so, ALCO is equipped with special tools, allowing it to manipulate internal product profitability. These tools comprise liquidity margin, which can be added to transfer prices to reflect current cost of market financing, and other margins, applied in order to regulate sales of single products.\textsuperscript{40}

\textbf{2.2.3 Interest rate risk}

Interest rate risk is the main risk that a commercial bank is exposed to, since bank’s activities as intermediaries between customers and financial markets result in creating assets and liabilities with incompliant interest rate characteristics. Various bank products and elements of balance sheet receive or pay interest based on different conditions. Rates can be fixed during the life of a transaction or flexible – where the rate is reset, either at periods of time specified ahead or at managements’ discretion. Interest rate risk results from unequal elasticity of assets and liabilities rate adjustment to market rates. For example, if assets’ elasticity is higher than that of liabilities, and market interest rates decrease, average rates on loans fall more than interest paid on deposits, resulting in diminishing net interest income.

Estimating interest rate elasticity and resetting profile for all bank products is necessary to select relevant transfer price. Not all products have simple LIBOR + margin interest. Non-market interest products require an estimate of their repricing characteristics.


\textsuperscript{40} Ibidem, pp.203-220.
2.2.3.1 Measuring interest rate risk

The most basic method of measuring interest rate risk is the gap analysis. In this model, all the assets and liabilities are put on a time scale, which is divided into time periods (e.g. into months below one year, and into years above). A loan or deposit is allocated to a period based on the time, when its interest rate is repriced. After all the products are divided according to the time interval when their rates may change, the difference between assets and liabilities in each segment is calculated. If this result is positive, more loans than deposits reprice in the specific timeframe, resulting in positive correlation of rate increase and interest income. When the gap is close to zero, interest risk is minimized. Cumulative gap is the sum of all individual gaps for different time periods. To show impact on interest income, the gap can be multiplied by the rate change. The gap analysis should be enhanced by measuring the elasticity of various products within one time segment. The simple gap model assumes that when a product’s interest rate is reset in a segment, it is reset by the amount that market rates change. However, product elasticity can be different than one. Different loans and deposits can have unequal level of reaction to market rate shifts. Even if the gap equals zero, elasticity differences entail interest rate risk (e.g. an equivalent amount of assets and liabilities reprices in a given time period; however assets have an elasticity of one while elasticity of deposits equals one half).41

The gap method doesn’t account for a number of factors. First of all, it doesn’t consider unparallel shifts in yield curve, where short term rates change differently than long term rates. Moreover, as a static measure, it doesn’t account for basis risk – a risk that some rates reprice on a different yield curve than the others do (e.g. some loans can be linked to central bank rates, whereas most products are reset based on LIBOR rates). Finally, it is a static method, and doesn’t include expected changes in balance sheet repricing structure. Other methods overcome those disadvantages. Sensitivity analysis applies different yield curve shift scenarios to the gap method. In more complex models, the entire balance sheet is simulated and bank’s income sensitivity to various interest curve changes is examined.42

2.2.3.2 Fixed interest income risk

A specific type of interest risk is linked with fixed income securities. Contrary to loans and deposits, interest rate changes don’t influence their coupons but their value. The effect is not on bank’s interest income, but on the value of its assets. Interest payments on these securities are fixed throughout their whole lives, along with the final payment of capital. The paper is priced as a series of discounted cash flows, where market yields are used as a discount factor. When yields rise, the present value of future cash flows falls, and the price of a fixed income paper reduces. Regular methods of risk measurement and control are not well suited here, so other techniques need to be employed. Duration is a measure of average time to maturity of a security (in years), where all the discounted cash flows are weighted by the time remaining to maturity. To determine an instrument’s elasticity to rate changes, modified duration is used. It is expressed in percent of security price change due to a one basis point parallel change in interest rates. In practice, instead of measuring percentage change, the absolute change in price of a security (in USD or another currency) is measured, called basis point value (BPV). Debt securities risk is managed through the use of interest rate derivatives - FRAs and IRSs. Due to their price reaction to rates change, fixed income securities always have negative BPV, whereas FRAs and IRSs have positive BPV. The total BPV on a portfolio of debt securities and interest derivatives can be used as a measure of interest rate risk and minimized.43

2.2.3.3 Managing interest rate risk

Interest rate risk can be managed by influencing the product structure. Changing business strategies in order to limit sales of some products (e.g. fixed rate loans) and promote others can result in long-term reduction of risk. Selling fixed-rate assets (e.g. bonds) has similar effect. Limits can be set on exposures to interest risk, as a proportion of bank’s income, capital or assets, further on divided by products or business units. Most often however, especially when debt securities are involved, yield curve risk is managed by the use of interest derivatives. As it was mentioned before, there are many different interest rate derivatives traded by banks: forward rate agreements (FRA), interest rate swaps (IRS), interest rate futures and options. FRAs and IRS are the most

widespread for risk management purposes. These instruments will be briefly described below.

A FRA is an agreement where one party (long) agrees to pay a specified above rate, in exchange for a floating market rate, which will be known in future. For example, in a 2x5 FRA a bank taking long position agrees to pay in two months a 3M LIBOR rate, receiving at the same time a rate fixed today, which is the 2x5 FRA rate. Both rates will be paid on an agreed nominal for a quarter of a year. There is only one cash flow – a net of both payments, made in two months from now, however the amount to be paid and the payer are unknown at the contract initiation. The most popular FRA agreements are: for 1 month (starting in 1 or months), for 3 months (starting in 1, 2, 3, 6 or 9 months) and for 6 months (starting in 1, 3 or 6 months).\textsuperscript{44}

An IRS is a series of FRAs. The most typical IRS changes a fixed rate into a 3M or 6M LIBOR. It can last from 1 to usually 10 years. A 1 year IRS based on 3M LIBOR is like entering today a into a series of FRA (3x6, 6x9 and 9x12) and a 3 month deposit. The first payment is known ahead, and equals the difference between the IRS rate and the current 3M LIBOR. An OIS (overnight interest swap) is an IRS based on O/N LIBOR, with everyday payments.\textsuperscript{45}

\subsection{2.2.4 Currency risk}

Currency risk is another type of risk, faced by banks that operate in more than one (domestic) currency. Even conservative commercial banks have such products - a typical example is a loan denominated in a foreign currency which has low interest rates. Currency risk exists when assets in a given foreign currency don’t equal liabilities, or, more precisely, when cash flows in a currency don’t even out (e.g. interest paid doesn’t equal interest received). This results in a currency gap, which influences bank profits. This effect can be shown using FTP methodology. Currency risk management requires using derivatives and pricing them with transfer prices is a complex issue.

\textsuperscript{44} Hull J.C. 2006, \textit{Options, futures and other derivatives}, Pearson Prentice Hall, New Jersey, pp.84-88.

\textsuperscript{45} Ibidem, pp.149-154.
2.2.4.1 Foreign exchange rates

Currency risk is a result of significant exchange rates variability. The value of the most important currencies – US Dollar, Euro, UK Sterling, Japanese Yen, Swiss Franc – is set on the market. Despite central banks’ interventions in defense of national currencies, this can result in large fluctuations. Central bank announces official fixing rates daily, based on prevailing market rates. However banks often quote more than one rate for each currency. They announce different price for foreign deposits (BID) than for loans (ASK), and profit from the spread between them. Moreover, exchange rates they offer to individual customers are dissimilar (with a larger spread) from those applicable for wholesale customers.

2.2.4.2 Currency risk measurement

Currency risk analysis and measurement is similar to interest rate and liquidity risk measurement conducted for each foreign currency on bank’s balance sheet. A so called net long or short position in foreign currency is the most widespread measure. It is calculated as difference between assets and liabilities (and off-balance derivatives) that mature in near future (e.g. a week), which can be further on divided into maturity periods, similarly to gap analysis. Net position should be calculated in each currency, and summarized, either as total of positive and negative positions, or as a sum of absolute values, or as the greater of the aggregate short positions and aggregate long positions.

2.2.4.3 Currency risk management

Currency risk can cause very large losses for banks, therefore most commercial banks seek to have zero currency risk exposure. As a basic tool of currency risk management, limits are established for aggregate currency position – usually 10% to 15% of bank’s relevant capital. Limits are also set on individual currency positions, most often expressed as a maximum absolute value of mismatch during specific time periods – this day, next week, next month, next half year etc. The net position for the next day or a few is then closed on everyday basis on currency markets, with spot and forward

currency transactions. These transactions consist of simple currency exchange, either immediately (spot) or on a future date, with an exchange rate set today (forward).\textsuperscript{47} Nevertheless, closing impending currency positions is not sufficient for liquidity disparity. Just like funding long term loans with short term deposits entails regular liquidity issues, funding loans in one currency with deposits in another one results in long term currency liquidity issues. This is a popular case in countries with high interest rates, where offering loans in currencies with low interest rates (JAP or CHF) is very popular with customers. This discrepancy can’t be handled within everyday currency position management, since interest paid in one currency is based on different rates than the interest received in another currency. For example, funding LIBOR CHF loans with LIBOR GBP deposits results in currency and interest risk combined. It is more suitable to hedge such transactions against both types of risk at once with derivatives such as FX Swap and CIRS. FX Swap (foreign exchange swap) is an instrument similar to a FRA, except that instead of swapping fixed for floating payments, it exchanges payments based on rates in different currencies. Likewise, CIRS (currency interest rate swap) is a foreign exchange version of a regular IRS. Typical FX Swap and CIRS deals would swap float for float, although fixed for float rate swap is also possible. More often than not, these derivatives include initial and final exchange of nominal, necessary for hedging currency risk.\textsuperscript{48} Using FX Swap and CIRS handles currency and interest rate risk, but not the liquidity risk. This can be handled with regular liquidity management methods, however finding long term funding for foreign currency loans might be impossible or very expensive, and currency swaps with long term maturities might be unavailable on global interbank market.

\textsuperscript{47} Ibidem, pp.271-280.
3 Basic transfer pricing theory

The first two chapters presented the basic concepts in banking, including functions and types of banks and the role of central bank. For each model of banking, different FTP system is relevant. Further on, financial markets were described with emphasis on the prevailing interest rates, which are most commonly the basis of transfer price formulas. Next, the need for risk management, including interest and liquidity risk, was brought into attention. The risks described are taken into account by the most sophisticated FTP models.

This chapter introduces transfer prices and describes fund transfer pricing systems. First of all, the need for and objectives of FTP are explained and transfer prices are defined. Secondly, different FTP methodologies are presented, beginning with simple ones and moving to the ones with increased complexity. Along with explaining methodology, arising issues are outlined: the choice between one transfer price or many, calculating TP internally or basing on market rates, using product pools or matching individual transactions.

3.1 Introduction to fund transfer pricing

To begin with, it is necessary to understand the need for FTP, its objectives and its definition, along with the definition of transfer price. This is the content of the following subchapters.

3.1.1 The need for fund transfer pricing

Fund transfer pricing system in general allows the decomposition of interest income. As shown in an exemplary bank’s income statement below, interest constitutes a large part of a bank’s profit:
Net interest income is the largest component of a typical commercial bank’s income (followed by fees and commissions) and can constitute up to 80 percent of a bank’s revenue. On the income statement, this component is decomposed into interest income and interest expense for the entire bank and no further analysis is available.  

Decomposition of net accounting interest result into products shows that all loans and other assets generate interest income, while deposits and other liabilities carry interest expense. Judging product effectiveness using this measure would result in evaluating all

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loans as profitable and all loans as causing losses. This is simply wrong, since giving a loan to customer requires funds that usually come from deposits placed by another customer. Each deposit has a value to the bank as a source of loan activity, and each loan bears the cost of using funds from that source. FTP puts an internal price on deposits, deducted as cost from loans.

Not only does transfer pricing allow to calculate profitability of loans, deposits and other products. It also enables measurement of interest income by branches, business lines and customers. Measuring profits on different levels allows the internal comparison of effectiveness, evaluation and appraisal.\textsuperscript{50}

Monitoring the participation of different sources in the creation of overall profits is one of the elements necessary to manage a bank. It allows to make rational decisions about resource allocation, cost control and level of profitability. Information on product and customer profitability creates the basis for pricing decisions, and indicates which products and customers are the most cost-effective for the bank. Making sound business decisions based on correctly calculated profitability becomes more important with increasing competition in financial services and in the environment of low but highly variable interest rates.\textsuperscript{51}

Faulty FTP systems can even cause bankruptcy, as was the case of Franklin National Bank and many other financial institutions in USA in the ‘70s.\textsuperscript{52}

### 3.1.2 Definition and objectives of a FTP system

In short, a FTP system “measures the value of products furnished by a profit center to other responsibility centers within a company. Internal exchanges that are measured by transfer prices result in (1) revenue for the responsibility center furnishing (i.e. selling) the product and (2) costs for the responsibility center receiving (i.e., buying) the product.”\textsuperscript{53}

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\textsuperscript{52} Deventer D. 2002, \textit{Transfer Pricing systems design: building clarity in the responsibility for and measurement of risk}, Kamakura Corporation, pp.1-6.

Basing on the definition above and on the requirements enumerated in the previous subchapter, a list of objectives of an FTP system can be built. A good FTP system should enable the following:\(^{54}\)

- Allocating interest margins to assets and liabilities, in order to reflect cost of funding.
- Determining profitability of products and customers in order to boost changes in assets and liabilities structure that lead to increased total profits. Transfer prices set a minimum required level of profitability for products, indicating which of them bring more gains to the bank.
- Evaluating business decisions in organization basing on the contribution of branches and business lines to overall profits. To fulfill this goal, it is necessary that decision makers are held responsible for the results that they are able to control.
- Control of interest rate and liquidity risk by transferring it to the unit responsible for interest rate risk management. Overall market risks can only be effectively managed on the central level, by treasury department and by ALCO.

Some of these goals were mentioned above, other will be explained in more detail in latter parts of the thesis, as various FTP methods are presented.

### 3.1.3 Defining transfer prices

Each fund transfer pricing system relies on transfer prices (TP). A transfer price is an internal rate of interest used to calculate transfer income or cost due to an internal flow of funds in a financial institution. It is very similar to actual rate of interest paid or received on a bank product, since it concerns the same transaction balance that the actual rate of interest does. As the actual accounting income received on a loan is calculated based on the interest rate, the internal transfer expense is calculated using the transfer price. For each loan, there’s a transfer cost, whereas for each deposit, there’s a transfer income.

The difference between interest rate and a transfer price is the interest margin, which allows to calculate the internal interest profit on a transaction. The actual method of assigning TP to a loan or deposit depends on the choice of FTP methodology.

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3.1.4 Bank products

There are a number of FTP methodologies available with different level of accurateness and complexity. These methods differ by their approach to transfer price calculation and by the level of assets and liabilities (A&L) decomposition that they allow.

Each bank product has different interest rate characteristic and maturity characteristics, that are the basis of assigning transfer prices. The most popular products, building up most of an average commercial bank’s balance sheet are: consumer loan, commercial loan, mortgage, credit card, line of credit, current account, savings account, term deposit. They differ by their maturity (average life), repayment schedule, interest rate type, etc. The table below presents the most typical characteristics of these products:

<table>
<thead>
<tr>
<th>Product</th>
<th>BS side</th>
<th>Maturity</th>
<th>Rate repricing</th>
</tr>
</thead>
<tbody>
<tr>
<td>consumer loan</td>
<td>asset</td>
<td>3mth-2yrs</td>
<td>fixed/Libor/Internal</td>
</tr>
<tr>
<td>commercial loan</td>
<td>asset</td>
<td>0.5-5yrs</td>
<td>Libor</td>
</tr>
<tr>
<td>mortgage</td>
<td>asset</td>
<td>10-30yrs</td>
<td>fixed or Libor</td>
</tr>
<tr>
<td>credit card</td>
<td>asset</td>
<td>Unknown</td>
<td>internal</td>
</tr>
<tr>
<td>line of credit</td>
<td>asset</td>
<td>Unknown</td>
<td>internal</td>
</tr>
<tr>
<td>current account</td>
<td>liability</td>
<td>unknown</td>
<td>+/- zero</td>
</tr>
<tr>
<td>savings account</td>
<td>liability</td>
<td>unknown</td>
<td>internal</td>
</tr>
<tr>
<td>term deposit</td>
<td>liability</td>
<td>1day-2yrs</td>
<td>fixed or Libor</td>
</tr>
</tbody>
</table>

Table 5: Typical bank products’ characteristics.

As the table shows, loans and deposits can have different maturities – varying from many years for a home mortgage loan, to even a day for an overnight term deposit. Some products don’t have actual maturities, as their repayment doesn’t follow a set schedule – e.g. funds on a current account are available to the owner at any point of time. Moreover, interest on products can be calculated by many methods. Term deposits can have a fixed rate, set at their origination and unchanged for their entire life. Many commercial loans receive interest based on a market reference rate, e.g. LIBOR 1M, which changes once every month for the whole life of the loan. Many products have rates set internally by bank authorities. Rate on a transaction is then changed whenever management decides to alter rates for the relevant product.

3.2 Single pool method

Out of many FTP methods created to allocate interest margin to bank’s assets and liabilities the most basic one is the single pool method. This method treats all transactions uniformly, putting them in one pool of funds. The providers of funds add to the pool, and the users take from it. Under this approach, the same one and only transfer
price rate is assigned to all the loans and deposits. There’s no difference in pricing products with various repricing and maturity characteristics. This is illustrated in the following graph using exemplary rates:

Graph 1: Transfer price in the single pool method.

3.2.1 Advantages and drawbacks of single pool

The single pool method is simple and easy to implement, without much investment in data systems. It doesn’t require much know-how or buying expensive IT systems. In fact, FTP calculations for this method can be done by one person in a spreadsheet. Single pool allows for assigning average cost of funds to all transactions, giving a crude estimate of product or branch profitability. It is good enough when a bank doesn’t have detailed databases of transactions, and possesses product information only on balance sheet level.

It is suitable for a small bank, with stable and undiversified sources of funds, financing its loans with deposits only. Also, the bank should be operating as a single unit, without many branches or business lines. Therefore it can be recommended for para-banks: savings and loan associations or credit unions. However, even for those institutions,

single pool should only serve as an initial FTP system, consequently developed to a more detailed approach.

This method however has a number of drawbacks that make it obsolete for larger commercial banks with various products. These disadvantages include the following:

- interest rate risk is not separated from credit risk and it cannot be transferred,
- single TP makes it impossible to create managerial incentives to attract deposits without simultaneously providing disincentives to sell loans,
- a single rate values doesn’t allow to differentiate transfer results according to the term structure of the portfolio,
- the method doesn’t take into account the historical interest rates prevailing at the time of transaction origination,
- it doesn’t allow fair measurement of managerial results

### 3.2.2 Calculating internal transfer price

In the single pool method, the transfer price is usually calculated internally – as an average interest rate on bank’s products. At the moment of calculation, all interest received on loans and paid on deposits is weighted by their outstanding balance. The resulting rate is a weighted average rate of interest of all banks A&L.

To calculate the transfer income or expense, the TP is the multiplied by product balance. Different levels of product decomposition can be used for balance, either basing on BS or customer’s account data. The balance can be calculated as a mean for a period of time. The actual length of the period should equal the frequency of TP calculation, which should be done repetitively, to account for interest rate variation.

Variations of average internal fund price calculation include computing it based only on interest expense on deposits or only on interest income on loans. However, choosing the mean deposit rate as the single TP favors loans (lower transfer expense) at the detriment of deposits, whereas choosing the average loan rate would have the opposite effect.

### 3.2.3 Net or gross balance

Although the single pool method is very straight forward, it entails some issues and dilemmas that can be solved in different ways. First of all, the single pool method can be used on a net or gross basis for each branch or business line. It means that the
transfer of funds can be employed either to all the deposits and loans in the unit (gross balance) or only to the net position of interest result.\textsuperscript{56}

In the net balance approach, a branch that uses more funds than it provides is charged only for the funds that it cannot rise by itself. This method relies on observation of the actual transfer of funds from and to the branch. If a branch lacks some funding, the central treasury department has to provide the financing, and invest the surplus in the contrary situation. Treasury does it usually by moving funds between branches, using the interbank market only as the last resort.

The gross balance method assumes that all the funds, not only the excess and lacking ones, are virtually moved through the treasury department. As a result, all the transactions are priced within the FTP system, contrary to only some in the net balance method. The gross methodology, although not reflecting real flow of funds, is preferable, since it allows better estimate of branch profitability and treats all transactions equally, disregarding the current net A&L position in the branch.

\subsection*{3.2.4 Double pool method}

As it was written above, the internal TP can be calculated basing on all products, or only on loans or deposits. Calculating the latter two rates allows a modification of the method by dividing the single pool into two separate pools. In the double pool method (also called split pools), loans are attributed the average loan rate, and the mean deposit rate is used as the TP for deposits. This approach allows better product profitability evaluation. Since all new deposits are valued in comparison to the current deposit portfolio, only the ones that increase overall profitability of deposits are attributed a positive interest margin.\textsuperscript{57}

However this modification causes an imbalance between managerial and accounting results. The difference between TP for assets and deposits called the spread isn’t attributed to any product, therefore it should be classified to a distinct FTP portfolio. This is represented in the graph below, which is a slightly modified version of the previous one:


\textsuperscript{57} Early B. 2005, \textit{Banker’s Guide to Funds Transfer Pricing}, Sheshnuff, p.64.
Adding more prices that differ not only by BS side, but also by repricing characteristics and term structure of products, leads to a multiple pool methodology, which increases the size and complexity of FTP portfolio.
4 Multiple pool method

Under multiple pool approach, all products are divided into a number of pools, divided by different criteria. Most often the criterion is to aggregate products based on their original maturity or repricing term. Additional factors may include product type and other attributes. Each pool covers a single part of the maturity spectrum, and their number is span depends on individual bank’s balance sheet term structure.

The bank establishes a set of transfer rates, assigning to products in each term segment a different interest rate. Under this approach, the difference between term structure of assets and liabilities is added to the FTP portfolio.

4.1 Market transfer prices

Instead of one or two transfer prices, a whole set of rates is needed under the multiple pool approach – one price for each pool. These can be derived internally, just as for single and double pool, by calculating average interest rate on assets and deposits in each pool. However, this approach lacks objectivity, and doesn’t encourage correct business decisions. A much better method is to base transfer prices on market rates. This approach is specifically suitable for banks that actively trade in the interbank market. For them, transfer prices determined in this way represent a source of income or cost alternative to dealing with customers. This concept reflects actual transactions – instead of taking in deposits from customers, a bank can borrow funds on the market. For each client transaction there’s an alternative in the form of interbank transactions. At any point of time, the rates prevailing in the market should be accepted as the cost of funds suitable for the bank.58

Applying market-based transfer prices provides the most methodologically consistent results, based on objective external criteria. Market rates allow objective verification of product pricing policy, they are also a good mean for evaluating management performance. Transfer prices should reflect market rates on instruments such as treasuries, interbank loans or interest rate derivatives. The bank must establish a set of transfer rates in the form of a yield curve that most accurately reflects its market cost of

funds. Most banks use the LIBOR/Swap curve, as it is built of instruments they most actively trade in.\footnote{Rice J. & Kocakülâh M. 2004, ‘Funds Transfer Pricing: A Management Accounting Approach within the Banking Industry’, \textit{Journal of Performance Management}, vol. 17 issue 2.}

### 4.2 Building pools of transactions

The above-mentioned rate curve shows the relationship between maturity and interest rate, as it was described in the chapter on financial markets. In multiple pool method, instead of two TPs as in double pool, there are two transfer price curves used – one for assets and another for liabilities, depending on their interest rate repricing characteristic. Pools are created of transactions with similar customer interest rate characteristics. The typical pool-building process is conducted on three levels – product, rate characteristic and currency. To each pool a rate from a LIBOR/Swap curve for a given currency is appointed. These curves are presented in the graph below, along with the transfer price selection process:

![Graph 3: Assigning transfer prices to multiple pools](graph.png)

The graph shows curves for the domestic currency, curves for any currencies that make up a significant part of portfolio need to be built. For the currencies with a small share of transactions, the main currency curves can be used. Rates from the curve are assigned to loans and deposits basing on the pool they are in. A loan that has a longer maturity would be assigned a higher transfer price under a
normally shaped rate curve. As shown in the graph, pools are constructed for typical product categories, according to their interest rate type and maturity. Typical product pools are listed below.

4.2.1 Long term fixed rate products

Products with long term (LT) fixed rates – e.g. fixed rate mortgages - are difficult to model under multiple pool methodology, as their rate structure is very inhomogeneous. Products with a rate fixed for a year or two – e.g. long term deposits – are easier to replicate. A rate from swap curve is assigned, from a point that is close to average time to maturity of transactions in a portfolio. It can be assumed for a portfolio of transactions that have been sold in similar numbers for an amount of time, that the average maturity equals half of the original term. E.g. a pool of two year fixed rate products can have a LIBOR 12M rate assigned. For the two years deposit pool, the average time (assuming constant sales structure) to maturity would be one year, as the transactions in the pool can have current maturities ranging from a day to two years. There can be a number of fixed rate portfolios, each for transactions of different length for a given product.

4.2.2 Float and internal rate products

Short term (ST) products with fixed rate (e.g. monthly deposits) and products with long maturities but with float rates can be treated uniformly. E.g. mortgages with interest based on a 3M LIBOR will have the same repricing characteristics as a pool of 3M deposits. Pools with rates from 1M to 9M can be created, according to their term characteristics.

Many bank products have rates set by management. Products with such an internal rate need to have a proxy market rate assigned, basing on predicted bank rate alteration frequency. This rate is set at discretion of management, basing on business conditions – such as level of sales – and on external environment – i.e. market rates or, most often, official central bank rates. Decisions to keep or change rates are usually made in monthly cycle, so for products with internal rates and with maturities above a month, often a 1M rate is assigned. Basing on historical frequency of internal rates alteration, another period length can be assumed.
4.2.3 Blended term for indeterminate maturity products

When the internal rate is combined with very short or unknown maturity – as for current accounts or credit cards – TP can be assigned as in the previous example, based on a single rate, usually 1M. Sometimes, a shorter rate is appointed, due to interpreting unknown maturity as being a very short one. However, the most popular approach is to divide each product with unknown maturity into two or more maturity layers each assigned a different average rate. The overall pool rate is then blended from all the rates on different pool layers. E.g. in current account pool, funds from many accounts are withdrawn on any given day, however, there’s always some amount of funds left in the whole pool. In other words, the sum of money deposited in accounts varies, but it doesn’t fall below a certain minimum level. This minimum level of funds, different for each product in each bank, can be calculated based on historical data. This residual amount is then treated as a subpool with a maturity of a year or even longer, whereas the fluctuating part of the portfolio is priced with weekly or even daily rates.\(^6\)

This residual subpool is represented in the graph:

As the residual level of deposits changes, the size of the subpool (expressed in percent of total portfolio) needs to reestimated. More than two subpools can be employed, representing layers with different volatility characteristic in the pool. The average of


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rate terms of all subpools, weighted by their size, is used as a proxy for the pool maturity.

4.3 Calculating transfer rates

The transfer price assigned to each pool is based on its maturity and on market rates prevailing for its term. For assets which bring interest income the TP is negative in order to calculate a cost of funds. For liabilities bearing interest costs the TP is positive, showing the internal income attributed to funds raised. However, since market rates vary constantly, transfer prices for the pools need to be changed from one period to another. First, the length of this period needs to be determined.

4.3.1 Price period length

There’s actually very little diversity in the choice of transfer price alteration frequency period. Usually, monthly periods are used for market price calculation, since internal reporting on managerial results is commonly conducted on monthly basis. External accounting reporting is most often conducted quarterly, but TP are not involved in external reports. The price can be calculated based on average daily TPs in a month; however, shorter periods can also be employed. Instead of calculating average monthly price and multiplying it by average monthly pool balance, daily prices and daily pool balance can be used. This approach adds accuracy to the pool model and should be implemented if data allows it.

4.3.2 Ex post or ex ante prices

Calculating average TPs for a pool should always be done with one goal in mind – the best approximation of customer interest rates in that pool.

There are two ways to approach that subject:

- One is to assign ex ante rates to transactions – the ex ante rates are set for a month ahead basing on current or historic rates. For business units, knowledge of the transfer price at the time of transaction is important, as the management can then make a correct business decision. They know how much interest they need to “charge” customer for a loan in order for the transaction to be profitable.

---

However, under pool methods, rates are recalculated each month, and the rate for the loan will be changed next month. So, under the ex ante approach in multiple pool method, the rate on the loan will be known ahead for the first month only, then TP will be reset for the whole pool. Since most bank products last longer than one month, there’s little gain from using ex ante prices to the quality of management decisions.

- Another method is to assign ex post prices. In this method, the prices are calculated after the end of a month. TheTPs are therefore unknown at the time of sale, which is a drawback. However, there’s a significant advantage, that the ex post price is a better approximation of actual market rates prevailing at the time of transaction. Since ex ante prices last only during initial month, the ex post method is preferred under multiple pool. Business units don’t know the TP on their loans when they sell them, however they can check current market rates, and, knowing the formula for determining the price, they know what average rates on loan pool are to be expected.

### 4.3.3 Weighted moving average methodology

After deciding between ex ante or ex post prices, the method of weighting daily rates in the monthly TP calculation needs to be chosen. The methods can be used with both ex ante and ex post prices, however here it is assumed that the latter technique is employed, as it is more suitable for multiple pools. There are a number of methods of approximating the TP for a pool of transactions that have the same rate type:

- The simplest methodology uses average market rates during each month. E.g. loans paying LIBOR 3M are priced with average LIBOR3M on that month. Also, daily prices can be used with daily pool balances. This is always suitable for LIBOR 1M and shorter rates.

- However, for rates longer than 1M it is more accurate to extend the period of time used in calculating the mean price to the term of market rate itself in order to better reflect the transactions that build up pools. For example, in the LIBOR 3M pool on any given day, some transactions have rates that repriced almost 3 months ago, some have repriced a month or two ago, and some had their rates reset just yesterday. So, a moving average of past three months (including the month for which we calculate the average) reflects the actual transaction rates
much better than one month average. For each rate term, a time span equaling the term is suitable, e.g. 5 past months and the current one for a LIBOR 6M.

- For TP to be the most correct approximation of customer rates structure in a pool, the day-by-day repricing composition of that pool needs to be taken into account. First, it is assumed that the transactions are evenly spread in time, i.e. that an equal piece of the transaction pool reprices each day. Then, for each piece of pool, a reset profile needs to be built. E.g. a LIBOR 3M loan that had the interest rate reset on the 1\textsuperscript{st} day of the current month will bear that rate for the entire month. However, another loan can be reset in the middle of the month. It would have the LIBOR 3M from the 15\textsuperscript{th} for half of the month, and a historical rate from 3 months before for the other half of that period. Doing that estimate for each day of the month results in obtaining a profile of weights for the average TP to be calculated.

The weighting profiles for all three moving average methods can be shown on a graph:

![Graph 5: Methods for calculating average monthly TP.](image)

The third method is preferred, as it gives the best estimate of interest repricing structure of a pool, with little extra effort necessary compared to other two methods.
4.4 Adjusting prices for liabilities

After building the product pools, assigning rate curves and calculating average rates, we have the basis for TP determination. For most loans, this is enough, and the price can equal the mean rate computed. For deposits however, additional amendments need to be done.

4.4.1 Deposit curve

As it was mentioned in the chapter on financial markets, LIBOR rates are the rates that banks ask for lending money to other market participants. Therefore, LIBOR rates are suitable TPs for loans. For deposits however, we need to know the market rate that banks pay to their depositors – the bid rate. As it is shown in the graph representing assigning prices to pools, two curves are necessary in the multiple pool method - the ask curve for assets and the bid curve for deposits.

Some financial instruments are quoted on a bid/ask basis, and some interbank deposit markets also follow that rule – e.g. in Poland there’s WIBOR (Warsaw Interbank Offer Rate) but there’s also WIBID – the bid rate. So in Poland, both curves can be directly based on market quotes. LIBORs however are only quoted as ask curve, and the bid curve needs to derived from it. As it was mentioned before, currently the spread to LIBID is most often estimated to be about 0,125 p.p. (percentage point). Thus, prices for deposits are calculated by subtracting 0,125 p.p. from LIBOR rates.

4.4.2 Reserve ratio adjustment

As it was written in the chapter on central bank (CB), in most countries banks are required to keep a part of their deposits in reserve instead of using them to fund loans. This reserve requirement is rewarded with interest by some central banks. Since the funds in reserve cannot be used, the ratio of reserve is deducted from transfer price. The only gain on those funds is the rate paid by central bank.

The overall deposit transfer price can be calculated using one of the following formulas:

\[
TP_{\text{dep}1} = (\text{LIBOR} - 0,125)(1 - 3,5\%) + 3,5\% \times CBrate
\]

\[
TP_{\text{dep}2} = \text{LIBOR} - 0,125 - 3,5\% \times \text{LIBID}_{1M} + 3,5\% \times CBrate
\]

Table 6: Formulas for TPs on deposits
The second formula uses an estimate of the interest lost due to reserve requirement, most often a 1M rate is used. The second formula is preferable, as it is also suitable for currency deposits, whereas the first one would result in overestimation of TP if rates for that currency are higher than domestic rates.

4.5 TPs for other assets and liabilities

The previous subchapter explained the treatment of deposits under FTP. These products are sold in business branches. However, there are more bank products than just loans and deposits. Specific products are dealt in by the central unit of bank, namely the treasury department. The specific instruments in treasury include:62

- Treasuries and other securities in held to maturity or for long term - these instruments should have a long term transfer price assigned, e.g. 12M. The TP is multiplied by the original price paid for the instrument at the moment of transaction origination.

- Trade instruments (treasuries and interbank loans & deposits) are held for short time and for speculative purposes, therefore they are priced with short term rates, e.g. O/N. Thus, the same instruments can be priced differently depending on their purpose and designated time of holding in portfolio.

- Derivative instruments have to be priced differently. As they are valued on market and often don’t pay interest, they are not valued by transfer prices. Instead, a cost of carry is calculated, relating short term rates to all the cash flows of the instrument.

- Equity is priced with cost of equity (COE). As a source of funding alternative to liabilities, cost of equity should be included in transfer pricing system. It can be done by pricing fixed assets with it. Another way is to price fixed assets with long term interest rates and include COE in all asset transfer prices. Adding the cost of equity margin requires allocating the risk weighted cost of capital to all the products and transactions. Introducing this margin to transfer prices relies on the concept that internal financing requires not only debt type financing priced with market rates, but in some part it also needs to employ bank’s capital, whose cost differs from market prices.63

4.6 Spread components in FTP portfolio

Apart from branches and treasury, the graph above shows also the FTP portfolio. Contrary to single pool method, where fund transfer pricing system didn’t leave any parts of accounting interest income unassigned to products, multiple pools leave out a significant part of interest, forming the FTP portfolio. In double pool, this portfolio included only the spread between prices for assets and liabilities. Under the multiple pool method, the spread includes not only the bid/ask spread, but comprises also the differences in pool term and currency structure along with other components.

The FTP portfolio is built up by the managerial transfer of funds from businesses, making it the source of funding for all transactions. Each negative TP paid by business for funding a loan is an income to FTP portfolio. When the sales unit gathers deposits, the internal transfer income is paid by the FTP unit. The total flow of funding of all transactions is the FTP income. To analyze this bundle of flows, it is necessary to extract the income due to different components of FTP system. Different transactions have more or less such components.64

The graph below shows the FTP portfolio components basing on two transactions – a domestic loan (EUR is assumed to be the local currency) and a currency deposit (in USD):

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The difference between the price on domestic loan (point A) and the price on foreign deposit (point E) is the result of FTP portfolio. The AE segment can be divided into:

- **AB segment – currency spread** – is the difference between the foreign currency curve and the local curve. FTP portfolio receives transfer interest on a loan in domestic currency, which in this case has higher rates than a deposit in foreign currency. If the loan was in a currency with lower rates, e.g. in CHF, the currency spread would be negative.

- **BC segment – bid/ask spread** – the difference between a loan and deposit curve in one currency, which equals 0,125pp. for LIBOR and EURIBOR. This spread can be cut in half by a MEAN rate into the spread earned on a loan and on a deposit.

- **CD segment – term spread** – the difference between the term of loan and the term of deposit, calculated in one currency. In this case it is positive, as the loan term is longer than the maturity of deposit, however it can be the reverse. To calculate the term spread separately, terms of both transactions can be compared to a short, e.g. O/N rate. The 6M-O/N term spread is the received on a loan, and the 3M-O/N spread is paid for the deposit.

- **DE segment – reserve ratio spread** – is the result of price on deposit moving away from the curve due to the reserve requirement amendment to the TP formula. Most often the ratio lowers TP on deposit, adding to the result of FTP portfolio.

- **An amendment not visible in the graph** would appear if the amount in deposit would differ from the loan balance. This difference doesn’t appear in rates, but in interest transferred, since the prices are then multiplied by different amounts. This is the assets&liabilities (A&L) imbalance spread, which develops when a bank has more liabilities than assets included in FTP system or vice versa.

- **Other amendments**, which are not shown in the graph, are corrective margins added to transfer prices. These margins are described in the following chapter.

### 4.7 Corrective margins

Corrective margins are another component of FTP portfolio. They are introduced to reflect external and internal business conditions. Positive margins added to TP for
product pools increase both the transfer cost of loans and the transfer income on deposits. Management can set the following margins:

- **Liquidity margin** – should be added to prices when actual cost of financing that the bank faces in the market differs from official interbank rates. It can be the result or bank’s credit risk as perceived by the market, when its financial condition requires a premium over market rate. Also, in times of market liquidity crisis, actual short term financing might be unavailable, and more costly long term financing must be raised from sources other than interbank loans. Corrective margins are added to TP to reflect the increased cost of funds.

An exemplary table of liquidity margins is presented below:

<table>
<thead>
<tr>
<th>currency term</th>
<th>EUR assets</th>
<th>EUR liabilit.</th>
<th>USD assets</th>
<th>USD liabilit.</th>
<th>other assets</th>
<th>other liabilit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>O/N</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>1W</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>1M</td>
<td>0.25%</td>
<td>0.25%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>3M</td>
<td>0.25%</td>
<td>0.25%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>6M</td>
<td>0.25%</td>
<td>0.25%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>12M</td>
<td>0.50%</td>
<td>0.50%</td>
<td>0.10%</td>
<td>0.00%</td>
<td>0.10%</td>
<td>0.00%</td>
</tr>
<tr>
<td>2Y</td>
<td>0.50%</td>
<td>0.50%</td>
<td>0.10%</td>
<td>0.00%</td>
<td>0.10%</td>
<td>0.00%</td>
</tr>
<tr>
<td>5Y</td>
<td>0.75%</td>
<td>0.75%</td>
<td>0.10%</td>
<td>0.00%</td>
<td>0.10%</td>
<td>0.00%</td>
</tr>
<tr>
<td>10Y</td>
<td>0.75%</td>
<td>0.75%</td>
<td>0.10%</td>
<td>0.00%</td>
<td>0.10%</td>
<td>0.00%</td>
</tr>
<tr>
<td>20Y</td>
<td>1.00%</td>
<td>1.00%</td>
<td>0.10%</td>
<td>0.00%</td>
<td>0.10%</td>
<td>0.00%</td>
</tr>
<tr>
<td>30Y</td>
<td>1.00%</td>
<td>1.00%</td>
<td>0.10%</td>
<td>0.00%</td>
<td>0.10%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

*Table 7: Exemplary liquidity margin table.*

Margins are appointed basing on currency and maturity of product pool, with balance sheet side (asset or liability) optionally taken into account. Using the table, management can foster gathering of deposits and/or limit sale of loans, when liquidity issues arise. Liquidity margins are typically positive, to reflect increased cost of funding. Negative liquidity margins are very uncommon. When management decides to change the table, new margins are reassigned to pools.65

- **ALCO margin** – reflects the target A&L structure that management has in mind. In order to boost sales of some products and reduce the significance of other products, margins can be used to influence product profitability. ALCO margins are set for each product separately, notwithstanding its term or currency structure, but taking into account the balance of transactions. Most often ALCO

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uses its margins to improve internal profitability of significant large transactions.

An exemplary ALCO margin table is shown below:

<table>
<thead>
<tr>
<th>products</th>
<th>&lt;100ths</th>
<th>&lt;500ths</th>
<th>&lt;1 mln</th>
<th>&lt;5mln</th>
<th>&lt;10mln</th>
<th>above</th>
</tr>
</thead>
<tbody>
<tr>
<td>loan 1</td>
<td>0,10%</td>
<td>0,10%</td>
<td>0,10%</td>
<td>0,10%</td>
<td>0,10%</td>
<td>0,10%</td>
</tr>
<tr>
<td>loan 2</td>
<td>0,00%</td>
<td>0,00%</td>
<td>0,00%</td>
<td>-0,10%</td>
<td>-0,10%</td>
<td>-0,10%</td>
</tr>
<tr>
<td>deposit 1</td>
<td>0,00%</td>
<td>0,05%</td>
<td>0,10%</td>
<td>0,15%</td>
<td>0,20%</td>
<td>0,20%</td>
</tr>
<tr>
<td>transaction 1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,25%</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 8: Exemplary ALCO margin table.

A positive margin limits profitability of a loan, whereas a negative one increases it (the opposite is true for deposits). Unique transactions require setting one margin only.

### 4.8 Pros and cons of multiple pools

The multiple pool methodology is complex and detailed in many areas. However, from an information technology point of view, it doesn’t require much computing power or detailed transaction information. It is not as easy to implement as single pool, however it can work based on databases supported with internally developed software. For larger institutions, some sort of professional application might need to be bought.

Multipool ensures a fairly good calculation of profitability for pools of float rate products, and approximates fixed rate pools’ results basing on current market rates. It takes into account the time structure of assets and liabilities and allows for many adjustments. It can be recommended for any commercial bank, with many branches and businesses, various sources of funding and complex product portfolio. It is suitable for banks that actively use interbank transactions. The method allows for more objective performance evaluation and provides management with tools for governing product structure and profitability.

However, multiple pool methodology has a number of disadvantages as well:66

- Profitability of products is influenced by changes in market interest rates.
- Historical interest rates prevailing at the time of the contract are not regarded.
- Method is not suitable for long term fixed rate transactions.
- Interest rate risk is not separated from credit risk.
- Managerial results are approximated with varying accurateness.

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• Increased disparity between managerial and accounting interest in the FTP portfolio.

• More IT resources required in comparison with single pool method.

The drawbacks listed above are not crucial however, and the multiple pool methodology is successfully used in many large banks. The main reason for preferring it to more accurate methodologies is the quality of transaction data a bank has. If bank’s data bases don’t allow to determine parameters like repricing and original maturity on every single transaction, multiple methodology is the only choice. Moreover, multipool method is the historical choice – it was employed when available hardware and software didn’t allow for successful implementation of more complex methods. Today, it still prevails in many banks, as switching to more advanced methodologies would require alterations in the majority of existing software, which may be costly, time consuming, and temporarily slow down data processing.

4.9 Historical multiple pool variation

To overcome some drawbacks of multiple pool methodology, adjustments can be implemented. Using average rates significantly distorts profitability of long term fixed rate transactions. Instead of current rates, historical rates from the initiation of transaction can be used. Using historical rates allows fair evaluation of product pricing decisions made at the time of transaction.

To resolve this issue, a adaptation of the multiple pool method divides the LT fixed rate pool into a series of historical pools. Each historical pool includes transactions that originated in a historical period of time, and assigns to them rates prevailing at that time. E.g. for a pool of fixed rate mortgages, twenty historical subpools can be created for each year in the past, with an average rate calculated based on the rates prevailing in that year. This way, transactions are divided according to the time of their initiation with rates assigned accordingly.
5 Matched rate method

Matched rate method (MRM) differs from multipool by one crucial aspect – instead of using transaction pools, prices are assigned to each transaction separately. This allows for TP to mimic perfectly the customer interest rate on transactions. Matched rate method can be interpreted as the result of employing the historical pool method with a vast number of historical pools, one for each transaction. In many aspects those two methods are similar – they use the same TP formulas and corrective margins, both methods entail a FTP portfolio.

5.1 Benefits of MRM

The main differences between multipool and matched rate include:

- Separation of credit risk and interest rate risk,
- Sales unit held responsible for credit risk only,
- Business transactions based on a fixed interest margin.
- Unbiased business decisions evaluation and motivation
- Interest risk centralized and transferred to a responsible unit

MRM offers significant advantages, however it is costly to implement. It requires buying expert applications that can fulfill a number of functions – processing of detailed transaction data, incorporating various aspects of advanced FTP methodology and translating interest risk data to treasury IT systems.

It can be recommended for largest commercial banks, which have detailed transaction databases and sufficient funds to build costly IT systems. It is suitable for banks that wish to improve business performance evaluation and interest risk management. If not in full scale, MRM can be implemented for large fixed rate transactions first, where it brings the most significant improvements.

Nowadays, its popularity rises due to the functions it has in aiding the assets and liabilities management. As the only method capable of effective interest rate risk transfer and management, MRM becomes a must in the environment of low and variable market rates. This method is indispensable for institutions that are active on financial markets, as they are faced with increased risks stemming from various financial instruments in their holding.

To sum up, MRM is the choice of future, and large banks that still use multipool are currently implementing MRM, or at least are planning to do so.
5.2 Business unit results

The main effect of MRM on branches and business units is that margins on all their loans and deposits are constant throughout the transaction duration. At the time of transaction origination, the TP is assigned based on repricing characteristic, in order to “freeze” the interest margin. As a result, business unit knows what the profits on a transaction will be throughout its entire life at the moment of product sale. This entails significant changes in business results evaluation, compared to multipool methodology:67

- With a fixed margin on transactions, business units’ profits are due only to the factors that the unit can influence. In MRM, branch managers are rewarded for the quality of decisions made in a given market environment, not for the effect of changes in market conditions, as is the case in multipool method. In multipool, business results include undeserved losses and gains due to interest rate fluctuation.
- With interest rate risk removed from business, financial plans can be set and evaluated despite of changing market conditions. Forecasted business results are still valid, even if actual interest rates differ significantly from predictions.
- In matched rate methodology, branch management is rewarded fairly, which is important for motivating future business performance. Knowing they’ll be rewarded for the results they can influence, managers make unbiased pricing decisions knowing total future results on a transaction. Their decisions are based only on actual cost of funds at the moment of transaction.
- Under multipool past transactions are affected by subsequent market rate fluctuations. Using current TPs distorts business decisions, as management tries to avoid fixed rate transactions. They make decisions basing not only on customer profit contribution. Each line managers tries to predict future rates and manage interest risk, which he is not responsible for.
- Knowing the net interest margins on transactions at their origination allows for detailed profit contribution analysis. Using MRM, this contribution can be measured of business line level, branch level and customer level without market rate variability bias.

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• Under MRM, business managers are only responsible for credit risk on their transactions, and the interest risk is transferred to the FTP portfolio.

5.2.1 Credit risk

With interest risk removed, business results are influenced by credit risk only. Sometimes, credit risk can also be removed from the branch. This is justified in case when bank’s structure includes a centralized credit risk unit, which takes over the credit decision authority from branches.

In such cases, when the credit decision is centralized, then the credit risk should be removed from business transactions. This can be done by attributing an average credit spread, expressed in percent of balance, to the sales unit as cost of credit risk. Actual credit losses should be then attributed to credit risk unit, with average credit spread as income. The average spread can be calculated for different products or customer types separately, based on past and predicted credit quality of product portfolio.68

5.3 Transfer price calculation

The core characteristic of the MRM is the assignment of individual transfer prices. For this purpose, just like with multipool, market rates are used. Contrary to multiple pool, there is no ex post or ex ante price dilemma – all TPs are based on rates prevailing at the moment of transaction origination. In practice, daily interest rate fixing is used, although for large transactions, intraday rates from the exact moment of transaction can be used. Rates from a curve are assigned to loans and deposits basing on their repricing characteristic. This doesn’t necessary mean a fixed TP, which is true only for fixed rate transactions. For float rate deals, TP mimics changes of customer interest rates on each loan and deposit. Other components of TP formula, like corrective margins, are kept constant from the moment of transaction origination. Only then the total interest margin on the loan will be unchanged for the transaction life. Just like in multipool, prices on deposits are taken from the BID curve and adjusted by reserve ratio. The specific TP calculation method depends on the interest rate type on a transaction.

68 Deventer D. 2002…, op.cit., p.16.
5.3.1 Float rate transactions
Transactions with interest based on regularly repriced market rates obtain a TP based on the market rate that the customer coupon is referenced to. For example, a 1 year loan paying interest based on a 3M LIBOR will have a TP based on the same rate. Each quarter, on the day that customer’s rate is reset to the current 3M LIBOR, the TP is reset as well. As a result, the interest margin on the loan is constant, despite of changes in both TP and customer coupon.

Float rate instruments reprice on a given day with a frequency dependant on their reference rate. When a transaction reprices during a month, it is important to observe transaction balance before and after the reprice date. The balance can change on any day due to early withdrawal of deposit or due to prepayment of loan, therefore it is necessary to differentiate between the balance before and after repricing. As a practical consequence, with MRM, transaction balances need to be measured daily.69

5.3.2 Internal rates
Similarly to multipool, products with yields set internally by bank management get TPs based on market rates with term best approximating the actual and predicted changes in internal rates. For reasons previously explained, most often monthly rates are used, sometimes quarterly rates (if management changes rates rarely, or when market conditions are stable). This entails a so called basis risk – a risk that internal rate will change with different frequency or by different amount than its market proxy. Contrary to interest rate risk, basis risk isn’t usually removed from business level. This is due to the fact that its business line management who is responsible for product pricing, and it’s their authority to use internal rates or to change them to market based rates in order to get rid of basis risk.70

Despite of the similarities between the multiple and matched rate methods, there is however one difference– in MRM, no average rates are allowed. Every transaction must be priced like a market transaction, with repricing schedule compatible with market standards. In order to best replicate internal rate change timetable, all products with internal rates have their TPs reset on the first day of each month (or quarter). This

70 Deventer D. 2002…, op.cit., p.15.
reflects the widely employed routine of introducing changes in bank rates from the begging of month, in order not to complicate monthly managerial accounting calculations. For example, a loan paying interest based on internal yield will have its LIBOR 1M TP (if such rate is assigned) reset on the 1st day of each month, independent of the actual transaction date. This is actually a drawback compared to the multiple pool approach to internal rate products pricing, since changes in rates on one day have a significant influence on the profitability on entire portfolio of products. Using average rates in multipool method smoothens any potentially large daily rates variations.

For large individual transactions with unknown maturity, another method can be used. If the transaction required a direct interbank transaction to fund it (or to place funds gathered from it in case of a deposit), the rate on respective market transaction can be applied as a fixed transfer price (after necessary amendments).

### 5.3.3 Transactions of indeterminate maturity

Transactions with unknown maturity are another products treated similarly under multipool and MRM. In matched rate methodology the multiple layer approach to product portfolio is also employed, dividing each product into layers with different actual maturity (historical or predicted), with respective market rates assigned. The average weighted maturity of products can also be calculated. There are however some differences. First of all, the subpool approach is obligatory in MRM, whereas in multipool it was one of the options. Next, in MRM, there are usually more pools than the typical couple in multipool. Finally, there’s no average rates employed, and each layer has a rate that reprices according to market rate schedule. For example, a current account portfolio would typically have the following layers:

- a 10 year layer, with amounts stable during many years and with a 10Y IRS price, changed every ten years;
- a 1 year layer, with a LIBOR 12M based price, reset each year on 1st of January;
- a monthly layer, with a 1M rate reset on the 1st day of each month;
- a daily layer, with O/N transfer price reset daily.

Similarly to MRM for internal rate transactions, instead of using average rates, yields from a specified day are used. This doesn’t necessarily improve the quality of FTP system, however it is a consequence of interest risk transfer to Treasury department, and will be explained later on.
5.3.4 Fixed rate transactions

Compared to the previously described transaction types, the treatment of long term fixed rate transactions is completely different under MRM than under multipool. Each fixed rate transaction is assigned a rate from the curve basing on its original maturity. Actually, the result is a slightly modified version of MRM - the maturity matching method (MMM). There is no repricing schedule, and the fixed rate on transaction can be only vaguely based on market rates. Therefore, a TP is assigned basing on the original maturity of transaction.

For example, a 5 year fixed rate commercial loan is assigned a 5 year swap rate prevailing in the market at the moment when the transaction was originated. This rate is then kept constant for the entire life of the transaction. As a result, each transaction has a fixed interest margin for its life. This is where MRM differs most significantly from multipool, where the interest margin would fluctuate as market rates change.

For transactions with unusual length, prices are calculated based on the interpolation methodology. E.g. a four and a half year loan would be assigned a TP calculated as a mean of 5Y IRS and a 6Y IRS.

5.3.4.1 Amortizing loans

Assigning TP to transactions basing on their original maturity can pose problems when dealing with amortizing loans, e.g. mortgages. Amortizing loans pay back principal evenly throughout their lives, instead of paying it in a lump sum at the end of transaction. As a result, their balance diminishes constantly. Therefore, funding for the transaction isn’t raised in the whole amount for its entire life, as a fixed rate based on contractual maturity would suggest. In order to better reflect the time span that the funds are necessary for, actual maturity (shorter than contractual) is calculated and used to assign the constant TP. A number of methods can be used to fulfill that goal.71

- Simple average – this method divides the loan into a series of all the principal repayments, and assigns to each one a TP from the moment in the futures when that principal cash flow will take place. Then, a simple average of all TP for consecutive payments is calculated.
- Balance weighted average – this a modification of simple average method, when all the TPs assigned to principal cash flows are weighted by the size of cash

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flow, i.e. by the portion of principal repaid. The principal repayment schedule set at origination is used, without taking into account any potential prepayments. This method is preferred to the previous one.

- Duration based – instead of using initial maturity, duration can be used to determine average length of transaction. Duration calculation was described in the chapter on risk management. In short, duration weighs all the cash flows by the time at which they occur.

- Median life – the simplest way to determine actual term of transaction is to use the time at which half of the principal will be repaid according to schedule. For evenly amortizing loans, this would equal half of the transaction life. This method is very popular.

These methods provide quite similar results, however for long term instruments in a variable interest rate environment, results may differ. The actual term determined by one of the methods is used not only to determine the transfer price, but also for other purposes, like assigning corrective margin. E.g. using the median life method, a liquidity margin is assigned to mortgages based on half of their contractual lives.

5.3.5 Prepayment option adjustment

Most products provide the customer with an ability to of early principal payment. Loans can be prepaid and deposits withdrawn ahead of schedule. This risk is essentially left together with interest rate risk in the FTP portfolio. Prepayment risk is mostly significant for long term fixed rate loans. At loan origination, funds are raised for the expected life of transaction, at market prices for that term. Prepayment results in a need for a reverse transaction for part of the initial amount, but at now prevailing rates. FTP center isn’t able to control that risk, therefore branches should be charged with the cost of such transactions. However, charging a marked based penalty for prepayment or withdrawal would result in significant costs for business lines in periods of interest rates decline, since prepayments are massive in such economic environment. A better method of including potential prepayments in FTP system is to calculate the value of prepayment option owned by customers on various products. This option value is then added to the transfer pricing rate (or substracted for deposits), similarly to other corrective margins.\(^\text{72}\)

\(^\text{72}\) Deventer D. 2002…, op.cit., p.17
5.4 FTP portfolio management

Fixing the interest margin on business transactions entails a transfer of interest rate and liquidity risk to the FTP portfolio. The portfolio is managed by ALCO (Assets and Liabilities Management Committee), however on a daily basis, the Treasury department administers the total pool of transactions.\(^{73}\)

The place of FTP portfolio in the overall bank structure is illustrated in the graph below:

![Graph 7: Business Units in a Bank.](image)

Treasury, under the guidance of ALCO, manages the risk of FTP portfolio. Treasury is divided into Trade book, which trades with the market both for profit and to close Bank book transactions and Bank book, whose task is to manage the surplus or lack of funding. Treasury is able to borrow and lend on the market, in order to ensure the necessary level of funding. Transferring all FTP transactions to treasury systems provides detailed information on interest rate and liquidity risk of the entire balance sheet. These risks are materialized in the overall FTP portfolio due to bank's funding mismatch, caused by sources and uses of funds having unmatched repricing terms, amounts, or origination dates. The mismatch is mainly composed of volume and term differences, the latter being more significant. The maturity mismatch component is a result of differences between the shorter and the longer tenor side of balance sheet. As is often the case, financing long term fixed rate loans with shorter term deposits conveys a risk that should interest rates rise, interest cost on deposit will increase while interest income on a loan will remain unchanged.\(^{74}\)

However, loans and deposits are valued in financial reports using accrual accounting – meaning that they’re presented in their nominal value, adjusted only for credit risk. Their book value doesn’t reflect the potential influence of market rate changes on future

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\(^{74}\) Payant R. 2000, ‘Funds transfer pricing and A/L modeling’, *Journal of Bank Cost & Management Accounting*. 

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profits. On the other hand, most instruments in treasury department (derivatives and trade securities) are marked to market (MTM) – their price is recalculated constantly in order to reflect how current market rates influence their value. In marked-to-market valuation methodology, the value of an exemplary loan would be influenced by changes in interest rates to the extent of predicted changes in future profits. Therefore, during the transfer of FTP transactions to Treasury, the valuation method is changed. MTM valuation of loans and deposits allows to measure interest rate and liquidity risk on the entire bank’s product portfolio. Translating all FTP transactions to MTM is possible provided there’s complete information on repricing and maturity characteristic of all transactions. This is available only in Matched Rate Methodology of FTP.

To allow for interest and liquidity risk management, all the transactions in FTP portfolio need to be observable by the Treasury department. This can be done provided that the treasury IT system responsible for following market transactions is able to communicate with databases on FTP transactions. Treasury can then manage all deals and close them with market when necessary. It doesn’t mean all transactions are paired off against one another or on the market. The goal of A&L management isn’t to eliminate all funding mismatches but to control them, since they are a source of bank’s profits. In order to fulfill this goal, ALM uses a number of techniques of interest rate risk management that accompany market-value accounting, e.g.: duration analysis or cash-flow analysis. For liquidity management, analysis of cash flows is combined with gap analysis, scenario analysis can also be used.75

5.5 Variations of matched rate methodology

The MRM is the only method that allows proper transfer of interest rate risk from business, leaving there a fixed interest margin. However, for foreign transactions, currency risk remains in the branch. Some variations of MRM try to overcome this problem, by setting a fixed exchange rate to transactions based on their origination date. This doesn’t account for the fact that each CF from or to customer in foreign transactions is priced by a different exchange rate. Therefore, a repricing exchange rate, similar to repricing interest rate should be assigned to such a transaction. However, the exchange rate issue is rarely covered by FTP systems, since it isn’t necessary for risk

management. Banks typically keep a very low open currency position, not taking much risk in that area (while they’re open to interest rate risk).

Another approach modifies the matched rate methodology by using its fixed rate variation for all transactions. The matched maturity rates are assigned to all deals, including those based on float or internal rates. This approach is derived from a concept, that it’s the transaction term, not the rate repricing characteristic that indicates its cost of financing. This method of including cost of liquidity is alternative to the corrective liquidity margin, used in regular FTP methodologies.
Conclusion
In the introduction, research questions on fund transfer pricing were asked. The conclusion presents summarized answers to those questions, fully developed in the thesis.

**Is FTP necessary, or can a bank cope without it?**
Fund transfer pricing system is necessary for successful management of any major financial institution and literally all large banks have implemented one of FTP methodologies. In a highly competitive environment, with historically low interest rates and decreasing interest margins, banks need to improve their performance management abilities in order to achieve sustainable profits. FTP is the best tool for analyzing net interest income, which is the biggest component of bank’s profits. FTP system is fundamental for financial institutions and no bank can be well-managed without possessing some sort of transfer pricing system.

**What are the advantages of using an FTP system?**
Various FTP methodologies provide different sets of advantages. Overall, fund transfer pricing provides the following benefits:

- Allows to calculate a cost of funds and apply them as a price to all internal sources and uses of funds.
- Allows to plan, motivate and evaluate management performance based on fair appraisal of results
- Permits removing interest rate risk from sales divisions by setting a fixed margin on transactions, leaving only customer’s credit risk
- Allows transferring interest rate and liquidity risk to a central unit responsible for its management
- Facilitates management of market risk through assets and liabilities management
- Transfer price allows to minimize interest margin fluctuations due to market rate changes
- It prices marginal cost of funds in order to improve business decision making
- Facilitates deep analysis of interest income, by product, branch, business line, transaction, etc.
• Interest income decomposition improves product pricing and tailoring the product offer to various needs

**How can it improve results?**

FTP system improves profitability by enhanced pricing. Applying a transfer price most reflective of actual funding cost to each transaction allows for perfected decision making. Prices for products are then set at a level than ensures an increase in bank’s total profits. Customers can be evaluated based on their overall contribution to bank’s results, and selective conditions can be awarded. The profit contribution of branches and business lines can be appropriately estimated, allowing to close down the units that don’t contribute to profitability. The same methodology can be used to evaluate management and even individual employees, basing on their contribution to profits, compared to their financial targets. Statistical studies show that accurate fund transfer pricing can generate a measurable increase in a bank’s interest margin.

Another benefit of FTP is the quality of interest rate and liquidity management it entails. Transfer pricing system can effectively move those risks away from sales units into a centralized portfolio. The overall level of bank’s risk can be then observed, divided into sources of origin, and managed. Asset and liability management is more effective when it can be conducted towards all bank’s loans and deposits and their funding mismatch directly by Treasury department. This is possible only with a sophisticated FTP system with a direct connection to Treasury IT systems.

**How to build an FTP system, is there an easy way to do it?**

Building a basic FTP system is relatively simple. The easiest way to implement an initial FTP system is through the use of a single pool method. In this method, only one transfer price is established, calculated based on average interest rates on all products. It is enough to divide interest profits between assets and deposits and to calculate branch results. This system is cheap and easy to apply, with literally no investment in IT or know-how necessary. It can be gradually enhanced, e.g. by using two transfer rates, one for deposits and another for loans, allowing to control generation of deposits and loans independently. Further amendments can include accounting for reserve requirement, building more pools for different products, or using current market rates instead of internal cost of funds. Such a system would be easy to establish while making transfer pricing effective.
In its more developed version – the multiple pool methodology, further refinements are possible. Various types of moving average are used to calculate prices for products with different repricing and maturity characteristics, more accurately reflecting the actual interest rates on transactions. Corrective margins are introduced, e.g. in order to apply cost of liquidity to transactions. The growing differences between transfer cost and income form the transfer portfolio. In multiple pool methodology, a reasonably accurate calculation of profitability on different products is possible. Time structure of assets and liabilities is accounted for, and marginal market costs are used as benchmark. This method is well suited for most users, especially when applied to products with unknown maturities or based on internal interest rates.

**How to develop a perfect FTP system?**

The choice of FTP methodology depends largely on resources available: manpower, know-how, quality of data bases, IT systems capacity and the budget for FTP. Financial institutions seeking to develop the perfect FTP methodology, should implement the matched rate method. It is a complex method, requiring significant investments and developments.

However, only this method allows for proper transfer of interest risk to a central unit, leaving a fixed interest margin in the business. Using historical rates individually assigned to transactions ensures a proper calculation of profits on customer and transaction level. A fixed margin ensures fair evaluation of management decisions and business results. Business decisions and their assessment are unbiased by market rate fluctuations, which are uncontrollable by sales unit. Removing interest rate risk from business units allows for proper risk management in a central unit. Treasury can observe risk characteristics of each transaction by valuing them by marking to market.

The matched rate method should be implemented by any large bank that has a significant amount of fixed rate transactions on balance sheet. It is also suitable for institutions that wish to better control their interest rate and liquidity risk.

Banks need to employ one of FTP methods in order to be able to analyze contributions to overall interest profit, to control and evaluate business results. Lack of a proper FTP system negatively influences bank’s overall profits and deteriorates the quality of risk control. FTP system is crucial for financial institutions and no bank can successfully expand without implementing one of its versions.
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