Microeconomics of Banking

Second Edition

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1 Introduction

1.1 What Is a Bank, and What Do Banks Do?

Banking operations may be varied and complex, but a simple operational definition of a bank is available: *a bank is an institution whose current operations consist in granting loans and receiving deposits from the public*. This is the definition regulators use when they decide whether a financial intermediary (this term is defined in chapter 2) has to submit to the prevailing prudential regulations for banks. This legal definition has the merit of insisting on the core activities of banks, namely, deposits and loans. Note that every word of it is important:

- The word *current* is important because most industrial or commercial firms occasionally lend money to their customers or borrow from their suppliers.[1]
- The fact that both loans are offered *and* deposits are received is important because it is the combination of lending and borrowing that is typical of commercial banks. Banks finance a significant fraction of their loans through the deposits of the public. This is the main explanation for the fragility of the banking sector and the justification for banking regulation. Some economists predict that commercial banks offering both loan and deposit transactions will someday disappear in favor of two types of specialized institutions,[2] on the one hand "narrow" banks or mutual funds, which invest the deposits of the public in traded securities, and on the other hand finance companies or credit institutions, which finance loans by issuing debt or equity.
- Finally, the term *public* emphasizes that banks provide unique services (liquidity and means of payment) to the general public. However, the public is not, in contrast with professional investors, armed to assess the safety and soundness of financial institutions (i.e., to assess whether individuals' interests are well preserved by banks). Moreover, in the current situation, a public good (access to a safe and efficient payment system) is provided by private institutions (commercial banks). These two reasons (protection of depositors, and the safety and efficiency of the payment system) have traditionally justified public intervention in banking activities.

Banks also play a crucial role in the allocation of capital in the economy. As Merton (1993, 20) states, "A well developed smoothly functioning financial system facilitates the efficient life-cycle allocation of household consumption and the efficient allocation of physical capital to its most productive use in the business sector." For centuries, the economic functions of the financial system were essentially performed by banks alone. In the last 30 years financial markets have developed dramatically, and financial innovations have emerged at a spectacular rate. As a result, financial markets are now providing some of the services that financial intermediaries used to offer exclusively. Thus, for example, a firm involved in international trade can now hedge its exchange rate risk through a futures market instead of using a bank contract. Prior to the development of futures markets, the banking sector was an exclusive provider of such services.

In order to provide a better understanding of how financial intermediation improves the allocation of capital in the economy, it is necessary to examine in more detail what functions banks perform. Contemporary banking theory classifies banking functions into four main categories:

- Offering liquidity and payment services
- Transforming assets
- Managing risks
- Processing information and monitoring borrowers

This, of course, does not mean that every bank has to perform each of these functions. Universal banks do, but specialized banks need not. In view of this classification, our initial definition of banks (as the institutions whose current operations consist in making loans and receiving deposits) may seem too simple. Therefore, to illustrate the proposed classification, the following sections examine how banks perform each of these functions.

1.2 Liquidity and Payment Services

In a world without transaction costs, like in the standard Arrow-Debreu model, there would be no need for money. However, as soon as one takes into account the existence of frictions in trading operations, it becomes more efficient to exchange goods and services for money, rather than for other goods and services, as in barter operations.[3] The form taken by money quickly evolved from commodity money (a system in which the medium of exchange is itself a useful commodity) to fiat money (a system in which the medium of exchange is intrinsically useless, but its value is guaranteed by some institution, and therefore it is accepted as a means of payment).[4] Historically, banks played two different parts in the management of fiat

money: money change (exchange between different currencies issued by distinct institutions) and provision of payment services. These payment services cover both the management of clients' accounts and the finality of payments, that is, the guarantee by the bank that the debt of the payor (who has received the goods or services involved in the transaction) has been settled to the payee through a transfer of money.

1.2.1 Money Changing

Historically, the first activity of banks was money changing. This is illustrated by the etymology of the word: the Greek word for bank (*trapeza*) designates the balance that early money changers used to weigh coins in order to determine the exact quantity of precious metal the coins contained.[5] The Italian word for bank (*banco*) relates to the bench on which the money changers placed their precious coins.[6] These money-changing activities played a crucial role in the development of trade in Europe in the late Middle Ages.

The second historical activity of banks, namely, management of deposits, was a consequence of their money-changing activities. This is well documented, for example, in Kohn (1999). Early deposit banks were fairly primitive because of the necessity for both the payee (the deposit bank) and the payor to meet with a notary.[7] Most of the time, these deposits had a zero or even negative return because they were kept in vaults rather than invested in productive activities. If depositors considered it advantageous to exchange coins for a less liquid form of money, it was mainly because of the advantages of safekeeping, which reduced the risk of loss or robbery. Thus initially bank deposits were not supposed to be lent, and presumably the confidence of depositors depended on this information being public and credible. This means that deposit banks tried to build a reputation for being riskless.[8]

Apart from safekeeping services, the quality of coins was also an issue because coins differed in their composition of precious metals and the governments required the banks to make payments in good money. This issue had implications for the return paid on deposits. As Kindleberger (1993, 48) puts it, "The convenience of a deposit at a bank—safety of the money and the assurance that one will receive money of satisfactory quality—meant that bank money went to a premium over currency, which varied from zero or even small negative amounts when the safety of the bank was in question, to 9 to 10 percent." Still, once the coins themselves became of homogeneous quality, deposits lost this attractive feature of being convertible into "good money." However, because deposits were uninsured, the increased efficiency obtained by having a uniform value for coins (implying a decrease in transaction costs), with coins and bills exchanging at their nominal value, did not necessarily apply to deposits. This point was later considered of critical importance during the free banking episodes discussed in chapter 9.

1.2.2 Payment Services

Species proved to be inadequate for making large payments, especially at a distance, because of the costs and risks involved in their transportation. Large cash imbalances between merchants were frequent during commercial fairs, and banks played an important part in clearing merchants' positions. Clearing activities became especially important in the United States and Europe at the end of the nineteenth century, leading to modern payment systems, which are networks that facilitate the transfer of funds between the bank accounts of economic agents. The safety and efficiency of these payment systems have become a fundamental concern for governments and central banks, especially since the deregulation and internationalization of financial markets, which have entailed a large increase in interbank payments, both nationally and internationally.[9]

1.3 Transforming Assets

Asset transformation can be seen from three viewpoints: convenience of denomination, quality transformation, and maturity transformation. *Convenience of denomination* refers to the fact that the bank chooses the unit size (denomination) of its products (deposits and loans) in a way that is convenient for its clients. It is traditionally seen as one of the main justifications of financial intermediation. A typical example is that of small depositors facing large investors willing to borrow indivisible amounts. More generally, as Gurley and Shaw (1960) argued, in an early contribution, financial intermediaries provide the missing link between the financial products that firms want to issue and the ones desired by investors. Banks then simply play the role of intermediaries by collecting the small deposits and investing the proceeds into large loans.

Quality transformation occurs when bank deposits offer better risk-return characteristics than direct investments. This may occur when there are indivisibilities in the investment, in which case a small investor cannot diversify its portfolio. It may also occur in an asymmetric information situation, when banks have better information than depositors.

Finally, modern banks can be seen as transforming securities with short maturities, offered to depositors, into securities with long maturities, which borrowers desire. This *maturity transformation* function necessarily implies a risk, since the banks' assets will be illiquid, given the depositors' claims. Nevertheless, interbank lending and derivative financial instruments available to banks (swaps, futures) offer possibilities to limit this risk but are costly to manage for the banks' clients.

To clarify the distinction between the different functions performed by banks, it may be worth emphasizing that the three types of asset transformation that we are

considering occur even in the absence of credit risk on the loans granted by the bank. A pawnbroker, a bank investing only in repos,[10] and a bank making only fully secured loans perform the three transformation functions we have mentioned: convenience of denomination, quality transformation, and maturity transformation.

1.4 Managing Risks

Usually, bank management textbooks define three sources of risk affecting banks: credit risk, interest rate risk, and liquidity risk.[11] These risks correspond to different lines in the banks' balance sheets. It is worth mentioning also the risks of off-balance-sheet operations, which have been soaring in the last two decades.[12] The following sections briefly sketch a historical account of the management of these different risks by banks. Chapter 8 offers a formal analysis of risk management in banks.

1.4.1 Credit Risk

When the first bank loans spread in Florence, Siena, and Lucca, and later in Venice and Genoa, lending was limited to financing the harvest that could be seen in the fields and appraised. Thus, credit risk was small. However, financing wars soon became an important part of banking activities.[13] Still, bankers tried to make their loans secure, either through collateral (jewels), through the assignment of rights (excise tax), or generally through the endorsement by a city (which could be sued in case of default, whereas kings could not be).

The riskiness of these loans seems to have increased through time. Initially banks used to arrange fully collateralized loans, an activity not intrinsically different from that of a pawnbroker. The change in the riskiness of bank loans can be traced back to the start of investment banking. Investment banking was performed by a different type of institution and was a different concept from traditional credit activity.[14] It introduced a different philosophy of banking because it involved advancing money to industry rather than being a simple lender and getting good guarantees. This implied making more risky investments and, in particular, buying stocks. This appraisal of risk on a loan is one of the main functions of modern bankers.

1.4.2 Interest Rate and Liquidity Risks

The asset transformation function of banks also has implications for their management of risks. Indeed, when transforming maturities or when issuing liquid deposits guaranteed by illiquid loans, a bank takes a risk. This is because the cost of funds—which depends on the level of short-term interest rates—may rise above the interest income, determined by the contractual interest rates of the loans granted by the bank. Even when no interest is paid on deposits, the bank may face unexpected withdrawals,

which will force it to seek more expensive sources of funds. As a consequence, the bank will have to manage the combination of interest rate risk (due to the difference in maturity) and liquidity risk (due to the difference in the marketability of the claims issued and that of the claims held). The management of interest rate risk has become crucial for banks since the increase in the volatility of interest rates after the end of the Bretton-Woods fixed exchange system.

1.4.3 Off-Balance-Sheet Operations

In the 1980s competition from financial markets made it necessary for banks to shift to more value-added products, which were better adapted to the needs of customers. To do so, banks started offering sophisticated contracts, such as loan commitments, credit lines, and guarantees.[15] They also developed their offer of swaps, hedging contracts, and securities underwriting. From an accounting viewpoint, none of these operations corresponds to a genuine liability (or asset) for the bank but only to a conditional commitment. This is why they are classified as off-balance-sheet operations.

Different factors have fostered the growth of off-balance-sheet operations. Some are related to banks' desire to increase their fee income and to decrease their leverage; others are aimed at escaping regulation and taxes. Still, the very development of these services shows that nonfinancial firms now have a demand for more sophisticated, custom-made financial products.

Since banks have developed a know-how in managing risks, it is only natural that they buy and sell risky assets, whether or not they hold these assets on their balance sheets. Depending on the risk-return characteristics of these assets, banks may want to hedge their risk (that is, behave like someone who buys insurance) or, on the contrary, they may be willing to retain this risk (and take the position of someone who sells insurance). Given the fact that a bank's failure may have important externalities (see chapters 7 and 9), banking regulators must carefully monitor off-balance-sheet operations.

1.5 Monitoring and Information Processing

Banks have a specific part to play in managing some of the problems resulting from imperfect information on borrowers. Banks thus invest in the technologies that allow them to screen loan applicants and to monitor their projects.[16] According to Mayer (1988), this monitoring activity implies that firms and financial intermediaries develop long-term relationships, thus mitigating the effects of moral hazard.

This is clearly one of the main differences between bank lending and issuing securities in the financial markets. It implies that whereas bond prices reflect market information, the value of a bank loan results from this long-term relationship and is a

priori unknown, both to the market and to the regulator.[17] In this sense we may say that bank loans are "opaque" (Merton 1993).

1.6 The Role of Banks in the Resource Allocation Process

Banks exert a fundamental influence on capital allocation, risk sharing, and economic growth (see Hellwig 1991). Gerschenkron (1962), in an early contribution, holds this influence to have been of capital importance for the development of some countries. Gerschenkron's position regarding the role of banks in economic growth and development has led to a continuing debate (Edwards and Ogilvie 1996). The historical importance of the impact of financial institutions on economic performance is still far from being well established. From a theoretical standpoint, the idea of "scarcity of funds" (which is difficult to capture in a general equilibrium model) could be useful in the study of economic development: underdeveloped economies with a low level of financial intermediation and small, illiquid financial markets may be unable to channel savings efficiently. Indeed, "large projects" that are essential to development, such as infrastructure financing, can be seen as unprofitable because of the high risk premia that are associated with them. This role of financial markets in economic development has now begun to be studied from a theoretical point of view, following in particular the contribution of Greenwood and Jovanovic (1990).[18]

Simultaneously, the fact that more bank-oriented countries such as Japan and Germany have experienced higher rates of growth in the 1980s has motivated additional research on the economic role of banks (Mayer 1988; Allen and Gale 1997). For instance, Allen and Gale (1995) closely examine the differences between the financial systems in Germany and in the United States.[19] They suggest that market-oriented economies are not very good in dealing with nondiversifiable risks: in the United States and Britain, for example, households hold around half of their assets in equities, whereas in bank-oriented economies such as Japan or Germany, households hold essentially safe assets. Banks' reserves work as a buffer against macroeconomic shocks and allow for better intertemporal risk sharing. The flip side of the coin is that bank-oriented economies are not very good at financing new technologies. Allen and Gale (2000) show that markets are much better for dealing with differences of opinion among investors about these new technologies.

1.7 Banking in the Arrow-Debreu Model

In order to explain the earlier statement that a microeconomic theory of banks could not exist before the foundations of the economics of information were laid (in the

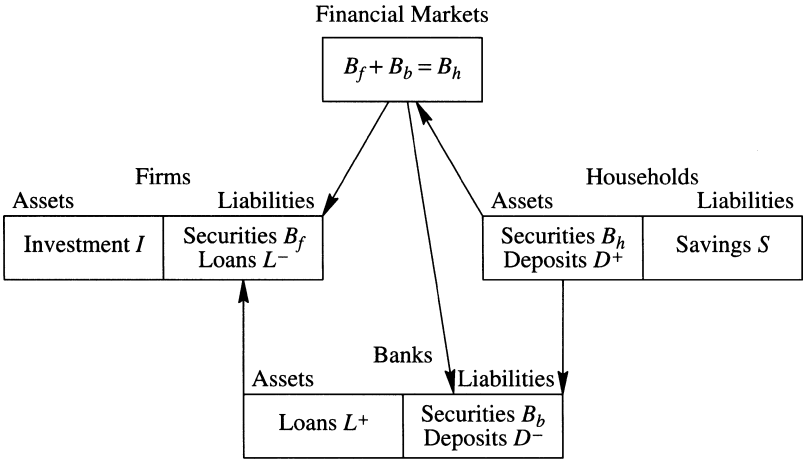

Figure 1.1
Financial decisions of economic agents.

early 1970s), this section presents a simple general equilibrium model à la Arrow-Debreu, extended to include a banking sector. To put things as simply as possible, the model uses a deterministic framework, although uncertainty could be introduced without any substantial change in the results, under the assumption of complete financial markets (Arrow 1953).

The financial decisions of economic agents in this simple model are represented in figure 1.1. Each type of agent is denoted by a particular subscript: f for firms, h for households, and b for banks. For simplicity, the public sector (government and Central Bank) is omitted. A more complete diagram is presented in chapter 3 (fig. 3.1).

For simplicity, consider a two-dates model ($t = 1, 2$) with a unique physical good, initially owned by the consumers and taken as a numeraire. Some of it will be consumed at date 1, the rest being invested by the firms to produce consumption at date 2. All agents behave competitively. To simplify notations, the model assumes a representative firm, a representative consumer, and a representative bank.

1.7.1 The Consumer

The consumer chooses her consumption profile (C_1, C_2), and the allocation of her savings S between bank deposits D_h and securities (bonds) B_h, in a way that maximizes her utility function u under her budget constraints:

$$\mathscr{P}_h \begin{cases} \max u(C_1, C_2) \\ C_1 + B_h + D_h = \omega_1, & (1.1) \\ pC_2 = \Pi_f + \Pi_b + (1 + r)B_h + (1 + r_D)D_h, & (1.2) \end{cases}$$

where ω_1 denotes her initial endowment of the consumption good, p denotes the price of C_2, Π_f and Π_b represent respectively the profits of the firm and of the bank (distributed to the consumer-stockholder at $t = 2$), and r and r_D are the interest rates paid by bonds and deposits. Because, in this simplistic world, securities and bank deposits are perfect substitutes, it is clear that the consumer's program $(\mathscr{P}_h)$ has an interior solution only when these interest rates are equal:

$$r = r_D. \tag{1.3}$$

1.7.2 The Firm

The firm chooses its investment level I and its financing (through bank loans L_f and issuance of securities B_f) in a way that maximizes its profit:

$$\mathscr{P}_f \begin{cases} \max \Pi_f \\ \Pi_f = pf(I) - (1+r)B_f - (1+r_L)L_f, & (1.4) \\ I = B_f + L_f, & (1.5) \end{cases}$$

where f denotes the production function of the representative firm and r_L is the interest rate on bank loans. Again, because bank loans and bonds are here perfect substitutes, $\mathscr{P}_f$ has an interior solution only when

$$r = r_L. \tag{1.6}$$

1.7.3 The Bank

The bank chooses its supply of loans L_b, its demand for deposits D_b, and its issuance of bonds B_b in a way that maximizes its profit:

$$\mathscr{P}_b \begin{cases} \max \Pi_b \\ \Pi_b = r_L L_b - rB_b - r_D D_b, & (1.7) \\ L_b = B_b + D_b. & (1.8) \end{cases}$$

1.7.4 General Equilibrium

General equilibrium is characterized by a vector of interest rates (r, r_L, r_D) and three vectors of demand and supply levels—(C_1, C_2, B_h, D_h) for the consumer, (I, B_f, L_f) for the firm, and (L_b, B_b, D_b) for the bank—such that

- each agent behaves optimally (his or her decisions solve $\mathscr{P}_h$, $\mathscr{P}_f$, or $\mathscr{P}_b$ respectively);
- each market clears

$I = S$ (good market)
$D_b = D_h$ (deposit market)
$L_f = L_b$ (credit market)
$B_h = B_f + B_b$ (bond market).

From relations (1.3) and (1.6) it is clear that the only possible equilibrium is such that all interest rates are equal:

$$r = r_L = r_D. \tag{1.9}$$

In that case, it is obvious from $\mathscr{P}_b$ that banks necessarily make a zero profit at equilibrium. Moreover, their decisions have no effect on other agents because households are completely indifferent between deposits and securities, and similarly firms are completely indifferent as to bank credit versus securities. This is the banking analogue of the Modigliani-Miller theorem (see, e.g., Hagen 1976) for the financial policy of firms.

Result 1.1 If firms and households have unrestricted access to perfect financial markets, then in a competitive equilibrium:

- banks make a zero profit;
- the size and composition of banks' balance sheets have no effect on other economic agents.

This rather disappointing result extends easily to the case of uncertainty, provided financial markets are complete. Indeed, for each future state of the world s ($s \in \Omega$), one can determine the price p_s of the contingent claim that pays one unit of account in state s and nothing otherwise. Now suppose a bank issues (or buys) a security j (interpreted as a deposit or a loan) characterized by the array x_s^j ($s \in \Omega$) of its payoffs in all future states of the world. By the absence of arbitrage opportunities, the price of security j has to be

$$Z^j = \sum_{s \in \Omega} p_s x_s^j.$$

An immediate consequence is that all banks still make a zero profit, independent of the volume and characteristics of the securities they buy and sell. This explains why the general equilibrium model with complete financial markets *cannot* be used for studying the banking sector.

1.8 Outline of the Book

As we have just seen, the Arrow-Debreu paradigm leads to a world in which banks are redundant institutions. It does not account for the complexities of the banking industry. There are two complementary ways out of this disappointing result:

- The incomplete markets paradigm, which explains why financial markets *cannot* be complete and shows why banks (and more generally financial intermediaries) exist. This is the topic of chapter 2.
- The industrial organization approach to banking, which considers that banks essentially offer *services* to their customers (depositors and borrowers), and that financial transactions are only the visible counterpart to these services. As a consequence, the cost of providing these services has to be introduced, as well as some degree of product differentiation. This approach is studied in chapter 3.

In chapter 4 we explore in more detail the contractual relationship between a lender and a borrower. We examine the different considerations that influence the design of loan contracts: risk sharing, repayment enforcement, moral hazard, and adverse selection. In chapter 5 we study the credit market and explore the possible causes of equilibrium credit rationing. In chapter 6 we examine the macroeconomic consequences of financial imperfections. In chapter 7 we study the causes for the instability of the banking system. In chapter 8 we provide a formal analysis of the methods employed by bankers for managing the different risks associated with banking activities. Finally, we examine in chapter 9 the justifications and instruments of banking regulations.

Notes

1. Even if it is recurrent, this lending activity, called trade credit, is only complementary to the core activity of these firms. For theoretical analyses of trade credit, see Biais and Gollier (1997) and Kiyotaki and Moore (1997).

2. Consider, for example, the title of the article by Gorton and Pennacchi (1993): "Money Market Funds and Finance Companies: Are They the Banks of the Future?"

3. The main reason is the famous argument of "double coincidence of wants" between traders.

4. For a theoretical analysis of commodity money, see Kiyotaki and Wright (1989; 1991).

5. Actually, a recent book by Cohen (1992) shows that in ancient Greece banks were already performing complex operations, such as transformation of deposits into loans. We thank Elu Von Thadden for indicating this reference to us.

6. When a bank failed, the bench was broken. This is the origin of the Italian word for *bankruptcy*, *bancarotta*, which means "the bench is broken."

7. It is customary to locate the origins of banking in England in the deposit activities of goldsmiths in the seventeenth century. Their capacity to deal with goldware and silverware made them into bankers. Still, as Kindleberger (1993) puts it, "The scriveners seem to have preceded the goldsmith as ones who accepted deposits. Needed to write out letters and contracts in a time of illiteracy, the scrivener became a skilled adviser, middleman, broker, and then lender who accepted deposits" (51).

8. Nevertheless, the need for the cities or the government to obtain cash could be such that the deposit bank could be forced to give credit to the city or to the king, as happened for the Taula de Canvi in Valencia and the Bank of Amsterdam. Also, Charles I of England confiscated the gold and silver that had been deposited in the Tower of London in 1640, and returned it only after obtaining a loan.

9. For an economic analysis of the risks involved in large payment interbank systems, see, for example, Rochet and Tirole (1996).

10. A repurchase agreement (repo) is a financial contract very similar to a fully collateralized short-term loan, the principal of which is fully guaranteed by a portfolio of securities (100 percent collateralization). For legal reasons, it is contractually implemented as if the borrower had sold balance sheet securities to the lender with a promise to buy them back later under specified conditions.

11. Two other sources of risk are not considered in this book: exchange rate risk, which affects banks involved in foreign exchange transactions, and operational risk, which concerns all financial institutions.

12. Note that these risks can also be decomposed into credit risk, interest rate risk, and liquidity risk.

13. This type of activity resulted in bankruptcy for several Italian bankers, such as the Bardi, the Peruzzi, and the Ricciardi (see, e.g., Kindleberger 1993).

14. In continental Europe the practice developed in the nineteenth century, with the Société Générale de Belgique or the Caisse Générale du Commerce et de l'Industrie (founded by Laffite in France).

15. We do not go into the details of these operations. The reader is referred to Greenbaum and Thakor (1995) for definitions and an analysis.

16. Screening and monitoring of projects can be traced back to the origins of banking, when bill traders identified the signatures of merchants and gave credit knowing the bills' quality, or even bought the bills directly (as in today's factoring activities).

17. Recent empirical studies (e.g., James 1987) have shown the importance of this specific role of banks.

18. More recently, Armendariz (1999) analyzes the role of government-supported financial institutions ("development banks") in less developed countries.

19. For another theoretical analysis of different banking systems, see Hauswald (1995).

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