DEPARTMENT OF ECONOMICS

UNIVERSITY OF MILAN - BICOCCA

WORKING PAPER SERIES

Imperfect Information and Monopolistic Pricing in the Banking Industry

Enzo Dia

No. 74 - May 2004

Imperfect Information and Monopolistic Pricing in the Banking Industry[*]

Enzo Dia[†]

May 2004

Abstract

We critically discuss recent developments in the theory of banking, focusing on the two set of services that banks jointly provide: payment services by means of bookkeeping transactions and financial intermediation services. The limitation of the available information, of the capabilities of the human mind, and of the available time of any individual, produce relevant departures from the basic assumptions of perfectly competitive markets, creating the need for institutions such as banks. It can be shown that market forces can be very effective in assuring contractual performance in the banking industry, reducing the need of generalised legal restrictions. Besides, taking into account the peculiarities of contemporary banking institutions, credit rationing seems to be a far less significant phenomenon. The main conclusion of the analysis is that the focus of many current regulations of the banking system, in continental Europe in particular, is misplaced. The current regulatory framework produces too many distortions in market prices and the allocation of resources, and regulations impose a heavy burden on taxpayers. On the contrary, the more fundamental causes of instability are not properly addressed by the current legal requirements.

Introduction

Banks provide jointly two fundamental sets of services. They provide payment services by means of bookkeeping transactions and they provide financial intermediation services. Most of the studies on the banking industry have focused on the second set of services, while the relevance of the first has often been neglected,[1] notwithstanding the fact that the provision of payment services was crucial in the historical development of banking institutions. In this paper we will critically discuss recent developments in the theory of banking, mainly due to the analysis of the importance of limited information and uncertainty and of the transaction costs and market imperfections that limited information and uncertainty cause. We focus on the two set of services that banks provide, showing how the limitation of the available information, of the capabilities of the human mind, and of the available time of any individual, produce relevant departures from the basic assumptions of perfectly competitive markets, creating the need for institutions such as banks. The fundamental role that synergies and economies of scope between the two sect of services play, helps to understand the historical development of credit markets.

The limited, asymmetric and costly availability of information is considered a market imperfection that makes extensive regulations a necessity and justifies the intervention of central banks or other authorities in the market. Due to the the asymmetry of information, equilibria where credit is rationed are often considered a general outcome of market interactions in the industry. When this phenomenon is considered to be quite general, a complete redefinition of the role and power of monetary policy is regarded as necessary. But most of the recent literature on the microeconomics of the banking industry has shown that many specific features of banking intermediation allow banks to overcome some of the problems posed by the limited availability of information. Even more importantly, it can be shown that market forces can be very effective in assuring contractual performance in the banking industry, reducing the need of generalised legal restrictions. Implicit contracts that shape many of the institutional features we observe can be very effective market solutions. Banks themselves have a specific role to play just because of the imperfect diffusion of information. In a world with costless availability of information banks would not exits. As a consequence the role of many of the specific aspect of the banking intermediation, such as the fragile structure of banking liabilities, can be understood only considering these problems. Taking into account the peculiarities of contemporary banking institutions, credit rationing seems to be a far less significant phenomenon.

The main conclusion of the analysis is that the focus of many current regulations of the banking system, in continental Europe in particular, is misplaced. The current regulatory framework produces too many distortions in market prices and the allocation of resources, and regulations impose a heavy burden on taxpayers. On the contrary, the more fundamental causes of instability, which require the design of a proper regulatory framework, are not properly addressed by the legal requirements.

---

[1]The most relevant exception is Eugene A. Fama, who worked his theory of banks on the basis of this fundamental bipartition.

Transaction services and financial intermediation

Banks provide jointly two different sets of services. They provide transaction services allowing their customers to transfer goods by means of simple bookkeeping entries. And they act as intermediaries between risk-averse agents that need to allocate their savings and risk neutral firms that invest on their behalf.[2]These two sets of services involve different skills and technology, and can be provided separately by different types of institutions. Central banks provide payment services to other agents without providing services of financial intermediation. Most mutual funds provide just financial intermediation, while pension funds and life insurers provide jointly financial intermediation services with insurance services. In the case of banks though, the two services are normally provided jointly, because banks can exploit relevant economies of scope. The joint provision of these two types of services has been so successful that banks that provided both services have emerged in the most different countries.[3] Even many contemporary central banks initially were universal banks that used to provide both services.[4] As a consequence, in order too understand the problems and the historical development of the banking industry it is necessary to analyse separately the two functions. At the same time it is important to understand the origin of the economies of scope between the two services, since historical trends of the industry show that these economies are certainly overwhelming and are a fundamental aspect of the banking industry as it stands.[5]

These two sets of services imply different industrial costs and provide different revenues, and in abstract the two services provided can easily be separated, defining two different problems. In empirical analysis though it is much harder, because revenues of one service are often confused with revenues or costs of the other and vice-versa. Banks in fact do not always charge their customers with the entire cost of their transactions by means of fees. They often prefer to implicitly charge part those costs as a reduction of the rate paid on deposits or an increase in the rate charged on loans. On the contrary, when the payment of interest rates on deposits was forbidden, banks used to pay interests implicitly, reducing the fees charged.[6]

The crucial importance of a separate study of the two functions has been recognised by Fama. He showed that in the provision of payment services the banking industry is not substantially different from any other industry, and it has to be analysed by means of standard general equilibrium analysis.[7] This implies that an

---

[2]See Fama [23].

[3]See for example Born [9].

[4]See Goodhart [29].

[5]A recent example is provided by the development of Money Market Mutual Funds. Traditional intermediaries such as mutual funds that did not provide monetary services began to provide them in competition with banks. These funds have actually become banks, even if of a peculiar kind, because they do not provide direct lending facilities that are illiquid.

[6]See Klein [42] and Barro and Santomero [3].

[7]In a second paper he showed that monetary problems of price level determination could be disentangled from the analysis of the banking industry. If banks were not required to hold reserves in currency, both functions that banks fulfil would not interfere with price level determination, that would just depend on the amount of currency issued. In this regard commercial banks would become similar to Money Market Mutual Funds. Even if they can provide monetary services and create liquidity, no one would think that they influence the price level determination.

industrial cost function with standard properties can be defined for the provision of these services. Unfortunately not much attention has been devoted in the literature to this aspect of the industry, notwithstanding the fact that most banks earn a relevant share of their profits from fees. Even more important, historically the first banks emerged to provide transaction services without the need of the physical transfer of gold or other precious metals. The transfer was in fact both expensive and dangerous. So the first banks were market solutions to problems caused by transaction costs and uncertainty. Storing gold in safe vaults and making payments by means of letters of credit or bank notes was an efficient way to reduce the cost and risk of the transactions. Letters of credit were based on personal knowledge and the reputation of the intermediary, bank notes just on the reputation of the issuer, since the holders of the notes could in no way monitor the reserves. This intermediation was possible because bankers could acquire information and develop a reputation at a lower cost than any other agent. As a consequence, a general equilibrium formalisation of this industrial problem must assume as a starting point the absence of perfect information.

The financial intermediation services have been deeply studied, since most of the literature has focused on this aspect of the banking industry. In a world with costless information banks would exist only because other agents face participation costs in the financial markets. They could make a better use of their time than studying the innumerable securities that could allow them a perfect smoothing of consumption.[8] Intermediaries would be useful in order to tailor portfolios of securities on the different needs of different agents, portfolios that could largely be packed in a standardised fashion, with obvious cost savings.[9] In this environment banks would not face any decreasing returns in the management of their asset portfolio. Loans would be perfect substitutes for bonds, and banks could securitize loans in any moment, just incurring in some transaction costs. The composition of the portfolio would just depend on the different transaction and industrial costs, and in equilibrium the difference in the return of the two assets would reflect those costs. Banks would in this regard not be different from mutual funds, the risk of their portfolio would depend on the market risk that a perfect diversification could always achieve, and any increase in the size of the portfolio would just imply a linear transaction or industrial cost. In this world the Modigliani-Miller theorem would apply to banking firms and the composition of their liabilities would have no relevance.[10] Financial intermediaries could obtain a degree of diversification that their liability-holders could not achieve and would invest as agents of both shareholders and depositors. If the costs of servicing deposits were not convex, as it seems reasonable to assume, banks would accept any amount of deposits, paying to depositors the return of the portfolio minus the transaction cost and the marginal proportional cost of deposits and to shareholders the return of the portfolio minus the transaction cost.[11] Under the assumption of perfect competition, deposits interest rates would be set endoge-

---

[8] We are assuming that it is costless to acquire information, but not to process it, because it requires time.

[9] See Allen and Santomero [2].

[10] See Fama [23].

[11] As in Santomero and Siegel [60] and [61].

nously in the market for deposits and they would vary in order to establish the zero profit condition in the banking market. Because of the constant returns to scale the supply of deposit services on part of banks would be perfectly elastic.[12] Abandoning the assumption of the costless availability of information, a peculiar role for banking intermediation emerges.

Relationship lending, a market solution for information costs

Since the acquisition of information is costly, and the future is uncertain, loans and bonds are two completely different assets. The crucial difference is that bonds are liquid, while loans are not. Bonds can be priced by the market on the basis of the publicly available information, in particular the information disclosed by means of the balance sheet of the issuer. Loans on the contrary are issued to firms whose business is informatively intense and the available information is scarce and opaque. When the disclosure of information is too expensive markets cannot properly price the risk and a lemon problem emerge, so that the market for debt cannot exist.[13]

Fama [22] showed that the a major function of the banking industry in the economic system is the analysis of information regarding the quality of the entrepreneurial projects that borrowers undertake. Fama's argument is based on the fact that certificates of deposits must pay a return competitive with the return on bonds, but are subject to reserve requirement, that under the institutional arrangements of the US represent a tax. Banks can finance their loans issuing CDs only if the cost of the tax is actually born by borrowers. The issuance of a loan must imply the furniture of a service that for some reason is worth more than the interest rate paid on a bond of comparable maturity, because firms actually pay a higher interest rate on loans than on bonds. Some firms, small firms in particular, do not have access to financial markets, so that bonds are not an alternative source of finance for them and in this case the rate on bonds does not impose a ceiling on banks. But even large firms that have a wide access to financial markets are indebted by means of both commercial paper and loans. "There must be something special about bank loans that make some borrowers willing to pay higher interest rates than those of the other securities of equivalent risk. Moreover, there must be something special about banks that prevents other intermediaries, like insurance companies and finance companies, whose liabilities are not subject to reserve requirements, from competing with banks to assure that it never pays to finance loans with CDs."[14] Bank loans can not be perfect substitutes for bonds.

Issuing loans banks undertake part of the risk of the investment, and their own entrepreneurial function is the analysis and selection of risks. Loans are different from bonds because banks get access to information regarding the entrepreneurial projects of the borrower that is not available to the market. Bearing the costs that the establishment of a personal direct relationship with the investor implies, banks can extend short-term credit and monitor continuously the borrowers. They can finance projects that would be unprofitable for other investors. Relationship

---

[12]This assumption is central in the works of Santomero and Siegel [60] and [61].

[13]See Ackerlof [1].

[14]Fama [22], p. 30.

lending allows banks to co-finance with debt projects that would otherwise be entirely financed with equity. The competitive advantage over any other investor is due to the long term character of the relationship that banks entertain with their customers that provides them with information regarding the quality of the investments and the reliability of the borrowers. By means of a consolidated personal relationship, they can obtain particular knowledge regarding almost every aspect of the entrepreneurial activity of the borrowers. This "inside lending" gives banks a comparative advantage with respect to any other form of "outside" debt. As "inside" lenders they can evaluate the investment projects, and even more importantly, the borrower. The success of most entrepreneurial projects is in fact based on some peculiar knowledge of market conditions. Peculiar information regarding the conditions of a particular market, in a particular place, in a particular moment.[15] The knowledge of these particular circumstances of place and time, together with the command of skills which are often based on *tacit knowledge*,[16] forms most of the intangible capital of the borrower, be him and individual or a firm. The true problem of the banker is to evaluate the intangible capital, that cannot be collateralised and often is the main asset of the borrower.[17] Whenever the intangible capital is large with respect to the tangible assets of the borrower, relationship lending is the only available source of finance beside equity. Large firms, or even better diversified corporations, whose business is well established and whose risks are well known, under normal conditions do not need the relationship to the extent that small firms do.[18] These firms can provide large collateral, whose value is easy to ascertain and can get finance trough financial markets as well as credit facilities from different banks. The empirical study of the relevance of relationship lending has accordingly been based mainly on small firms' bank credit. Berger and Udell [4], Petersen and Rajan [53], and Cole [12], among others, have provided a strong evidence supporting the theory.[19] The specific skills that the relationship lender acquires in the evaluation

---

[15]See Hayek [34].

[16]Information and skills that are embedded in the particular traditions, rules of conduct and capacity of single individuals, and are not transferable because they are strictly subjective.

[17]"Not all the knowledge of the ever changing particular facts that man continually uses lends itself to organization or systematic exposition; much of it exists only dispersed among countless individuals. The same applies to that important part of expert knowledge which is not substantive knowledge but merely knowledge of where and how to find the needed information." Hayek [35] p. 25.

[18]This is not true when they are distressed.

[19]Petersen and Rajan [53] showed that the availability of financing increases for firms that have close ties with an institutional creditor. According to their results, "relationships are valuable and appear to operate more trough quantities rather then prices". (Petersen and Rajan [53], p. 3). Their work is based on the analysis of a data set of small firms in the USA. Berger and Udell [5] showed that "borrowers with longer relationships pay lower interest rates and are less likely to pledge more collateral". (Berger and Udell [5], p. 351). They use data for small business, and the main difference with respect with the former work is their focus on loans issued under lines of credit, a restricted set of loans, the one most likely to be affected by the nature of the relationship. The study by Cole [12] has analysed "the importance of relationship to the availability of credit", confirming its importance for credit relations. The hypothesis of the work is that a bank cannot easily and quickly increase the number of its borrowers because it has to evaluate their solvency. If it wishes to rapidly expand its activities it has to rely on already existent relationships, and this represents a severe constraint on the possibility of expanding the number of loans granted. This

of intangible capital and the analysis of "inside" information cannot be obtained by other intermediaries such as insurance companies and prevents them from competing in the issuance of loans. Fama's argument though has another implication. It must be explained why borrowers that could get access to cheaper finance in the bond market are willing to pay banks a premium in order to obtain loans.

Small firms are normally considered to need banks because they could not get financed otherwise, but this statement is not correct. Small firms need banks to manage their payments, while they have two relevant alternative sources of funds, represented by self financing trough the liquidity generated and the issuance of equity. Self financing has always been a very important source of finance, and even in a country where banks have played a key role, such as Germany, it has recently been shown that self-financing was the main source of finance during the nineteenth century. The issuance of equity is normally financed by the individual owners with their own patrimony, and it becomes very important when the firm is hit by a liquidity shock. The development of venture capital and private equity investments has increased the relevance of equity finance even for small firms that have a limited access to financial markets. The only source of finance that is normally precluded to small firms is the bond market. The reason is that the cost of the disclosure of the relevant information, necessary for the market to price the risk, is normally overwhelming the benefits of the issuance of bonds. The disclosure of the relevant information in fact normally requires the presence of an intermediary whose reputation guarantees the reliability of the information itself.[20] Firms willing to access the bond market need to get financed from banks for a relevant period of time, because the issuance of loans is an important signal for the market. When the intermediary places the bond, it must be willing to keep a relevant stake of the placement, providing another important signal to the market. Both Fama and Diamond suggested that large firms need to rely on bank loans in order to be able to place their bonds. For this reason, even if they do not need to pay the higher interest rates charged on loans, because they have access to cheaper sources of finance in the bond market, large firms borrow from banks to signal their credibility to the market. This explanation though is not entirely convincing for those firms which already have a good established reputation, a good credit rating and whose capital is largely composed of tangible assets. These firms must have another reason to borrow from banks. The most reasonable explanation is that the relationship is worth the cost because it provides a safety net in case large adverse shocks make it difficult the access to financial markets. Shocks of different origin may in fact jeopardize the information available to the market. In this case the market cannot properly price the risk, a lemon problem emerges and the market dries up. There are different examples of the kind of shocks that cause these problems. A typical case is a negative demand shock, such as the one that affected suppliers of telecommunications companies in the late 2001. Another example were the scandals that have put in question the reliability of the accounting figures provided by many different firms. Other shocks may affect the market as a whole, as it happened after the collapse of the LTCM, following which no bond could be placed for more than a month. In any

---

leads the bank to have different kind of contractual agreements with different classes of customers.

[20]As shown by Diamond [18].

of these case often companies may find themselves in the impossibility of getting finance, in the moment they need it most, because their liquidity is strained. Bank loans provide insurance against shocks, allowing the firm to get immediately the necessary liquidity. For this reason even when they do not borrow relevant sums from banks, large firms are always willing to pay fees to obtain lines of credit that they often do not use. The fees and the higher rate that they eventually pay is the insurance premium.

The fundamental problem that affects the borrower-lender relationship is that the asymmetry in the knowledge of the factors that affects the possible outcomes of the investment project causes typically both moral-hazard and adverse-selection problems. Different assumptions regarding the particular form of asymmetric information have been proposed, to study different aspects of the banking firm. Asymmetries of information cannot be used to explain all aspects of the intermediation of banking institutions without incurring the risk of choosing *ad hoc* assumptions to justify *ex post* the institutions we observe. But the relevance of the asymmetries highlights a fundamental institutional problem: any contractual agreements that rational agents establish must be incentive-compatible. Since lenders by definition know less about the investment projects undertaken by the borrowers than the borrowers themselves, their contractual agreements must be rational given that each part knows the incentives of the other. The fundamental contribution of Gale and Hellwig [28] was to show that the standard debt contract is incentive compatible. They showed that with costly state verification an efficient mechanism that guarantees the correct disclosure of the information is given by a contract which allows the creditor to obtain all the returns of the project when the borrower declares that he cannot fulfil his obligations. It can be shown that the optimal contractual agreement is a debt contract, where the rate charged is obtained given the market interest rate and the quantity of funds demanded imposing to the borrower the whole cost of verification. When the verification is too costly the debt contract remains optimal if the borrower must incur in case of default in a cost that it cannot transfer. If this bankruptcy cost is large enough the borrower has always the incentive to report the correct outcome to the lender, and so the contract is incentive-compatible. A typical example of the cost of bankruptcy is the value of the reputation: if the borrower values his reputation (which allows him to borrow in the future) more than the benefits from opportunistic default, he will always report the correct outcome. Asymmetric information produces another important outcome, it generates monopoly power. Sharpe [66] showed that "customer relationships arise between banks and firms because, in the process of lending, a bank learns more than others about it own customers. This information asymmetry allows lenders to capture some of the rents generated by their older customers".[21] Relationship lending allows the bank to price monopolistically and the higher return due to the market power makes the higher risks of the project worth. According to this theory firms are trapped in the relationship because it is too costly to convey the relevant information to other banks. Sharpe suggests as well that competition among banks to capture the rents could generate an inefficient allocation of capital, since competing banks would offer better terms to all customers, because they cannot select them, in order to get a

---

[21]Sharpe [66], abstract.

share of the rents. The inefficiency is due to the incapability of the bank to perfectly price discriminate. This problem though can be solved by means of implicit contracts, non binding commitments backed by reputation. Under the agreement of these implicit contracts, banks would not exploit their market power in order to keep the borrowers of good quality. The questionable assumption of the model is that competing banks would use price competition to attract new customers at the cost of mispricing the risk. Sharpe's argument in fact implicitly depends on the assumption that banks are risk neutral, so that they do not require a proportional return for the risk involved in financing the low quality projects. But as we will discuss further, even risk neutral banks would require a premium to finance investments with opaque information. The opacity of information produces radical uncertainty, that is not a risk that the market can price. Establishing the relationship and developing their knowledge, banks provide a valuable service, they create the knowledge necessary to price the risk. The price that firms pay for this service is the monopolistic rent that they pay on loans. Empirically, Cosimano and Mc Donald [15], analysing a large panel of bank loans, have shown that banks in the US exploit significant market power in the market for loans. This results strongly support our conclusions.

Delegation of monitoring activities and the banking firm

The lender we have been describing up to now does not necessarily reflect any of the peculiar features that banking institutions have acquired in most countries. We were alternatively used the terms bank and banker, because we were focusing on the entrepreneurial aspects of the lending activity. Considering a world in which information is not perfectly available and uncertainty and transaction costs play an important role, we must focus on institutions. It is necessary to explain the role of banking firms, showing what makes these institutions different from contracts available in the market.[22] When the relevant information is not available in a costless way a whole set of problems emerges that make institutions necessary. Whenever the bank is not just an individual firm, the main problem of banking firms is how to create an organisation that allows the desk officer with the necessary freedom to evaluate projects and borrowers, keeping under control the agency problems.[23] The root of the problem lies in the fact that since not all possible outcomes of a deal can be forecasted, two parties cannot stipulate contracts that cover all possible contingencies. Because of the incompleteness of contracts, other non-contractual mechanisms have to be developed.[24] The peculiar aspects that make banking firms different from other institutions can be understood trying to explain if and how interactions among rational agents can produce institutions similar to the ones we normally observe. This exercise is necessary to distinguish features that are constituent parts of the institution from features that are an un-necessary outcome of the particular regulation put in place.

In first order it necessary to ask why the analysis of the inside information that banks undertake cannot be dealt with by the final providers of finance, savers in

---

[22]As it was shown by Coase.
[23]See Berger and Udell [5].
[24]See Rajan [55].

general. The main reason is that the information is costly to acquire. In most cases the cost would be so heavy that it could not be sustainable by most individual agents willing to lend part of their endowments. It follows that a group of different lenders has a strong incentive to delegate the function of monitoring to a specific intermediary, in order to avoid duplication. But delegation raises the problem of the control of the intermediary on part of the lenders, depositors in particular. Since the intermediary normally is a firm with limited liability, the problem is to control the risk taking activity of the bank. Diamond [17] has shown, that diversification among different investment projects plays a crucial role. The larger scale of activity of a delegated intermediary allows a much wider diversification than any individual lender could achieve. In the case when there are no limits to the extension of the portfolio of the bank and returns from the projects undertaken by borrowers are independent, diversification can reduce the risk to zero, solving any problem regarding the control of the intermediary on part of risk adverse lenders. Niinimäki [52] has recently showed that the same crucial role can be played by intertemporal diversification, when the two main assumptions of Diamond's model are relaxed. The mismatch of maturities, that produces the intertemporal diversification, allows lenders to monitor the behaviour of the intermediary in a very efficient way.

Another characteristic feature of banking institutions is the peculiar structure of their liabilities. Diamond and Rajan have proved that the fragile financial structure of banks has got an economic rationale. Demand deposits, which are subject to bank runs, allow banks to overcome the problems due to the illiquidity of an assets portfolio composed mainly of loans.[25]The relationship lender has in fact got specific skills and knowledge that allow her to select and monitor investment projects. As a consequence, she can obtain a higher return from the resources she lends than any unskilled agent could do. When she acts as an intermediary agent of the holders of the liability, once the terms of the contract are stipulated and she has invested the sum received issuing loans, she always faces an incentive to threaten not use her skills unless the terms of the original agreement are renegotiated in her favour. Her creditors would in this case have no better option than accepting the new terms, and the relationship lender could reduce the payment down to the amount that the unskilled lender could obtain liquidating the loans. "Because the best user of the asset cannot commit to employing his specialized human capital on behalf of others, the asset is illiquid."[26] For this reason it would be very difficult for banks to finance their lending activities, because no one would be willing to lend to banks. In order to solve this problem banks can issue demand deposits, redeemable at demand. The threat to refuse his collection skills, would in this case cause a bank run, forcing the bank to liquidate immediately all the assets and loosing any rents. The threat of a bank run guarantees that banks (and their shareholders) pass trough to depositors the premium that the entrepreneur pays. "So the fragility of her capital structure enables the relationship lender to borrow against the full value of the illiquid loan she holds. This then enables her to lend up front without demanding an expected return premium for illiquidity, and without liquidating the entrepreneur when faced with a

---

[25]See Diamond and Rajan [19]
[26]Diamond and Rajan [20], p. 423.

liquidity shock. Financial fragility allows liquidity creation."[27] In other words "the fragility of capital structure enables the relationship lender to issue demand deposits worth the full value of the illiquid loan portfolio she holds. This than enables her to lend upfront as if the loan itself were liquid".[28]

The intermediation of the banker is necessary because the entrepreneur, whose assets are illiquid too, could not issue deposits himself. The important difference between the entrepreneur and the banker is that the first creates value, while the second's capability is just to recover more of the value created by the entrepreneur if he defaults. The bank run is an effective threat for the banker, because losing the ownership of the loan her rents are reduced to zero, so she is has everything to loose form the run. On the contrary the entrepreneur, using his own skills produces value. This implies that a mechanism such as a bank run would not be effective in reducing his incentive to renegotiate. Subtracting the ownership of the investment project in order to liquidate the asset, the depositors would loose most of the value. A bank run would allow just a small percentage of the depositors to recover a small percentage of the money lent. So this kind of threat could hardly be a strong enough guarantee for creditors. Besides the entrepreneur could even keep some of the return of the investment even after the liquidation of the tangible assets that he has eventually provided as collateral. The higher this return the higher would his incentive be.

The fundamental constraint that might prevent the borrower from renegotiating is the need to renew the agreement with the bank in the future. If the entrepreneur repeatedly needs finance he has an incentive not to renege his initial commitment. This is true if he faces enough uncertainty regarding his future liquidity needs.[29] The position of the bank can strongly be reinforced if all bankers agree explicitly or implicitly not to extend credit to someone that has previously defaulted. Not surprisingly this is a common feature of all banking systems. Because of this mutual agreement, banks can in fact credibly adopt an implicit tit for tat strategy, that is efficient as long as the gains from a single default do not exceed the expected gains form the continuation of the relationship. And not surprisingly most bank loans and lines of credit are usually short term, and need a frequent renegotiation. Quite surprisingly, on the contrary, relationship lending is sustainable only when the borrower is subject to some radical uncertainty regarding his future liquidity needs. The future uncertainty is effective in deterring opportunistic behaviour because the assets of the borrower are *not* liquid. As highlighted by Myers and Rajan [49], in fact, greater assets liquidity reduces the firm's capability to commit to a specific course of action. Finally, the moral hazard problem can be reduced if the capability of the bank to obtain and process the relevant knowledge regarding the investment grows as the relationship takes place and goes on. In this case the bank could get a higher share of the return in case of default, either by directly running the business, or transferring the ownership of the investment to another entrepreneur. As we will discuss in more detail, an important device that banks normally adopt in order to follow this strategy is to compel borrowers to hold deposits in the bank itself, so that the bank can manage the payments of the firm, obtaining relevant information.

---

[27]Diamond and Rajan [19] p. 3.
[28]Diamond and Rajan [20], p. 424.
[29]Formally this implies that he is uncertain regarding the number of repetitions of the game.

A very important conclusion that we can draw from this literature is that in the banking industry the role of market forces in assuring contractual performance is very relevant, much more than in other industries. Klein and Leffler, in their fundamental contribution on the topic,[30] have shown that implicit contracts may be a powerful device to insure contractual performance. They showed that implicit contracts backed by reputation can be very efficient as long as the value of the reputation, measured by the discounted flow of future gains from the continuation of the relationship is larger than the benefit from breaking the contract. In the case of firms supplying products of different quality, they showed that higher prices can be a very effective device since increasing the value of the reputation they signal the willingness to stick to the agreement. In the case of the trade relationship between banks and customers can be very efficient for both parts. On the one hand it can easily be shown that if the borrower expects relevant benefits from future relationships, debt contracts may be incentive compatible even when the cost of verification of the uncertain cash flows of the borrower is so high to make the actual verification on part of the lender impossible. If the borrower gives a relevant value to the gains from future debt contracts, she will always be willing to declare the correct outcome. This is important because it shows that debt contracts may be subscribed and respected even when the legal system is not based on the Rule of Law, or when the enforcement of the law is poor. This explains why unreliable borrowers such as the feudal kings and lords, or many contemporary democratic governments, could obtain credit from the private sector.[31] On the other hand the market power with respect to both depositors and borrowers which benefits banks, gives banks a strong incentive not to renege their commitments whenever they stipulate long-term contracts.

Bonds, loans and imperfect information

In order to understand the role and the function of banks in the economic system it is necessary to explain why financial market and banks complement each other. In order to do so it is necessary to explain what makes the portfolio of assets of a bank different from a market portfolio that any agent can purchase in a world where the cost of the acquisition of information is not irrelevant. Even in this case it is reasonable to assume that banks can manage a portfolio of bonds without incurring in increasing marginal costs. If the costs of servicing deposits are not convex, banks would still accept any amount of deposits, paying to depositors and shareholders the net return of the portfolio. Non linear costs are in fact quite implausible as long as we assume banks to be price takers in the market for bonds, which is normally sound. On the contrary with imperfect information it is necessary to assume that the issuance of loans implies the existence of convex default costs. The reason is that increasing indefinitely the quantity of loans issued, sooner or later a bank will end up financing projects with a lower than average return. The assumption is that the information gathering technology presents decreasing returns. If banks cannot

---

[30]Klein and Leffler [43].

[31]And conversely why a too large extension of credit provides an almost irresistible temptation to default.

perfectly discriminate among customers, and consequently cannot perfectly price discriminate, their default costs increase more than proportionally as the quantity of loans is increased.[32] Another way by which the same phenomenon can be seen, is that increasing the amount of loans the analysis of the value of the collateral becomes increasingly difficult and complex. This argument might seem at odds with standard financial theory, such as the CAPM, that suggests that there is a market price for risk, and any agent can buy any amount of risk at the market price. But it is not. Banks in fact can buy in risks in financial markets as any other agent buying bonds, and obviously we assume that they do not face any decreasing return in this activity. But a competitive market for risk exists just for investment projects on which enough information has already been disclosed. Loans are issued to finance projects whose risk cannot be efficiently priced. And Diamond has shown that it's mainly by means of banks that firms get access to financial markets, because banks can disclose the relevant information to the market in a more credible way. Issuing loans, banks provide the market with signal regarding the credit worthiness of a particular borrower.[33]

There is an apparently obvious argument for the opposite conclusion that lending on a larger scale implies lower default costs: the consideration that a higher level of loans should imply a higher diversification. But benefits from diversification cannot be a linear, or even less a convex function, of the amount of loans. The reason is that diversification is limited by the existent production structure of the market where the bank is structured. And there is an even more substantial problem. Banks do not have perfect ex-ante information on the risk of the projects that they finance.[34] Their entrepreneurial function is to discover and properly price the risk of different projects.[35] So they can't make use of any peculiar knowledge on the correlation of different risks, because they cannot forecast ex-ante the correlation of the shocks among different projects. The banks like the market cannot price the risk, simply because there is no risk to be priced, the uncertainty of the investment projects entertained by the borrowers is in fact not measurable.[36] When banks obtain the necessary information and have enough knowledge to do a reliable evaluation of the correlation of the risk of a firm (or of a single industrial project with the

---

[32]Alternatively it ca be assumed that banks have a constant return to scale technology in the monitoring activity, and that returns are a convex stochastic function of the level of monitoring. This is the road followed by Gorton and Pennacchi [30].

[33]See Diamond [18].

[34]"Much of the particular information which any individual possesses can be used only to the extent to which he himself can use it in his own decisions. Nobody can communicate to another all that he knows, because much of the information he can make use of he himself will elicit only in the process of making plans for action. Such information will be evoked as he works upon the particular task he has undertaken in the conditions he finds himself, such as the relative scarcity of various materials to which he has access. Only thus can the individual find out what to look for, and what helps him to do this in the market is the responses others make to what they find in their own environments. The overall problem is not merely to make use of given knowledge, but to discover as much information as is worth searching for in prevailing conditions". Hayek [36], p. 77.

[35]These arguments are in line with the arguments exposed by Scholtens and Van Wensween [62] on the role of financial intermediaries, and are of course in the spirit of the Austrian school.

[36]See Knight [45].

other risks of the market), they are not necessary any more. In this case banks become willing to promote the issuance of bonds on part of the firm, gaining a commission on the transaction, or otherwise to securitize the loan. The impressive development of the loan sales market has allowed banks to focus on their primary role, the disclosure of the information reducing the uncertainty of the finance activity. The secondary market for loans allows banks to sell their assets as soon as they become marketable. But there is another aspect of the problem. Since banks can sell in any moment any part of their loans portfolio, it has become increasingly difficult for the market to price the portfolio of banks. As a consequence it has become even more risky than before for long-term investors to finance banks. They prefer to buy the individual risks in the market for commercial paper.[37] As a consequence banks must rely mainly on deposits for their finance or they must incur in the expensive investment of building a reputation for having a high-quality portfolio of loans. Gorton and Pennacchi [30] have studied empirically loans sales by banks in the US. They showed that "the model's prediction that a bank will retain a greater portion of more risky loans, that is, those with a higher equilibrium loan sale yield, was strongly supported by our empirical test." Besides, "the empirical evidence as a whole suggests that certain types of loans may not be perfectly liquid. A loan selling bank must continue to convince loan buyers of its commitment to evaluate the credit of borrowers by maintaining a portion of the loan's risk".[38] When dealing with high-quality borrowers, on the other hand, it is difficult to keep the monopolistic rents due to the exclusive information. These rents cannot be kept for long when the investment projects financed are successful and the information on the risk is spread. The root of the problem is that information becomes in a short time a non-rival public good, which the bank cannot use in monopolistic condition for long periods of time, since it is impossible to stop the firm from disclosing the relevant information to the competitors. As Rajan has convincingly argued in fact, "there is a fundamental trade-off between bank debt and arm's-length debt. The bank can monitor the firm and control its investment decisions. However, in the very process of doing this, it alters the division of the surplus between itself and the firm. This distorts the firm's incentives. The firm may than prefer credit from arm's-length sources, which provide neither the benefits of bank debt nor the costs".[39]

Imperfect information and the deposit contract

The microeconomic literature on the banking industry did not stress for a long time the difference between deposits and other sources of funds. In a world with perfect information there would not be any. Abandoning the assumption of costless information, the relevance of the Modigliani-Miller theorem has been put in question, and many recent works show that banks can only substitute deposits with other liabilities to a limited extent. Flannery [25] showed the existence of relevant search costs in the market for deposits and was the first to study deposits as a quasi fixed input for the bank. He showed that in two different time periods banks in the US

[37]See Rajan [55] and Myers and Rajan [49].
[38]Gorton and Pennacchi [30], p. 409-410.
[39]Rajan [54], p. 1392.

have paid a higher rate on demand deposits than on CDs. Since operating costs of deposit balances are notably larger for retail accounts than for negotiable CDs, this kind of behaviour of the banking sector was apparently irrational. Flannery showed that it can be explained as the effect of the relevance of search costs in the market for deposits. Since banks cannot easily increase the level of deposits without incurring in search costs, nor are depositors willing to change bank easily as interest rate vary, the rate on deposits is sticky and banks consider deposits as a quasi-fixed input. On the contrary CDs are very good substitutes of bonds and other financial instruments, and their market is very competitive, so the rate adjusts as quickly as the rate on bonds. As a consequence a sharp decline of the rate on bonds is not matched by a proportional decline of the rates on deposits, and if the shock is strong enough the rate on CDs can become lower. Different empirical works that have estimated the price elasticity of deposits have confirmed this explanation.

Many different studies, conducted in different periods and with different econometric methodologies, have proved that deposits rates are sticky. Neumark and Sharpe [51] besides showed that not only rates are sticky, but "on average bank are quicker to adjust their deposit rates downward, when above the "equilibrium" than they are to adjust upward when below the equilibrium. Deposit interest rates of banks in more concentrated markets are found to exhibit stronger asymmetries in their dynamics." Accordingly they ascribed both stickiness and asymmetries to market power of the banks. Hannan and Berger [31] found similar results and suggested some plausible explanation for the finding of asymmetric behaviour. In particular they showed how their findings were inconsistent with an explanation based on costs arising from the reaction of customers, as sometimes is assumed as the effect of a kinked demand curve due to the search costs. Anyway, they showed that it could be the result of price conjectures arising because of the existence of a kinked demand curve. Because of the relevance of transaction costs (mainly search costs) and of the importance of the relation with the bank, depositors do not react when interest rates are increased, and react only when they are reduced under a certain threshold level. This behaviour determines either a kinked curve if transaction costs are the same for different customers, or a curve of decreasing elasticity if transaction costs are different. Assuming this kind of demand, banks might derive conjecture of greater prices for interest rates increases than decrease, as in the case of a poorly competitive market. We can conclude that interest rates on deposits are sticky and vary asymmetrically downwards and upwards, reflecting both imperfect competition and transaction costs.

The same kind of behaviour has been analyzed by Hess, considering the problem from the point of view of the depositor. Hess [37] is a study of the relevance of transaction costs in financial markets. This work is based on an econometric comparison of wholesale and retail financial transactions, and reached the conclusion that transaction costs in retail markets are statistically significant and economically relevant.[40] The conclusions of the econometric estimations conducted by Hess can be summarized as follows: in both the wholesale and the retail market there is

---

[40]Moreover, and quite surprisingly, "the estimated cost of not trading increased from the 1970s to the 1980s because lower wholesale transaction costs increased the wholesale amount of trading much more than they increased the retail amount of trading." Hess [37], pp. 408.

low substitutability between short-term and long-term assets and among long-term assets. The main difference between the two cases is that own interest rates are significant in the determination of the portfolio only for the wholesale market.

Hess [38] applied portfolio theory to evaluate empirically the behaviour of depositors, in order to understand the observed fact that notwithstanding a strong reduction in the rate of CDs at the beginning of the 90s depositors did not adjust their portfolios. This behaviour could be explained by either transaction costs considerations or by a low substitutability among deposits assets. The empirical estimation showed that transaction costs are again significant and relevant, to the point the estimated demand schedule in a portfolio model without transaction costs is almost horizontal, while adopting a portfolio model with transaction costs it becomes almost vertical. But the main conclusion of the paper is that CDs with long maturities are very poor substitutes for demand deposits and CDs of short maturities. When interest rates fall banks adjust the rates of the first kind of instruments, because they are compelled to do so, since long term CDs are good substitutes for other market assets. Depositors do not change their portfolio choice of instruments, because of the low substitutability among demand deposits, short term CDs and long term CDs. Moosa [50] came to similar conclusions, showing that empirically M1 and time deposits display significantly different elasticities of responses with respect to the same variables. He concluded that they do not provide a homogeneous set of services nor satisfy the same set of motives. According to his study, the demand for M1 is largely explained by a capital-theoretic medium of exchange rationale while time deposits holdings are explained by a portfolio balance rationale.

To summarize, the picture that emerges from these studies is of a credit market segmented from other financial markets, but in a particular way: long term certificates issued by banks are good substitutes for other bonds, and banks have to adjust their rates to compete with the market rates. On the contrary, demand deposit and short run certificates, that are close substitutes, represent a segmented market whose demand is very inelastic. The empirical findings that support the hypothesis of the relevance of both search costs and market power in the market for deposits is not surprising. The literature on the cost of information has in fact shown that in presence of search costs monopolistic competition becomes the normal market structure. Search costs allow the firm to charge non-competitive prices.[41]

Economies of scope in banking: banks as liquidity providers

Flannery [25] was the first work to show that a long term relationship was a necessary feature of the relationship between banks and depositors as well as lenders. High search costs are in fact associated with the establishment of a deposit relationship, giving a relevant value to the maintenance of the relationship for both depositors and the bank, since these costs are normally shared. The joint supply of both deposit and lending services to long term customers might provide scope economies, because the deposit relationship provides information that can be used in the provision of lending services.[42] Accordingly, banks can provide financial services to the

---

[41]See Salop [57] and Salop and Stiglitz [58] and [59].
[42]Vale [73]

economic system, at a much lower cost than any other intermediary.[43] The source of the complementarities and of the economies of scope between the provision of deposit services and loans can be understood returning to the two separate functions that banks provide: the provision of payment services and financial intermediation. Banks have always provided jointly the two sets of services because there were relevant economies of scope that could be exploited between the two services. Since the true entrepreneurial problem in the provision of both lies in the discovery and management of the relevant information, in many cases one could not be provided without the other.[44]

Kashyap, Rajan and Stein [41] showed that the economies of scope can be explained considering the two services of deposit and lending as "two manifestations of the same primitive function: the provision of liquidity on demand".[45] They showed that the bank performs the same kind of activity both issuing loans and accepting deposits. The basic activity of bankers consists of screening their customers providing payment services. This investment in information that the bank undertakes establishing the relationships with the customers allows depositors to allocate their savings optimally, getting a premium without giving up the liquidity. On the other hand it provides entrepreneurs with the liquidity they need to conduct their transactions.

Up to now we have considered exclusively the demand of financial intermediation services on part of firms and individual entrepreneurs. But firms, and entrepreneurs in general, need to rely on banks for the provision of payment services to a much larger extent than households. Bookkeeping transactions managed by banks are virtually the only available means of payment in business transactions, so that we do not normally realise the importance of the role that banks play in this regard. In the absence of banks complex transactions involving cash payments would be extremely expensive. Different types of activities that require quick transfers would be virtually impossible. The importance of the transaction services which the banking system provides lies with the guarantee that banks furnish, avoiding an enormous amount of otherwise necessary information acquisition. Banks implicitly provide everyone that receives a payment with a screening and certification service regarding the reliability of the issuer.

Managing the payments and other financial transactions of the borrower, banks can monitor the activity of their customers in a very efficient way. The management of the payments allows a constant monitoring of the liquidity of the firm, providing banks with most of the fundamental information they need regarding the business. The cash-flow of the firm conveys information regarding the health of the firm in real time, and its volatility measures the impact of shocks that affect the business. In order to fully exploit the synergies between the two functions, banks lend exclusively to firms that agree to settle all or most of their transactions by means of the bank

---

[43]The empirical analysis of Rogers [56] showed the existence of relevant complementarities among loans, deposits and other financial services.

[44]As we have already noticed, since in current banking practice revenues and costs of the two services are normally confused, it is very hard to proof empirically the relevance of the economies of scope.

[45]Kashyap, Rajan and Stein [41],Abstract.

itself. To achieve this aim they simply compel borrowers to hold a fraction of the loan or credit facility issued in the form of deposits.[46]In order to get access to the transaction services, firms must deposit their liquidity with the bank. They use the bank to deposit their liquidity because it is in the mutual interest of both the bank and the firm itself. The bank can increase in this way its liabilities and extend accordingly its revenues (this represents the implicit payment that Sprenkle [67] was considering as the reason for the firm to hold the apparently irrational amount of deposits that they normally hold). Firms can manage their payments in the most efficient way.

A fundamental issue is whether the creation of liquidity on part of banking firms is subject to any binding constraint. Potentially a monopolistic bank in a closed economy could provide the system with the amount of liquidity it desires, because the entire amount of loans issued would feedback in its own deposits with certainty, financing the loans that the bank has already conceded. In a competitive system the mechanism could remain formally unchanged, but we cannot assume that the banking system can provide liquidity without any constraint,[47] without running the risk of falling into a "fallacy of composition".[48] Banks in fact have to face their budget constraints that compel them to lend exclusively resources they have already obtained. It becomes important to realise how individual banks create liquidity for the system, since decisions regarding loans are taken at the individual level, while the feedback on deposits is the effect of the loans of all banks of the system. Brunner [10] has provided a fundamental explanation showing how the multiplier linking the amount of loans issued to the amount of deposits of the system emerges in a competitive banking system. Under a system of regulation that requires reserve coefficients, banks lend on the basis of their available free reserves. He has shown that the multiplier operates determining the amount of free reserves and showed the factors that affect the value of the multiplier for individual banks. The magnitude of the multiplier connecting deposits to loans depends on both institutional factors and market conditions, and it is peculiar of every bank. The main factors are probably market concentration (the feedback is higher as the market is less competitive), the velocity of circulation of money (the higher the velocity, the lower the feedback) and the degree of openness of the region in which the bank operates (the more closed the economy of the region is, the higher the feedback).

In a (monopolistically) competitive banking system banks are constrained in every period by their liabilities, and by the availability of free reserves. But since assets feedback in liabilities because of the liquidity creation, the problem is bounded as long as the feedback coefficient is smaller than one, generating a multiplier that does not diverge. As it was initially realised by Tobin, the constraint on the size of the bank must be caused by the presence of some convex costs. Our previous discussion showed that convex costs in the banking industry are the costs of default.

---

[46]As shown by Sprenkle [67] and [68].

[47]As post Keynesians or the theory of monetary circuit often do, see Lavoie [46] for a recent discussion of the issue.

[48]Keynes observed that is incorrect to infer conclusion regarding the behaviour of aggregates from theoretical considerations exclusively derived at the micro level, but the same can be true the other way round.

In this framework default costs act as the true constraint on the creation of liquidity. A constraint which can be overcome if banks are allowed to roll over indefinitely the debt to insolvent borrowers. If the default of the borrower could be indefinitely postponed, the maximisation problem of the banking firm would become unbounded, and the process of liquidity creation could in principle become explosive. The most serious problem that regulatory agencies have to face is that banks always have a strong incentive to roll over loans rather than causing a default. Since defaults are the only constraint that banks face, because creating liquidity they can directly or indirectly overcome any resource limitation, the enforcement of rules that compel banks to write off non-performing loans as soon as they emerge becomes of crucial importance.

Market forces may not be efficient enough to guarantee the stability of the banking system when large negative shocks hit the borrowers. When the value of non-performing loans becomes larger than the value of capital, the interest of managers and shareholders of banks is to roll the loans over, colluding with the borrowers at the expense of the debt-holders of the bank. In this case the value of equity becomes zero and shareholders have nothing to loose from the postponement of the bankruptcy, since all the new risk falls on debt. Implicit or explicit contractual guarantees are not sufficient to protect bond-holders in this case and the threat of bank run may not be sufficient. It is the information asymmetry between equity and debt-holders that provides a strong incentive to equity-holders or their agents to collude with borrowers. Since when the negative shock hits the portfolio of the bank the first obtain the information in advance, they can collude *to prevent* the divulgation of the information. In absence of external rules that impose the write-off, the debt contract with a banking intermediary is not incentive-compatible anymore in the case of extreme shocks.

Portfolio composition

The theories of banking intermediation reviewed so far have focused on the direct lending activities of banks. The study of the problems concerning the limited availability of information has brought these theories to emphasize the role of deposits. [49] They have showed how financial intermediaries specialised in the issuance of loans, financed by fragile liabilities such as deposits, can spontaneously emerge and successfully operate in financial markets. Banking intermediation by means of demand deposits allows the financing of uncertain investment projects on part of risk-averse agents. And demand deposits can be substituted by other liabilities to a limited extent only. As Flannery [26] has shown, credit intermediaries can not easily obtain long-term credit. Following Merton, he showed that a leveraged bank has a very strong incentive to increase the risk of its assets, because shareholders benefit at the expense of bondholders. Debt is in fact a concave function, while equity is a convex function of the value of the underlying investment. Equity holders always face a strong incentive to increase the risk profile of the investment once a bond has been issued, because the extra risk would be faced by bond-holders. In an efficient market

---

[49]In stark contrast to older models of banking, that did not stress the peculiarity of deposits, such as the classic model by Klein [44].

rational bondholders would proportionally increase the cost of finance for the bank. As a consequence the cost of debt finance is much higher for a bank than for any other firm, because banks are risk dealers and there it is no contractual agreement that can establish ex-ante the risk taken. Since this problem worsens with the duration of the bond, banks are pushed towards short term sources of finance, deposits in particular. The possibility of being redeemed on demand makes deposits immune from this problem. Banks can obtain long-term credit issuing bonds to a limited extent only, and these funds cannot substitute deposits.

The peculiar fragile structure of banks' liabilities, centred on deposits is necessary for the financing of opaque investment projects. But the same fragile financial structure could be used to purchase other assets, and would always be useful to reduce agency problems due to the superior information of the intermediary.[50] In other words, deposits are necessary for loans, but loans are not necessary for deposits. Banks could issue deposits and use the funds to buy bonds or any other asset. So if banks are constrained in the choice of their liabilities they must not necessarily be so in the choice of their assets. The optimal composition of the portfolio of assets of the bank remains an open problem. Traditional portfolio theories, such as Hart and Jaffe [32], have tried to adapt Markovitz portfolio approach to the problem of an intermediary. The model has been applied to banks assuming banks to be risk adverse agents that maximize a concave utility function where profits are the argument. Assuming all returns to be exogenous, the optimal portfolio of assets and liabilities is jointly determined. The main flaw of the model is that under the assumption that interest rates on assets are higher than on liabilities, the bank might be willing to expand its portfolio indefinitely. The relevance of this problem can be reduced introducing an endogenous process of interest rates determination, assuming that banks compete monopolistically and estimate the demand for deposits and loans, as proposed by Szegö [71]. Yet these models have not been further developed because they are at odds with the standard assumption of risk neutrality in the theory of the firm. For most problems, besides, the assumption of risk aversion is not necessary, and portfolio models can be developed even in its absence. In a fundamental paper, Lindley and Sealey [65] have shown that studying the industrial problem of the banking firm, deposits have to be considered as an input, and in order to maximise profits banks have to equate separately the marginal revenues and costs of any asset. As in the case of a multi-product industrial firm, there is not a corner solution, so that the bank does not choose to allocate all the portfolio in just one asset, as long as management costs are different. Since the industrial costs of assets such as bonds or loans are completely different, the maximisation problem of the banking firm is a portfolio problem. Returns offered by securities such as bonds, equities, shares of hedge funds or complex derivatives represent the opportunity cost of loans. Under the regulatory framework existent in most countries, banks are in fact now to a large extent free to choose the composition of their assets portfolio from a wide range of alternatives. The progressive deregulation of financial and credit markets has strongly increased these possibilities, and the universal bank has become the dominant model for banking firms. The analysis of the factors that affect the composition of the portfolio of banks has become increasingly important,

---

[50]In the absence of which the intermediation would be useless.

since banks do not need to rely exclusively on direct lending anymore. And because of the imperfection of information, banking intermediation is not neutral. If banks decide to reduce the issuance of loans, innovative investment has to be financed more intensely with equity, but if equity markets are bearish, it could be difficult.

The peculiarity of the composition of the liabilities of the bank has got another important implication. The bank may not be free to choose the size of its liabilities, and, accordingly the size of its assets portfolio. This problem is linked to the double function that demand deposit play, because agents demand deposits not just as an asset in the optimal allocation of their savings on one side they, but they mainly demand deposits for the transaction services they provide. This implies that a large part of the demand for deposits depends on factors entirely exogenous to the market, such as income variations. As a consequence higher interest rates might increase the demand for deposits to a limited extent only. This means that banks must consider the amount of deposits as largely exogenous in the short run, a quasi-fixed input. Deposits may be split in two categories: core deposits, whose amount is largely insensitive to interest rates and depends essentially on the demand for transaction, and other deposits (mainly time deposits) whose demand varies with interest rates. This distinction is particularly relevant because the theories discussed so far imply that banks can substitute deposits with other liabilities to a limited extent only. Empirically this prediction has been strongly supported. Jayaratne and Morgan have shown that "loan growth at banks is positively, strongly correlated with their deposits growth, even after controlling for lending opportunities . . . The lending deposits correlation is most pronounced at poorly capitalized banks, where the theory suggests the informational frictions should be the more severe."

Credit rationing and interest rate smoothing

The importance of the composition of the portfolio has been neglected in recent years, but it lies at the roots of any explanation of equilibrium credit rationing. This theory assumes that firms are rationed because banks choose not to allocate their assets to direct lending in the amounts that would be necessary to fulfil the demand at the given rates.[51] Interest rates on loans do not rise eliminating the demand in excess because banks cannot properly screen the risk of different borrowers, which end up being pooled together. Consequently an increase of the interest rate does not produce higher revenues because it would cause higher default costs. The theories of equilibrium credit rationing though are in contrast with the theories of relationship lending and delegated monitoring we have reviewed so far. The last in fact show that there are strong market incentives for banks to specialise in the discovery and analysis of information regarding investment projects. The information gathering activity in fact gives banks market power, producing rents that last as long the uncertainty of the outcome of the investment remains too high for the market to price the risk. In other words there are strong market incentives not to pool borrowers. The banking industry can be efficient not because it can be competitive, but on the contrary because in many situations banks can price discriminate almost perfectly. Banks have strong incentives to invest in information, just because

---

[51]See Jaffe and Russell [40] or Stiglitz and Weiss [69] and [70].

these investments allow them to price discriminate. If the information costs are large enough, since the investment on information are normally largely invariant to output and nonsalvageable, the bank may often be in a natural monopoly. And the bank can not only price the loan monopolistically, but it can price-discriminate to the extent that is able to obtain the same information of the borrower. Borrowers accept the monopolistic and discriminatory pricing policy because it allows them to obtain credit even when the costs of direct verification would be so high to otherwise prevent the stipulation of an incentive-compatible contract. Since the quantity of funds demanded depends on the value of the investment project and the equity of the borrower, the borrower can be willing to leave the entire surplus generated by the loan to the lender. The borrower benefits from the share of the investment that belongs to the equity, which he would not be able to obtain without the loan.

The importance of the pooling problem depends on the relevance of the costs of developing specialized knowledge regarding the intangible capital of the borrower.[52] The pooling of borrowers occurs when the cost of the relevant information is too high to allow the bank to discriminate among borrowers of certain classes. This may often be the case when the number of potential borrowers is large, the average amount of every loan demanded is small, and the risk profile of potential borrowers is similar *ex ante.* Under these extreme conditions only the bank accepts to pool the borrowers, in particular if the number of potential borrowers is large, so that the problems due to the pooling can be reduced by means of statistical analysis.

Even in this case though, we can't conclude that firms are necessarily credit rationed. We should rather conclude that banks' portfolios are in these conditions eschewed in favour of bonds or risk-free asses, reducing the financing of innovation. Small firms that do not have access to financial markets can in this case be rationed, but not necessarily. This is an implication of the fact that banks do not freely choose the amount of deposits, and accordingly the size of the portfolio. In the absence of constraints on the liability side, the spread between the net return on loans and the net return on other securities would establish the amount of loans issued. But since banks need deposits, and cannot freely choose their level, the problem must take into account what happens on the liability side.[53] Banks in fact always have to service core deposits if they want to stay in business, and in the amount demanded by the public. And the amount of core deposit services that the bank provides must not necessarily be sufficient to finance the desired portfolio. When their quantity is sufficient, since banks have to invest these amounts and price loans monopolistically, they will always satisfy the demand for loans and invest in other securities only the residual amounts. Banks in fact issue loans as long as the marginal return equates the return of a portfolio of market securities. Clearly in this case firms are normally not rationed, and do not need any other liability, a part from capital, even if the pooling problem can cause an inefficient allocation of

---

[52]On theoretical grounds Chan and Kanatas [11] showed that collateral can be used as a device to solve the informational problems due to adverse selection and moral hazard. Stiglitz and Weiss [70] showed that the use of collateral cannot avoid all the problems of asymmetric information that might produce equilibrium credit rationing.

[53]Assuming that the liquidity creation is constrained by the proper definition of rules that compel banks to write-off non performing loans.

credit among different investment projects. For rationing to emerge in this case, the information problems have to be so severe that banks choose at the margin to allocate funds raised as deposits to riskless securities. This situation does certainly not occur in normal circumstances.

The other possibility is that the bank itself is rationed, because the amount of core deposits is not enough to satisfy the demand for loans. In this case the increase in the size of the portfolio must be matched by an expensive increase in the amount of liabilities. The increase of the liabilities must not necessarily come from a higher level of deposits. The marginal cost of deposits has to be compared with the marginal cost of other liabilities, and this holds for any different asset, since those costs are not the same, because of the economies of scope in the analysis of information.[54] In this case rationing may occur, if banks do not have enough information on their depositors and cannot price discriminate.[55] In this case increasing the amount of deposits implies the payment of interest rates on all outstanding deposits, and this implies a non linear increase in costs and a discontinuity in the supply curve of loans. This happens only if the marginal cost of other sources of funds is very high, otherwise the extra finance can be raised issuing CDs or bonds. In this case the supply curve of loans has kink. To summarise, credit rationing may occur only if the bank is rationed by the availability of core deposits and the gap between marginal cost of deposits (interest rates plus marginal industrial cost) and marginal costs of other sources of finance (market interest rates) is wide.

The empirical relevance of equilibrium credit rationing has been seriously put in question, since the empirical evidence provided by the supporters of the theory was not univocal. The empirical tests in support of credit rationing have mainly been tests of the degree of stickiness of loan interest rates. Many different econometric estimations have shown that the commercial loan rate is slow to adjust to open market rate changes. But the evidence regarding credit rationing has remained quite controversial. Interest rate stickiness is in fact just a necessary condition for the existence of credit rationing, not a sufficient condition. The stickiness of the rate on loans proves just that the market for loans is not perfectly competitive. The cause of the inefficient pricing can be the existence of equilibrium credit rationing, but it can be market power of banks, or it can reflect the relevance of transaction costs that cause the demand curve of individual firms to be kinked. The work by Berger and Udell [4] represented a big step ahead, since it was the first to use a large panel data to address the problem using microeconomic data. The work confirmed previous findings on the stickiness of commercial loan rates, but caste serious doubt regarding the relevance of equilibrium rationing. It emerged in fact that loans issued under commitment, (that are free from rationing by definition) do not behave differently from normal loans. In particular it appeared that "the proportion of new loans issued under commitment does not increase significantly when credit conditions are tight."[56] They concluded that the stickiness of the loan rate is not the effect of equilibrium rationing, but is most likely the effect of intertemporal interest rates

---

[54]As underlined by Lindley and Sealey.

[55]Time deposits can be considered a device to segment the market for deposits in two classes, in order to price discriminate.

[56]Berger and Udell [4], abstract.

23

smoothing on part of the banks, a suggested by Fried and Howitt [27].

The market power produced by the investment in information allows banks to price monopolistically, giving them the chance to negotiate implicit contracts with their customers. Fried and Howitt showed that banks can have an interest in smoothing interest rates charged to firms because of the long term character of the relationship with their customers. Banks in fact can find profitable to establish an implicit contract involving a risk sharing agreement with their borrowers, sharing the risks associated with an uncertain future. "If loans were negotiated in spot auction markets customers would then be exposed to the risk of fluctuating interest rates on loans. A bank may be willing to insure the customer against part of such risk by a policy of keeping interest rates less variable than they would be in spot auction markets, in return for which the customers may be willing to compensate the bank in the form of a higher average interest rate."[57] One of the main conclusions of their model is that a greater variance in the sources of finance for the bank produces a lower loan rate and that the level of rationing increases with an increase in expected costs of funds for the bank. Berlin and Mester [6] and [7],[58] provided further evidence in favour of the hypothesis of intertemporal smoothing trough the exploitation of long term relationships. These works are important as well because they were the first to test empirically how bank's lending is affected by shocks. According to their results "in general loan rate smoothing in response to a *credit risk* shock is not part of an optimal long-term contract between a bank and its borrower, while loan rate smoothing in response to an *interest-rate shock* is".[59] Only for the smallest subset of banks a significant positive relation could be found for a credit risk shock. After testing for the alternative hypothesis that the relation could be driven by inefficient pricing, which they rejected, they concluded that interest rates smoothing is part of an efficient contract between banks and borrowers for all classes of banks, only in the case of interest rate shocks. The second work is based on the same dataset as the previous one, and considers the relationship between smoothing and core deposits, which are defined as deposits whose interest rates are particularly inelastic. They found that "banks more heavily funded with core deposits provide borrowers with smoother loan rates in response to changes in aggregate credit risk." [60] The reason is that core deposits insulate the bank's cost of funds from shocks, so that banks that rely mainly on core deposits can provide more loan rates smoothing in response to shocks.[61]

---

[57]Fried and Howitt [27], p. 472.

[58]The first of the two works was based on a panel of data consisting of information regarding the terms of each loan of a set of US banks. This permitted the authors to estimate the degree of smoothing and to run a regression of smoothing on profits. They considered a positive relation to be a proof of the optimality of a risk sharing implicit contract.

[59]Berlin and Mester [6], p. 873. Author's italic.

[60]Berlin and Mester [7] p. 580.

[61]These findings are probably not at odds with the findings of the former work, as it is widely recognised that small banks are the ones that rely more heavily on core deposits as a source of finance. A higher dependence on deposits is normally peculiar to small banks, and this work seems to justify the widely held opinion that small local banks are in general more willing to smooth shocks.

Conclusion: the stability of the banking system

The importance of uncertainty and limited information in the banking industry has produced the particular characters that banking institutions have assumed in centuries of evolution. The liquidity of deposits is not an anomaly; it is not just the result of historical accident, but it is rather the peculiar aspect of banking institutions. This is confirmed by the observation that similar institutions have emerged in different countries and in different periods of time. Banks are banks because they finance the entrepreneurial activity creating liquidity.[62]

The current regulatory framework does not correctly take into account the relevance of implicit contracts and the importance of market incentives for the banking system. The original objective of the regulation was the protection of depositors in order to insure the stability of the financial system to prevent contagion. But the regulation has become more extensive, and in order to avoid the disruption of the human capital invested in the relationships that would occur with the bankruptcy of banks, regulators do not normally allow banks in general, and large banks in particular, to go bust anymore. In most countries regulators are normally free to choose the preferred option for the rescue of troubled institutions and are granted extensive powers that produce heavy distortions of market prices. These distortions could be avoided by the design of a proper regulatory framework for the bankruptcies of financial institutions, based on principles similar to those of Chapter Eleven of the US. If bankruptcy procedures aim to keep the institution in function as long as revenues cover variable costs, human capital is preserved whenever its preservation is economically viable. The introduction of a framework of this kind would avoid the moral hazard implicit with every scheme which is ultimately backed by tax-payers, and all the distortions that derive. The standard deposit insurance scheme should always be enough to avoid the contagion generated by the panic the follows the disclosure of shocking new information.

On the other hand debtors, and ultimately taxpayers, are not protected enough by current regulation from the occurrence of extreme shocks. In this regard capital requirements cannot *per se* be the solution, since too stringent capital requirements would produce an irrational allocation of capital and penalise banks with respect to other financial institutions. In order to protect debtors of banks and to prevent the stability of the system much more stringent regulations are necessary for book-keeping entries; besides these regulations must be continuously revised to follow the evolution of financial markets. In particular non-performing loans must always be written-off as soon as the information is available, and special provisions must be imposed for the risks implicit in the trading of derivatives, which can be a highly risky business and whose information is always extremely opaque. The imposition of rules is necessary in this case because market forces alone cannot produce incentive-compatible contracts that covers extreme outcomes, and the incompleteness of contracts may in these events case be dangerous for the stability of the system. Shareholders and managers of banking institutions face in fact a strong incentive to collude with borrowers at the expense of bondholders and tax-payers, whenever large defaults occur.

---

[62]As was originally illustrated by Schumpeter. See Schumpeter [63] and [64].

References

[1] ACKERLOF, George A. "The Market for Lemons: Quality Uncertainty and the Market Mechanism", *Quarterly Journal of Economics* vol. 84, August 1970, pp. 488-500.

[2] ALLEN, Franklin and SANTOMERO, Anthony M., "The theory of financial intermediation", *Journal of Banking & Finance* vol. 21, 1998, pp. 1461-1485.

[3] BARRO, Robert J., and SANTOMERO, Anthony M., "Household Money Holdings and The Demand Deposit Rate", *Journal of Money, Credit and Banking* vol. 4, n. 2, May 1972, pp. 397-413.

[4] BERGER, Allen N. and UDELL, Gregory F., "Some Evidence on the Empirical Significance of Credit Rationing", *Journal of Political Economy*, vol. 100, 1992, pp. 1047-1077.

[5] BERGER, Allen N. and UDELL, Gregory F., "Small Business Credit Availability and Relationship Lending: the Importance of Bank Organisational Structure", *The Economic Journal*, vol. 112, February 2002, pp. 32-53.

[6] BERLIN, Mitchell and MESTER, Loretta, "On the profitability and cost of relationship lending", *Journal of Banking & Finance* 22, 1998, pp. 873-879.

[7] BERLIN, Mitchell and MESTER, Loretta, "Deposits and Relationship Lending", *The Review of Financial Studies* vol. 12, n. 3, 1999, pp. 579-607.

[8] BOOT, Arnoud W. A., GREENBAUM, Stuart I., and THAKOR, Anjan V., "Reputation and Discretion in Financial Contracting", *The American Economic Review* vol. 83 NO 5, December 1993, pp. 1165-1183.

[9] BORN, Karl Erich, *International Banking in the 19th and 20th Centuries*, Berg Publisher Ltd., Stuttgart, 1983.

[10] BRUNNER, Karl, "A Schema for the Supply of Money", *International Economic Review*, vol. 2, N. 1, January 1961, pp. 79-107.

[11] CHAN, Yuk-Shee and KANATAS, George, "Asymmetric Valuations and the Role of Collateral in Loan Agreements", *Journal of Money, Credit and Banking* vol. 17, February 1985, pp. 84-95.

[12] COLE, Rebel A. "The importance of relationship to the availability of credit", *Journal of Banking & Finance* vol. 22, 1998, pp. 959-977.

[13] COSIMANO, Thomas, "The Federal Funds Market under Bank Deregulation", *Journal Money, Credit and Banking* Vol. 19, No. 3, August 1987, pp. 326-339.

[14] COSIMANO, Thomas, "The Banking Industry Under Uncertain Monetary Policy", *Journal of Banking and Finance* 12, March 1988, pp. 117-139. *Journal of Monetary Economics* 41, 1988, pp. 57-70.

[15] COSIMANO, Thomas, and McDONALD, Bill, "What's different *among* banks?", *Journal of Monetary Economics* 41, 1998, pp. 57-70.

[16] COSIMANO, Thomas, VAN HUICK, John B., "Dynamic Monetary Control and Interest Rate Stabilization", *Journal of Monetary Economics* 23, 1989, pp. 53-63.

[17] DIAMOND, Douglas W., "Financial Intermediation and Delegated Monitoring", *Review of Economic Studies* 51, 1984, pp. 393-414.

[18] DIAMOND, Douglas W., "Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt", *Journal of Political Economy*, Vol. 99, no. 4, 1991, pp. 689-721.

[19] DIAMOND, Douglas W. and RAJAN, Raghuram, "Liquidity risk, liquidity creation and financial fragility: a theory of banking", *NBER Working Paper* n. 743, December 1999.

[20] DIAMOND, Douglas W. and RAJAN, Raghuram, "Banks and Liquidity", *The American Economic Review Papers and Proceedings*, VOL. 91 No. 2, May 2001, pp. 422-425.

[21] ELSASYANI, Elyas, KOPECKY, Kenneth J. and VAN HOOSE David, "Cost of Adjustment, Portfolio Separation, and the Dynamic Behaviour of Bank Loans and Deposits", *Journal of Money, Credit and Banking* vol. 27, November 1995, Part I, pp. 955-974.

[22] FAMA, Eugene, "What's Different About Banks?", *Journal of Monetary Economics* vol. 15, January 1985, pp. 39-57.

[23] FAMA, Eugene (1985), "Banking in the Theory of Finance"", *Journal of Monetary Economics* vol. 6, January 1980, pp. 39-57.

[24] FAMA, Eugene (1985), "Financial Intermediation and Price Level Control", *Journal of Monetary Economics* vol. 12, 1983, pp. 7-28.

[25] FLANNERY, Mark J., "Retail Bank Deposits as Quasi Fixed Factors of Production", *The American Economic Review* vol. 57, 1982, pp. 527-535.

[26] FLANNERY, Mark J. (1994), "Debt Maturity and the Deadweight Cost of Leverage: Optimally Financing Banking Firms", *The American Economic Review* vol. 84 NO 1, 1994, pp. 320-331.

[27] FRIED, Joel and HOWITT, Peter, "Credit Rationing and Implicit Contract Theory", *Journal of Money, Credit and Banking* 12, August 1980, pp. 471-487.

[28] GALE, Douglas and HELLWIG, Martin, "Incentive-Compatible Debt Contracts: the One-Period Problem", *Review of Economic Studies*, No. 52, pp. 647-663.

[29] GOODHART, Charles A. E. (1985), *The Evolution of central Banks*,The MIT Press, Cambridge, Massachusetts and London.

[30] GORTON, Gary B., and PENNACCHI, George G., "Banks and Loan Sales: Marketing Nonmarketable Assets",*Journal of Monetary Economics* vol. 35, 1995, pp. 389-411.

[31] HANNAN, Timothy H. and BERGER, Allen N., "The Rigidity of Prices: Evidence from the Banking Industry",*The American Economic Review* vol. 81, 1991, pp. 938-945.

[32] HART, Oliver D. and JAFFEE, Dwight M., "On the Application of Portfolio Theory to Depository Financial Intermediaries", *Review of Economic Studies*, April 1973, pp. 129-147.

[33] HART, Oliver D. and MOORE, J., "Incomplete Contracts and Regonetiations", *Econometrica*, Vol. 56, n. 4, pp. 755-785.

[34] HAYEK, Friedrich A. von, *Individualism and Economic Order*, London, Routledge and Kegan Paul,1945.

[35] HAYEK, Friedrich A. von, *The Constitution of Liberty*, London, Routledge and Kegan Paul, 1960.

[36] HAYEK, Friedrich A. von, *The Fatal Conceit: The Errors of Socialism*, in *The Collected Works*, vol. 1, edited by W.W. Bartley, London, Routledge, 1988.

[37] HESS, Alan C. "The Effects of Transaction Costs on Households' Financial Asset Demand", *Journal of Money, Credit and Banking*, Vol. 23, 1991, pp. 383-409.

[38] HESS, Alan C. "Portfolio Theory, Transaction Costs, and the Demand for Time Deposits", *Journal of Money, Credit and Banking*, Vol. 27, 1995, pp. 1015-1032.

[39] HUTCHINSON, David E., "Retail bank deposits Pricing: An Intertemporal Asset Pricing Approach", *Journal of Money, Credit and Banking*, vol. 27, n. 1, February 1995, pp. 217-231.

[40] JAFFE, Dwight and RUSSELL, Thomas, "Imperfect Information, Uncertainty and Credit Rationing", *Quarterly Journal of Economics*, Nov. 1976, No. 90, pp. 651-666.

[41] KASHYAP, Anil K., RAJAN, Raghuram and STEIN, Jeremy C. "Banks as Liquidity Providers: An Explanation for the Co-Existence of Lending and Deposit Taking" *The Journal of Finance*, vol. LVII, No. 1, February 2002, pp. 33-73.

[42] KLEIN, Benjamin, "Competitive Interest Rates Payments on Bank Deposits and the Long-Run Demand for Money", *The American Economic Review*, vol. 64, n. 6, December 1971, pp. 931-949.

[43] KLEIN, Benjamin, and LEFFLER, Keith B.,"The Role of Market Forces In Assuring Contractual Performance", *Journal of Political Economy*, vol. 89, No. 41, 1980, pp. 615-640.

[44] KLEIN, Michael, (1971), "A theory of the banking firm", *Journal of Money, Credit and Banking* n. 3, March 1971, pp. 205-218.

[45] KNIGHT, Frank H., *Risk, Uncertainty, and Profit.* Boston, MA: Hart, Schaffner & Marx; Houghton Mifflin Company, 1921.

[46] LAVOIE, MARC, "The credit led supply of deposits and the demand for money: Kaldor's reflux mechanism as prevoiusly endorsed by Joan Robinson", *Cambridge Journal of Economics*, n. 23, 1999, p. 103-113.

[47] LELAND, H. E., and PYLE, D. H., "Information Asymmetries, Financial Structure and Financial Intermediaries", *Journal of Finance*, Vol. 32, N0. 2, 1977, pp. 371-387.

[48] MERTON, Robert C., "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates", *The Journal of Finance*, vol. 29, May 1974, pp. 449-470.

[49] MYERS, Stewart, and RAJAN, Raghuram "The Paradox of Liquidity", *Quarterly Journal of Economics*, August 1998, No. 112, pp. 733-771.

[50] MOOSA, Suleman A., "Dynamic Portfolio Balance Behaviour of Time Deposits and 'Money'", *The Journal of Finance* vol. XXXII, NO. 3, June 1977, pp. 709-717.

[51] NEUMARK, David and SHARPE, Stephen A., "Market structure and the nature of price rigidity: Evidence from the market of consumer deposits", *Quarterly Journal of Economics* vol. 107, 1992, pp. 657-680.

[52] NIINIMÄKI, J. P., "Intertemporal Diversification in Financial Intermediation", *Journal of Banking & Finance* vol. 225, 2001, pp. 965-991.

[53] PETERSEN, Mitchell A. and RAJAN, Raghurham J., "The Benefits of Lending Relationships: Evidence from Small Business Data",*The Journal of Finance* vol. XLIX no.1, March 1994, pp. 3-37.

[54] RAJAN, Raghuram G., "Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt", *The Journal of Finance*, vol. XLVII, No. 4, September 1992, pp. 1367-1400.

[55] RAJAN, Raghuram G., "The Past and the Future of Commercial Banking Viewed through an Incomplete Contract Lenses", *Journal Money, Credit and Banking* Vol. 30, No. 3, August 1998, pp. 524-550.

[56] ROGERS, Kevin, "Product Mix, Bank Powers, and Complementarities at U. S. Commercial Banks", *Journal of Economics and Business*, vol. 50, 1998, pp. 205-218.

[57] SALOP, Steven, "Information and Monopolistic Competition", *The American Economic Review*, vol. 66, no. 2, May 1976, pp. 240-245.

[58] SALOP, Steven and STIGLITZ, Joseph, "Bargains and Rip-offs: A Model of Monopolistically Competitive Price Dispersion", *The Review of Economic Studies*, vol. 44, no. 3, October 1977, pp. 493-510.

[59] SALOP, Steven and STIGLITZ, Joseph, "The Theory of Sales: A Simple Model of Price Dispersion with Identical Agents", *The American Economic Review*, vol. 72, no. 5, December 1982, pp. 1121-1130.

[60] SANTOMERO, Anthony M., and SIEGEL, Jeremy J., Thomas, "Bank Regulation and Macro-Economic Stability", *The American Economic Review* vol. 71, No. 1, March 1981, pp. 39-53.

[61] SANTOMERO, Anthony M., and SIEGEL, Jeremy J., Thomas, "Impact of Regulation on Money Market Institutions", *The Journal of Finance* vol. XXXVII, No. 2, May 1921, pp. 357-369.

[62] SCHOLTENS, Bert, and VAN WENSWEEN, Dick, "A critique on the theory of financial intermediation", *Journal of Banking & Finance* vol. 24, 2000, pp. 1243-1251.

[63] SCHUMPETER, JOSEPH A., *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycles* (translated by Redvers Opie, with a special preface by the author). Cambridge Mass: Harvard University Press, 1934. Second Printing 1936; Third Printing 1949. Originally published in German in 1912 as *Theorie der wirtschaftlichen Entwicklung*.

[64] SCHUMPETER, JOSEPH A., *Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process*, New York and London: McGraw-Hill Book Co., Inc., 1939. Revised edition published in 1964.

[65] LINDLEY, James T., and SEALEY, C. W. Jr., and "Inputs, Outputs and a Theory of Production and Cost at Depository Financial Institutions", *The Journal of Finance*, Vol. XXXII, No. 4, September 1977, pp. 1251-1266.

[66] SHARPE, Steven A., "Asymmetric Information, Bank Lending, and Implicit Contracts: A Stylized Model Of Customer Relationships", *The Journal of Finance*, vol. XLV, No. 4, September 1990, pp. 1069-1087.

[67] SPRENKLE, Case M., "The Uselessness of Transaction Demand Models", *The Journal of Finance*, December 1969, pp. 835-848.

[68] SPRENKLE, Case M., "On the Observed Transaction Demand for Money", *The Manchester School*, 1972, pp. 261-267.

[69] STIGLITZ, Joseph and WEISS, Andrew, "Credit Rationing in Markets with Imperfect Competition" *American Economic Review* 71, June 1981, pp. 393-410.

[70] STIGLITZ, Joseph and WEISS, Andrew, "Asymmetric Information in Credit Markets and Its Implications for Macroeconomics" *Oxford Economic Papers* 44, 1992, pp. 694-724.

[71] SZEGÖ, Giorgio PP., *Portfolio Theory With Application to Bank Asset Management*, Academic Press, London, 1980.

[72] THISTLE, Paul D., McLEOD, Robert W. And CONRAD, B. Lynne, "Interest rates and bank portfolio adjustments", *Journal of Banking & Finance* vol. 13, 1989, pp. 151-161.

[73] VALE, Bent, "The Dual Role of Demand Deposits under Asymmetric Information", *Scandinavian Journal of Economics* vol. 95. (1), 1993, pp. 77-95.

[74] WHEELOCK, David C. and WILSON, Paul W., "New evidence on returns to scale and product mix among US commercial banks", *Journal of Monetary Economics*, vol. 47, 2001, pp. 653-674.