Technology, competition and information acquisition – the golden triangle of banking?

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Abstract

Financial institutions' main task is to efficiently allocate capital in society. Two factors are crucial for this process to maximize social surplus; competition and information acquisition. Both these factors have gone through considerable changes over the last two decades, due to deregulations and liberalization in financial markets, and technological development. The latter has given rise to a change in the nature of information, which in turn impacts on financial markets' structure and incentives. Information can, with the use of new technology, now be classified into two groups; hard (quantitative) and soft (qualitative) information. Hard information is easy to collect, interpret and transfer, and processes involving hard information are increasingly automated. Soft information is collected personally, requires subjective interpretation and is not easily transferable. It cannot be transformed into numbers, and requires more resources and effort to collect than hard information. The result is increased use of hard information. Competition increases because a larger number of agents are able to give loan offers and attract borrowers based on hard information, and both firms and households experience easier access to less expensive capital. Two negative effects may be identified from this process, however: The incentives to perform a thorough due diligence of the loan applicants are weakened, and the access to capital for the borrowers who are dependent on disclosing proprietary information to get credit (relationship lending) is deteriorated.

I try to find out whether the increase in competition in the banking market has a positive or negative effect on relationship lending. The existing literature delivers various answers to the issue in question, which I show by presenting and comparing two models that predict different results. The main reason for why the results differ is the distinction between hard and soft information. In the first model, the authors do not distinguish between the different information types, and the result is that increased competition will reduce the level of information acquisition in banks. This is in line with predictions from standard economic theory, and has led to concerns about the efficiency of the allocation of capital as competition in the market increases. Competition is modeled through the reusability of information, i.e. the extent to which the already acquired information can be reused. A high degree of competition is associated with a low degree of reusability.

In the second model, the authors make the distinction between hard and soft information. Here, competition is represented by the presence of information sharing institutions in the market, like credit bureaus and rating agencies, which will increase the general accessibility to hard information. The result is that increased competition will increase the effort to gather *soft* information because the value of having soft information increases when there are many agents in the market with access to hard information. This model is the most modern, and paints the most realistic picture of the situation in the banking market today.

I compare the two models within four areas. First I look at how competition is modeled and what impacts this have. Second, I compare the source for profits in the models, i.e. how profits arise in the different environments. Third, I discuss the models' results and the reasons for why they differ, and finally, I look at the realism of the models by pointing at issues and simplifications.

Defining which model is the best fit for giving an answer to my question about how competition influences relationship lending is not straight forward. There are other factors than the distinction of hard and soft information that influence on the banks' business models. The organizational structure of the bank and the structure of the market it which it operates are also crucial determinants when the bank is choosing how to adapt to a more competitive environment. All these elements have to be taken into account when regulating the banking market, and what is beneficial in one market may be harmful in another. This fact points to the importance of extensive knowledge and clear objectives when regulating the banking market.

The financial crisis of 2008 is an example of the consequences increased competition and weaker incentives to do information acquisition in the banking market might have, and it underlines the urgent need to learn more about this.

Preface

This thesis marks the end to my studies at Blindern, a challenging and educational period. I have gained knowledge and made friends for life, and I am looking forward to take it all out in the big world!

When deciding the topic for the thesis, I did not have a clear idea of what I wanted to write about. During a summer internship in Danske Bank, I came to realize how complex banks are, and the great social responsibility that they bear. I was very fascinated by how people worked every day, and how much knowledge they had about their clients and the markets they operated in. My supervisor, Tore Nilssen, convinced me that this could be my topic. He deserves a great "thank you!" for motivation, ideas, questions, corrections, criticism and praise!

Some other people also deserve special thanks:

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Last, but not least, my family and friends have been supportive and motivating throughout the process. I am looking forward to spend more time with you! A final thanks to Josef – the most patient person I know!

Any mistakes that have been made, or inaccuracies that are not accounted for, are entirely my own responsibility.

Oslo, January 2015
Maren Myre Baksaas

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1 Financial institutions, competition and information acquisition

Financial institutions' main task is to efficiently allocate capital in society such that profitable and viable projects, which will increase social welfare, are being realized. Two factors are crucial for this process to maximize social surplus; competition and information acquisition. Efficient competition is wanted in this market as in other markets to maximize consumers' surplus, by giving them multiple choices and market prices. Information acquisition is crucial for lenders to get creditworthy borrowers, but also for those borrowers who would be credit rationed without the possibility to disclose proprietary information to lenders.[1] However, both competition and information acquisition among financial institutions have gone through considerable changes over the last 40 years; changes that have had an effect on incentives, possibilities and decision-making. The liberalization process of financial markets, which started in the 1970s, introduced competition to the sector, after it had been heavily regulated since the crisis in the 1930s.[2] The liberalization consisted of lifting of controls of rates, banking investment activities and geographical restrictions, elimination of compulsory investment coefficients and different financial institutions' activities converged.[3] The recent advances in technological development have contributed further, with globalization of the financial markets as a natural continuation of the process.[4] Moreover, more advanced technology has also given rise to a change in the *nature of information*, which in turn affects the structure of financial markets and the agents' incentives. Acquisition, processing and transfer of information are processes that can be automated, and this has led to a proliferation of transaction-oriented lending. Economies of scale render this type of funding even more profitable and accessible, and both firms and households experience easier access to less expensive capital. But for the borrowers who are dependent on disclosing information to get credit, this might be an unfortunate development, as less proprietary information based lending may deteriorate their access to capital. However, economists still have not been able to fully understand the consequences and impacts that globalization and increased use of transaction based lending will have in the future. The recent financial crisis was an example

[1] By proprietary information I mean information about the borrower that cannot be found in registers or other public collections.
[2] Vives (2010), p.4.
[3] Vives (2010), p. 5.
[4] For a detailed description of how the liberalization process proceeded in Norway, see Krogh (2010).

of the consequences that increased competition may have, and underlines the importance and urgent need to learn more about this.

1.1 Hard vs. soft information

The regulatory changes in financial markets in the 1970s and 1980s led to increased competition and innovation of new financial products. Information technology has facilitated the use of derivative instruments and securitization techniques,[5] and financial products have become increasingly complex. The automation of information processing has changed the structure of financial markets. Personal contact between the parties is no longer necessary, and computers replace human abilities. The consequences are lower transaction costs and rapid information exchange between agents and across borders. But there are certain types of information that cannot be neither collected nor processed by machines, and this is what leads to the differentiation of information about borrowers. In his working paper from 2004, Petersen introduces the concept of "hard" and "soft" information, and gives the following characteristics of the two:

(i) Hard information

Hard information is quantitative information. It is reported as numbers, and is typically financial statements, payment history, stock returns etc. It does not require personal acquisition, and is easy to collect, transmit and store. If such information is collected by a person, it can easily be transferred to another person or a computer for decision making. Hard information is standardized and makes comparisons easy. No interpretation is needed to evaluate a firm's sales numbers or default statistics against the same information from another firm. As technology allows for the process (from acquisition through evaluation to decision making) to be handled by machines and software, and for large amounts of data to be analyzed quickly, more and more information is "hardened". The lowering of costs that this implies makes it simple and efficient to grant loans for the lender and thus easier to get relatively cheap capital for the borrower.

(ii) Soft information

As opposed to hard information, soft information is qualitative information that cannot easily be transformed into numbers. It is often reported as text, and the acquisition of this

[5] Vives (2010), p. 5.

information is personal.[6] Soft information can be opinions, ideas, the management's future plans or the perception about the CEO of the firm (honesty, motivation, incentives, capacity etc.). Soft information is subject to personal interpretation and perception, and the collector of soft information should therefore be the same person as the decision maker, as this information is difficult to transmit. Soft information is time consuming to collect, and often revealed during relationships which are developed over time and multiple interactions between the parties. The acquisition and use of soft information are costly processes that require more resources than the use of hard information.

Before the technological revolution, all information was considered soft information, even if the content was quantitative. The reason is that collection had to be done physically, and once acquired, the information was not easily transferable to others. Banks have historically served as a repository of information about borrowers.[7] Once a lending relationship was established, the bank continued to monitor the borrower, and as they interacted over time and through multiple transactions, the bank learnt more and more about its client. Because having exclusive information about a client is a competitive advantage, the banks deliberately kept the information soft by not publishing it or in other ways making it publicly available. Today's information technology makes the hard information easily accessible, which lowers barriers to entry into the financial markets, and leads to increased competition in markets where the activities are based on hard information. However, banks continue to acquire soft information about borrowers, and the role of banks versus that of bond markets is defined by the banks' superior ability to collect and use this soft information.[8]

I have chosen to focus on banks in this thesis, though there are many types of different financial institutions that all contribute to competition in the market. The first reason for this is the banks' role as "soft information experts", and the second is that competition in banking is different from competition in other markets. Too much competition among banks may threaten financial stability, which in turn may entail great social costs. Competition in the banking market must therefore be handled differently than competition in other markets.

[6] This may be about to change with the social media revolution. People disclose what was traditionally soft information on line, and this information becomes accessible to anyone. The interpretation of this information, however, remains a characteristic of soft information. In the future, this type of information may be viewed as a "hybrid", soft in content but hard in existence.
[7] Petersen (2004), p. 2.
[8] Petersen (2004), p. 3.

Combining the two crucial factors for an efficient allocation of capital - competition in the banking market and the use of information acquisition in these banks – yields the backdrop for the topic of this thesis. I try to explain how the former impacts the latter by presenting two existing models that deliver different results. The distinction between hard and soft information plays a crucial role in obtaining these oppositions, and it is thus tempting to claim that distinction between hard and soft information has not only changed the organizational structure in the financial markets; it has also affected the predictions of economic theory.

1.2 The financial crisis

In this section, I present a simplified analysis of the financial crisis, based mainly on NOU 2011:1. It is not a satisfactory description of the crisis, and several important factors have been left out. The section is however meant to serve as a brief illustration of how increased competition in financial markets can lead to lower incentives for information acquisition and what the consequences may become.

The financial crisis led to the most serious decline in the world economy since the big depression in the 30s, resulting in big financial losses, high rates of unemployment, and government crises around the globe.[9] Now, 6 years later, the economy still has not fully recovered, and economists and other researchers are trying to get the total picture of contributing factors, reasons and consequences to avoid a similar situation in the future. Financial crises have existed as long as there has been financial interaction, and though we do not know exactly how, why or when they occur, certain common features have been identified in an economy in the build up to one:

(i) Powerful economic growth. The growth in the period before a financial crisis has historically been stronger than that before an ordinary, cyclical economic downturn. The increased consumption that economic growth entails leads to an increase in asset prices, lower unemployment and debt and credit growth, for households, firms and governments.

(ii) Deregulations, liberalization and increased competition in financial markets. This leads to more risk taking and innovative and complex ways to make profits.

[9] NOU 2011:1, p. 9

Both these features were present in the years before 2008. The world economy had been through rapid globalization, and the growing interaction between countries had led to an increase in international trade, production and investments. According to IMF, the world economy experienced its greatest growth since the beginning of the 70s between 2003 and 2007. [10] In the wake of the "dotcom-bubble" that burst early 2000, most central banks in western countries had kept low interest rates for a long time, encouraging households to consume, and stimulating to take on debt. Asset prices were increasing, especially bond and house prices. Low interest rates and a high demand for funding increased banks' willingness to grant loans, especially mortgages, and property investments increased. Income and equity requirements were reduced, down payment time prolonged and "interest-only periods" introduced.[11] By innovating new loan products, the banks themselves contributed to the increased demand for credit,[12] and thus their own possibility to gain profits.

One of these "new products" was the subprime mortgage. Banks granted mortgages to households, which under normal circumstances would not be creditworthy, and took collateral in the house. Many Americans took advantage of this opportunity, and from 1996 to 2006, the share of households owning their own house in the U.S. increased from 65% to 69%,[13] while the quality of the borrowers fell considerably. A complex system of securitization had been developed, and loan portfolios consisting of subprime mortgages were sold to big investment banks that again would split and combine portfolios and come up with new products. Because the original banks were not keeping the loans themselves, and because the sellers worked under a beneficial bonus system – rewarding those who sold the most - a thorough due diligence of the borrowers was neglected. The banks thus built up big loan portfolios dependent on a continuous increase in house prices, and resold these to interested buyers, like big investment banks. By granting loans to more people, profits rose.

However, the increase in American house prices flattened out, and eventually began to fall (figure 1). House owners of poor quality, whose only collateral was the house, would walk out the door, leave the house to the bank and get rid of their debt. More and more borrowers were forced to do so, and the banks faced considerable losses, as the houses they now owned did not cover the value of the loans they had granted. Insecurity about the banks' wealth and

[10] NOU 2011:1, p.38
[11] NOU 2011:1, p.50
[12] NOU 2011:1, p. 50
[13] NOU 2011:1, p. 40

losses due to the securitized products rose, and assessing the value of the different financial products became increasingly difficult. And when a bank's wealth is hard to determine, it becomes tough for it to get funding in the market. Skepticism grew, interest rates and risk premiums increased, and the banks stopped lending to each other. This was a paradox, as banks' need for finance from the market had increased with the disappearance of the possibility to get finance through securitization. Governments and central banks had to take action and lowered interest rates and provided liquidity. The problems in the financial sector led to a downward adjustment in the forecast for future international economic growth.

Figure 1. From The Economist Online, 1st December 2010. The S&P/Case-Shiller National Home Price Index measures the change in value of residential real estate on a national level. The 10-City Composite Home Price Index measures the same change in value in 10 metropolitan areas of the U.S. http://www.economist.com/blogs/dailychart/2010/12/house_prices

Banks tightened credit requirements, companies cut production, employment and investments, and the real economic crisis was a fact. Several countries still struggle with high levels of unemployment, governments have had to take on big cuts and focus on deleveraging instead of making investments, and economic growth is low.[14] The crisis also entailed distributional effects, as debt and receivables have changed, and millions of people have lost their income due to unemployment.

What started as a relatively small problem in a limited part of the mortgage market in a limited part of the world, developed into the most comprehensive global financial crisis of our

[14] In France, for instance, the economic growth is predicted to increase only by 0,4% and 0,8% in 2014 and 2015, respectively, and the unemployment is expected to stay at 10% until 2016 when growth is expected to rise. Source: OECD (2014).

time. While systemic factors contributed to accelerating, amplifying and spreading the crisis, the poor quality borrowers were the roots to the beginning of the problems. The finance editor in Aftenposten, Ola Storeng, writes: *"The financial crisis had hardly been possible if it were not for the credit rating companies that for so long, and so wrongly, vouched for irresponsible lending."* Further, he says: *"The financial crisis, with its origins in irresponsible lending within property…".*[15] He blames the lack of credit assessment of the borrowers for the turmoil, and it is plausible to think that it was the fierce competitive environment that had led to the decreasing incentives.

[15] 17th September 2008, The Economics Section, p. 4. This is my own translation from Norwegian.

2 Banks, information and competition

As pointed out in section 1.1, among financial institutions, the focus will be on banks in this thesis. This does however not mean that the analysis is not valid for other financial institutions, and the models may very well be adjusted to fit them too. Banks perform many of the same tasks and provide the same services as other financial institutions and vice versa, but organizational structure and business models may vary. To thoroughly understand the role of the bank and its importance in society, I will give a short explanation of banks and try to describe their most important features, followed by a reminder of competitive and monopoly markets. At the end of the section I put banking and competition together to explain why banking is special in this regard.

2.1 What is a bank?

Banks intervene with individuals, households, small and medium sized enterprises (SMEs), large corporations and governments; basically every economic actor of every size and importance. A bank has several functions in society. Among them are: supplier of credit, information collector and monitor, provider of trust, storage place for money, provider of payment systems, financial systems and consultancy, and conduit for the money policy outlined by the central bank. I will focus on the bank's role as a supplier of credit and information collector and monitor.

The supplier of credit

Without the credit allocated by banks, the economy would lose efficiency. By lending to individual consumers (households), the bank creates flexibility in the economy by making it possible for them to invest in assets like a house or a car, but also by letting them control when and how to buy these goods and services. As the households' consumption accounts for 41% of total GDP in Norway,[16] it is evident that this is an important feature. By lending to small and medium sized firms and helping them to get started, grow and prosper, the bank promotes innovation - another critical feature of a healthy and diverse economy.[17]

[16] 2013-numbers from Finansdepartementet, Meld. St. 1. (2014-2015). Private consumption: 1234,5 billion NOK, total GDP: 3011,4 billion NOK. Table 2.2, p. 26.
[17] According to Nærings- og Handelsdepartementet (2012), p.13, a small and medium sized firm in Norway is a firm with less than 100 employees. In EU, the definition is firms with less than 250 FTEs (full

Historically, SMEs account for a large share of the job growth, especially after an economic crisis. In Norway, 99,5% of all firms have less than 100 employees, and they account for 39% of total value creation.[18] Hence, they are extremely important to a sound economy. Holmström and Tirole (1997) show that with indirect lenders (banks),[19] a larger number of firms, especially those who do not have much equity,[20] are able to get credit than if the indirect lenders were not present. (This result is based on the fact that monitoring may be a substitute for collateral, increasing the firms' incentives to behave diligently.) The banks also lend to large corporations. The largest, global companies often need more credit than a single bank can provide, and thus the banks take part in syndicated loans.[21] And finally, the banks lend to governments by buying government bonds. This way states and governments can get access to the necessary credit to fund public needs and improvements.

The information collector and monitor

Due to asymmetric information - where the borrower knows more about itself than the financial markets do - the bank screens its applicants before granting a loan. The borrowers may also be dependent on the possibility to communicate its plans and visions to get a loan. The bank sorts out what it believes are profitable projects and keeps monitoring the borrower during the lending relationship. It does so to ensure efficiency in the process, and to use this information in a potential renegotiation of the loan. Whenever the term *information acquisition* is being used in this thesis, this is the process I am referring to. This function is one of the bank's most important functions, and Boot (2000) even claims that it is the banks' *raison d'être*.[22]

Consumers are considered risk averse, with a preference for smoothing consumption over time. They want to "store" their surplus money in a safe place,[23] but still have quick and easy access to it in case of liquidity needs. By using a bank, the risk averse savers' preferences are met; the deposits are safe and liquid. At the same time, firms need funds to undertake

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time equivalent), an annual turnover of less than 50 million euros or an annual balance of less than 43 million euros. This definition is also used in Norway in connection with grants financed wholly or partially by EU funds.

[18] Nærings- og Handelsdepartementet (2012), p. 3 and 16.

[19] By *indirect lenders* we mean intermediaries between investors and entrepreneurs who grant loans based on screening and monitoring of the borrower.

[20] The capital poor firms are often the new, young and small firms.

[21] A syndicated loan is a loan where several lenders go together to provide the amount needed.

[22] Reason to exist.

[23] I consider the general consumers as savers, i.e. they deposit money in the bank (as opposed to the firms who borrow from the bank).

projects, usually more than what a single consumer can provide, and of longer maturity. The bank then pools together the deposits to a bigger loan with longer maturity. Many small short-term deposits are transformed into a big long-term loan. This operation is called *asset and maturity transformation.* By placing itself in the middle, creating liquid collateral and committing to make payments, the bank renders productivity enhancing investments possible, improving the overall efficiency in the economy. However, this asset transformation is a fragile feature of a bank and can be reason for bank runs. The combination of high (short-term) leverage and opaque bank assets of long maturity makes the bank vulnerable to systemic impact. At the slightest hint of trouble, risk averse depositors are susceptible to call back their deposits, by the fear of losing it all if the bank becomes insolvent. This may become a self-fulfilling prophecy if more and more depositors withdraw their money. The banks, financed to a large extent by these deposits, may thus find themselves in a situation where they cannot pay their obligations; they have turned insolvent. Even a sound bank can get into trouble this way. And because banks are largely interconnected, they are subject to contagion. One bank's trouble can become the problem of an entire industry, and further a whole society. To prevent such bank runs, most governments offer deposit insurance,[24] securing the consumers' savings placed in the banks. After all, the banks are essential to the economic system, and a melt-down in the bank system will make a modern monetary system stop functioning.

If there were no banks, direct financing would be the only way to invest surplus money, and to get funding for a project.[25] The savers would have to take on the role as investors, searching for profitable projects in which they would want to invest. Searching around is time consuming and finding the "right" project would require expertise. In addition, due to risk aversion, the saver would need to diversify her capital to reduce the risk of losses linked to the investment, hence duplicating the workload that searching implies. Moreover, if the saver finds a project to invest in, she requires a detailed contract to make sure the money will be spent as planned, and that the borrower is actually exerting an effort; thus increasing the probability that the project has a profitable outcome and that the saver gets her money back.

[24] Deposit insurance may lead the banks to take higher risks.
[25] Direct financing is directly between agents, with no middle man to transform assets or maturity, nor take care of the monitoring.

Diversifying the investment then requires multiple, often complex, contracts and a lot of effort to monitor the job the borrowers do. [26]

The *borrower* would have to find a number of lenders to get the necessary amount of money. But even if he did, the maturity on the loans would still be a problem. Investments that are not liquid until maturity is not compatible with the risk averse savers' preferences. Hence, the bank as an intermediary – offering safe and liquid, short-term deposits for the savers and big, long-term loans to the borrowers, eliminating the searching and monitoring costs for the investors, and reducing risk by diversifying its loan portfolio – is economically efficient and socially beneficial because it allocates resources to those who need it, while meeting others' wishes and requirements.

2.2 Relationship lending

In the presence of lending and borrowing, there will always be asymmetric information problems. The borrower has private information about himself and his firm. This proprietary information could be critical to get a loan granted, but the borrower might not want to disclose the information to financial markets, by fear that it could benefit its competitors.[27] By using the bank as an intermediary, the borrower can reveal information that the lender wants and needs, without spreading it out in the market. The bank acquires valuable knowledge about its client, and uses this knowledge to develop the structure and terms for the loan.

When a loan is granted based on information acquisition, this is called relationship lending. According to most theories, relationship lending is first and foremost important for SMEs. By sharing information about their projects with a bank, the bank may believe that the firm will become profitable in the longer run, and grant loans that otherwise would have required equity or collateral. Once the loan is granted, the bank continues to monitor the borrower to make sure he acts as agreed, and that he sticks with the covenants specified in the loan agreement. Hence, the bank learns about its client over time, and they develop a long-term

[26] We might end up in a situation where we have too much monitoring; all the small borrowers that have invested in the same project spend resources on this, or the contrary; every investor relies on the other investors to monitor the borrower (free rider-problem), but this is not a theme here.
[27] Boot (2000), p. 13

relationship. The problems related to the informational asymmetries related to soft information are thus mitigated.

In a larger context, it makes sense to talk about relationship *banking* or *intermediation*, as numerous financial services could be based on information acquisition about the client. [28] The more services that are filled by one bank, the more information it can get about its client. The access to information increases with the scope of the relationship, and it is this access to information that constitutes the bank's comparative advantage over other types of lenders.

While there exists no exact, unanimous definition of relationship banking, Boot (2000) writes the following:

> *" We define relationship banking as the provision of financial services by a financial intermediary that:*
>
> *i. Invests in obtaining customer-specific information, often proprietary in nature; and*
> *ii. Evaluates the profitability of these investments through multiple interactions with the same customer over time and/or across products."*[29]

To refine the definition of relationship lending, I return to the differentiation of information presented in section 1.1. While direct lending relies on hard information like default history, accounting reports and financial disclosures, indirect lending is based on soft information. Despite the increased accessibility to information in general, it is the banks that remain the specialists on soft information. Relationship lending is then when a bank and a borrower enter a loan agreement based on sharing of proprietary information. My aim in this thesis is to investigate whether increased competition threatens or reinforces this role of the bank.

2.3 Benefits and costs of relationship lending

The most obvious benefit from relationship lending is the small and young firms' access to credit, which - as pointed out earlier – is important for economic growth. The extent to which such firms have access to capital is an important measure of the performance of the economy.

[28] E.g. letters of credit, deposits, clearing, cash management etc.
[29] p. 10

Though small and insignificant in the beginning, they may be the "industrial giants of the future".[30] Petersen and Rajan (1994) show that the availability of credit for these firms increases when they can apply for loans based on information sharing. Because such firms are usually not subject to reporting requirements, there might be large information asymmetries between them and potential investors. The investors do not know the firms, the management or the investment opportunities for the firm, but a close relationship to a bank changes that. By establishing relationships and exchange information, informational asymmetries are alleviated, and frictions in the flow of capital are reduced. The longer the duration of the relationship, the less risky will the lender consider the loan. It knows that the borrower is trustworthy and that its investment projects are viable. This will further increase access to funding for the borrower.

With information sharing, the bank may also want to subsidize the firm in the start-up period. When young, a firm may have zero, or even negative, current profitability, and zero collateral. However, the project it engages in may be considered viable and profitable in the longer run, and expected future profits may be high. Knowing this, the bank can "subsidize" firms by grant favorable loans, anticipating a share of the future surplus through the future rents it is able to extract, which can make up for the losses it takes in the beginning.[31]

Another benefit is the contractual features that relationship lending entails. Boot (2000) writes that mutual trust and respect between the parties entail discretions and flexibility, which may give rise to implicit long-term contracting, producing value unattainable through other means. It becomes easier to be flexible in terms of renegotiation of contract terms, for example. This can increase the effectiveness of covenants and collateral. Stringent covenants can be included in the original contract because both parties know that if these turn out to be unreasonable later - at the arrival of new information - they can be renegotiated. As for collateral, the theoretical literature has shown that moral hazard and adverse selection problems can be alleviated if the firm has own value at stake.[32] However, to be efficient, the use of collateral requires monitoring, and with relationship lending, the bank will be an agent willing to do this.

[30] Petersen & Rajan (1994), p. 5
[31] Boot (2000), p. 15
[32] Boot (2000), p. 14

A final benefit is that the monitoring, to which the relationship lending exposes the borrower, may serve as a certification device, making it easier for the firm to get other funding simultaneously. There is thus a complementarity between relationship lending and capital market funding. [33]

Relationship lending might instinctively appear purely beneficial, but there are some costs related to it. Boot (2000) discusses two factors that may have a negative impact. The first is the soft-budget problem that can lead the firm not to exert its very best effort from the beginning. If it is on the verge of bankruptcy, it might turn to a lender to ask for more credit, hoping to restore business and avoid bad outcomes. Where a new lender never would accept to grant such a loan, the incumbent lender may accept, hoping to get some of the previous loan recovered. However, knowing this ex ante may lead to a moral hazard problem for the borrower, as it knows that ex post, it will be better for the lender to extend credit than not to.[34]

The second cost addressed is that of the hold-up problem. When the bank acquires proprietary information about the borrower it may get an information monopoly, and be able to charge higher loan rates than if the information was of a different nature. The borrower might get locked in, and this can make her reluctant to borrow from the bank in the first place. Multiple lending relationships can mitigate this problem, but this in turn will worsen the availability of credit.[35]

2.4 Information and bank structure

The use of information - and whether it is hard or soft - and the organizational structure of the bank influence each other. Stein (2002) argues that bigger, more hierarchical banks rely more heavily on hard information than smaller banks, as the decision maker is located further away from the information collector in the organizational structure. In such cases, decisions have to be made based on easily transferable, standardized information with a uniform interpretation; hard information. The use of hard information allows a more impersonal communication between the bank and the borrower, and it will be easier for the larger banks, which rely on

[33] Boot (2000), p. 8
[34] Granting seniority to the lender might reduce the problem, as a threat to call the loan becomes more credible.
[35] Von Thadden (1995) shows another way to alleviate this problem, by establishing a long term line of credit, but with a termination clause. Then a lender can terminate a lending relationship, but if it wishes to continue it, it must do so at prespecified terms.

this type of information, to lend to more distant customers. In such a big bank, the incentives for acquiring information might also be weakened as the information collector may face a situation where the decision makers have a different opinion about where the capital should go, and allocate the resources to a different borrower and a different project. Knowing this ex ante, the information collector will not put the same effort in the information acquisition process as if he knew for sure that there would be capital to allocate to the applicant he assessed. In smaller banks, there is a shorter way between the information collector and the decision maker, and they can therefore to a larger extent rely their decisions on soft information, which is beneficial for the small and young firms. If for some exogenous reason (geography or the competitive situation) a small firm is forced to borrow from a big bank, it will most probably be credit rationed, because it may be dependent on being able to transfer information to even get a loan, or to get the best possible loan terms. Much of this credit rationing could be alleviated if the firm could choose a smaller bank.

In addition, access to capital relies on informational transparency. While big firms and corporations report and keep track of their business numbers automatically, this information is not necessarily very easily accessible from smaller firm. Hence, they are particularly dependent on financial intermediaries to alleviate these informational asymmetries.

2.5 Competition vs. monopoly

Competition in markets leads to efficiency, lower prices and innovations. The ideal situation and reference point in economic theory is the perfect competitive market, a market in which buyers and sellers have no impact on prices. The firms competing in a market will always attempt to reduce their costs, increase the quality of their product, or introduce new products to gain competitive advantage. Consumers will face multiple choices, and buy from the producer that offers the best price. Market prices are determined, and production and allocation efficiency are achieved. The opposite of a perfectly competitive market is a monopoly, a market in which the sole producer maximizes profits by determining the production quantity and the price of the product he produces. The result is higher prices and smaller quantities than what perfectly competitive markets would have entailed.

While widely discussed in economic theory, perfectly competitive markets do not exist in reality. It is a theoretical concept we use to describe the most desirable situation, yielding the

biggest possible social surplus. There will always be noise that disturbs one or several of the factors necessary for a perfectly competitive market. Pure monopolies are also rare, as most countries have established authorities to monitor and regulate monopolies and enhance competition. This is why most economies today are a mix of market and state economies; the state intervenes in the market to improve non-favorable situations, in an attempt to bring the market as close to perfect competition as possible by using policy instruments and rules of redistribution. The goal is to maximize consumers' welfare. Because – as already mentioned – perfectly competitive markets are the most beneficial to the consumers, competition policy aims at maximizing social welfare by minimizing the deadweight loss caused by monopolies.[36] There are however situations in which it might be favorable to have one sole or very few producers. It can be for reasons of economies of scale, or because high profits may encourage investment and risk-taking.[37]

2.6 Banking and competition

Competition in banking is desirable and beneficial for efficiency and maximization of total welfare. These arguments are derived from standard economic theory, in which the increased welfare from competition arises from lower loan rates (prices) and a larger loan volume (quantity).[38] But because of banks' very special structure, functions and the impact a failure may have on the entire society, there are some concerns that must be addressed in the banking market that do not require the same attention in other markets. It is important to ensure stability in financial markets, as bank failures and financial instability can lead to important social costs. In addition, many bank products are characterized by asymmetric information and implicit risk sharing arrangements, which also complicate the picture.

Up until the 1970s, the banking market was characterized by tight regulations, interventions and stability.[39] But competition and antitrust policies developed during the last half of the 20th century, and with the idea that competition enhances efficiency, the liberalization also reached financial markets. This liberalization indeed did increase the competition among banks, leading to financial development and output growth, but it also led to more instable markets. The liberalization took place by removal of restrictions and rules, and barriers to

[36] The deadweight loss is the difference between total surplus and monopolistic surplus.
[37] Risk-taking can be a positive feature if it leads to innovation and daring investments.
[38] Fischer (2000)
[39] Vives (2010), p. 4

entry were alleviated. This made it possible for banks to enter new markets, both geographical markets and product markets. They could use their fantasy and creativity to invent new products and ways to engage in gambling activities to make profits. But another important factor that has increased the competition is the advance in information technology. It has become increasingly easier to find and collect information. Not only has the competition *between banks* become fiercer, they now also face competition from other financial intermediaries.

Competition in banking can influence stability in several ways. The most evident is banks' willingness to take risks. When competition increases, each bank's market share is reduced; hence the charter value of the bank is reduced as well. [40] This may lead to a moral hazard problem for the bank, where it might act less prudent when investing its loan portfolio, because the values at stake are smaller. Put otherwise: because competition erodes profits, it will encourage banks to gamble when making investments. As several changes in prudential regulation have occurred - opening up for competition in the financial markets - financial crises have become more frequent. [41]

Competition in banking needs to be controlled. It requires policies and regulations. However, these regulations do not come without side effects. Deposit insurance and using the central bank as the lender of last resort are two instruments on which the banking system rests. They are put in place to avoid bank runs and systemic failures if banks are put out of business. However, knowing that it bears no downside risk, the bank continues to face moral hazard problems. It can take chances it would not have taken otherwise, and is encouraged to gamble and potentially gain large profits, as if it succeeds, it does not need to share the profits with anyone. The incentives for the bank to offer good loans by screening and monitoring its borrowers are weakened, and this, in turn, leads to a higher probability that bad quality borrowers get credit. The regulators, on their side, face problems of time inconsistency. They may, ex ante, say that they will not help if the bank fails, while ex post, it may seem optimal to help after all.

One way of mitigating banks' risk loving behavior is to impose capital requirements. When banks are obliged to use a certain amount of own capital when making loans, the adverse effects of gambling are internalized. This encourages more prudent investments. "Capital

[40] A bank's charter value is the capitalized value of expected future profits.
[41] Hellmann et al. (2000)

requirements reduce gambling incentives by putting bank equity at risk", as stated in the abstract in Hellman et al. (2000). However, capital requirements alone are not sufficient to obtain the wanted behavior by banks. They could be tempted to increase the interest rate on deposits, attracting depositors and win market shares. To enhance the efficiency of the deposit insurance, it could be combined with deposit rate ceilings. The cost of holding own capital must then be sufficiently high to reduce banks' willingness to pay high deposit rates. [42]

A lot of research has been done on the optimal level of competition in banking markets. There must be a balance between efficient competition that benefits the consumers and the possibility for the banks to make profits. A future higher profit will moderate banks' risk-taking because banks with some market power have a higher charter value, and thus more to lose if it fails. Hence, the incentives for screening and monitoring borrowers are stronger; to make sure they are of good quality. So when regulating the banking sector there is a welfare trade off that must be considered – a certain market power that reduces the risk taking behavior of the bank but might lead to higher prices of credit, vs. competition that lowers prices but may cause instability. According to the existing literature, there is no "conventional wisdom regarding the optimal market structure of the banking industry or the desired nature of bank competition".[43]

2.7 Relationship lending and competition

Building a relationship over time allows the bank to intertemporally and cross-sectionally reuse the information it has gathered, which has certain advantages: (i) it does not have to devote resources to gathering the same information one more time, and (ii) it knows its client and the client's needs, wishes and capabilities, and can therefore customize loans and other services that will benefit both parties.

The existing literature delivers various answers to how increased competition in the banking market impacts relationship lending. Intuitively, it would be natural to anticipate a negative correlation between interbank competition and relationship lending. It is both time and resource consuming for the bank to create long relationships with clients, and with a larger number of banks capable of doing so, the client will always face many offers, and the

[42] With this combination of regulations, Hellman et al. (2000) show that any Pareto efficient outcome can be realized.
[43] Yafeh & Yosha (2001), p. 63

expected lifespan of a relationship is shortened, hence its value reduced. A lower relationship value erodes future profits, and banks devote fewer resources to relationship lending. Petersen and Rajan (1995) show that if a firm is located in a competitive bank market, it is approached more often by different banks with different offers than a firm located in a less competitive bank market.[44] The free rider problem may also be enhanced under competition. As outside lenders can observe what other lenders and firms do, they can offer better terms to the borrower, without doing the screening themselves. They free ride on the incumbent lender's screening effort. This lowers the incentives to devote resources to screening, as possible profits are reduced.

A complementary negative effect of shorter relationships due to more competition is that subsidizing young and new firms becomes difficult. There are two reasons for why this strategy is tough to conduct in a competitive bank market. With many players, the banks must charge market rates, and cannot charge neither lower nor higher interest rates than its competitors. This would either attract or chase all borrowers in the market, respectively. As a consequence, intertemporal prizing, where the borrower pays interest "by ability",[45] is not possible because the bank needs to break even on a period-by-period basis. "This can be extremely distortionary to the firm's incentives and may, in fact, result in the firm not receiving credit at all", as stated in Petersen & Rajan (1995), p. 408-409. The other reason that makes intertemporal sharing of surplus difficult under competition is the fact that the bank does not know how long the borrower will stay with it. Under competition, the turnover in the banking market is high, because the borrowers regularly face new offers, and switching costs are low.[46] Borrowers change lenders more frequently. If the bank does not expect the relationship to last very long, thus not being able to enjoy a share of the future rents, it will not grant a loan to a firm that will not be able to repay within a certain, short time frame. Not knowing whether it will be able to extract future rents from the relationship, the bank will not be willing to grant cheap and favorable loans to young lenders. This may have unfortunate consequences, like reduced investments and efficiency losses.

In a monopoly situation, however, this is obviously not an issue, and it may actually be easier for small, de novo lenders to obtain credit in a more concentrated market. Empirical studies

[44] This tendency is especially strong for older and established firms, as their existence in itself is a proof of viability and a positive payment history.
[45] The loan can be cheap in the beginning, when the firm is young and financially constrained, and become more expensive as the firm grows profitable.
[46] Included in switching costs are searching costs, transaction costs etc.

(Petersen & Rajan (1995), Fischer (2000), Yafeh & Yosha (2001), Ogura (2007)), have shown that, in relatively small and concentrated markets, relationship lending, based on soft information acquisition, is a dominant form of financing, and banks and firms form close ties.[47] A bank with market power may also serve to mitigate the moral hazard problem of the entrepreneur. Because market power enables the bank to extract profits from a surplus created from monitoring, the incentives to monitor are high. Market power thus acts like an implicit equity stake,[48] and the incentives to engage in an inefficient project are mitigated for the borrower. In bigger and more competitive markets, transaction based lending, based on hard information, has a much stronger position.[49]

My purpose with this thesis is to investigate the relationship between competition and relationship lending, and how the former impacts the latter. However, it is worth mentioning that one might also turn this issue around, and ask how relationship lending affects competition. As an incumbent bank will have more information about its borrowers than an outside bank trying to enter the market, there is a likely effect that this will deter entrance for the latter. Banks can use this fact strategically, and it has been argued that banks invest in information acquisition to deliberately impede entrance from new banks. In a concentrated market with already established, close ties between banks and borrowers, this effect may perpetuate itself, and enhancing competition may be difficult.[50]

But there is also a view in the literature that increased interbank competition may increase the amount of relationship lending, by increasing the value of information. This view requires that hard information is separated from soft information. Because banks are the experts in soft information acquisition, it might be exactly this that becomes their competitive edge in a world with increasingly fierce competition. In this situation, the prices are driven to a minimum, so the banks do not make much profit on interests, and must therefore find other ways to attract customers. Establishing relationships with deep knowledge of the firm and its operations can make the bank unique to the borrower, and this may be the competitive advantage necessary for the bank to win over other funding options.

[47] Examples of such markets are the German and Japanese credit markets.
[48] Fischer (2000), p.8.
[49] Examples are U.S. and U.K. markets. However, relationship lending is perceived as an essential feature of small business finance also in these markets, and despite the increasing globalization.
[50] For instance by reducing regulations or other reforms.

3 The theories

To illustrate the implications of two different information types, I present two theoretic models that each tries to explain what happens to relationship lending when bank competition increases. The first model is presented in Chan et al. (1986), and I name it "the negative model" based on the result it delivers on how relationship lending is affected. When competition increases, the bank devotes fewer resources to information acquisition. The second model is presented in Karapetyan & Stacescu (2014). They distinguish between hard and soft information, and the result is that increased competition increases the banks' effort to gather *soft* information, and relationship lending increases. Hence, I name this model "the positive model".[51] I sketch the framework of the models, and sum up the results. Calculations and proofs can be found in the articles, and is therefore not presented fully here.

3.1 The negative theory

As mentioned in section 2.7, the most intuitive relation between competition and relationship lending is that increased competition leads to less relationship lending due to a higher degree of turnovers in the banking market. Shorter relationships impede the possibility to reuse information, and this assumption is the building block in this model from Chan et al. (1986).

3.1.1 The reusability of information

With more players in the game, the information the bank has about its clients loses value, because it is likely that other banks soon will have access to the same information. The bank becomes reluctant to devote resources to collect information, as future surplus is reduced. Chan et al. (1986) therefore use the *reusability of information* as a proxy for the degree of competition. The higher the degree of reusability, the lower the degree of competition, and vice versa. However, increased competition may also influence the bank's future profits through other channels; by reducing the spread between the interests on the banks' liabilities and the rates it can charge on its loans, or by increased prices on deposit insurance.[52]

[51] The word "positive" in this context has no connection to "positive" in the context of positive vs. normative.
[52] The bank's only liabilities in this model are its deposits.

The authors investigate the banks' reduced possibility to reuse information in the wake of the many bank failures that took place in the U.S. in the 1980s. The media had at the time drawn a picture of the banks as innocent victims of deregulations and liberalization of the market. Chan et al. however, claim that the banks themselves had to take on some of the responsibility for why this increase in failures emerged, and that lack of information acquisition from the banks' side played a decisive role. The claim that less due diligence reduced the quality of the borrowers, which eventually led banks into bankruptcy. This claim is similar to that of Ola Storeng in 2008 (see section 1.2), and the similarity between the two statements makes the model interesting and relevant, though it is quite old.

There is a positive correlation between the degree of reusability of information and the size of the surplus that the bank can extract from having information about the borrower. This expected informational surplus constitutes the incentive to *ex ante* screen applicants to find good profitable projects to invest in. Two criteria must be met for the information to be reusable:

(i) Durability. With durable information we mean information that does not lose value over time – it is as informative in period 2 as it was in period 1.[53]

(ii) Solvent lenders. Due to moral hazard problems, the information is non-transferable. Hence, having durable information is worthless unless you actually have the means to make a loan.

Screening applicants to collect reusable information is costly. However, if the bank anticipates high informational rents, it will devote resources to this, expecting that it will yield a greater payoff in later periods.[54] Once having collected the information, the bank can use the informational advantage to either charge lower interest rates than its competitors (we will see this in the next section), or to extract the surplus. It is the latter alternative Chan et al. pursue in their model; the bank's object is to maximize the profits. The authors' arguments are as follows: increased competition in the banking market will reduce the information's degree of reusability and lead to less information acquisition and relationship building between banks and their clients. This will in turn reduce the quality of the borrowers, which may lead to bank failures.

[53] "We refer to information about a borrower as durable if it continues to inform through time, i.e. if its temporal rate of decay is small", Chan et al. (1986), p.244
[54] The screening will lead the bank to assets of higher quality, with higher probabilities of repayment.

3.1.2 The model

Chan et al. (1986) consider a bank and a continuum of borrowers over three periods, $t = 0, 1, 2$. At $t = 0$, the bank obtains a certain amount of dollars in deposits and make loans to borrowers. There are two types of borrowers: good-quality borrowers and bad-quality borrowers. The good-quality borrowers repay their loans at $t = 1$ with varying probabilities, while the bad-quality borrowers always default. Then, at $t = 1$, the bank makes new loans to those who repaid.[55] No new borrowers enter the game at this stage.[56] At $t = 2$, a fraction of the good-quality borrowers who got granted a loan at $t = 1$ repays. The timeline of the bank's actions (figure 2):

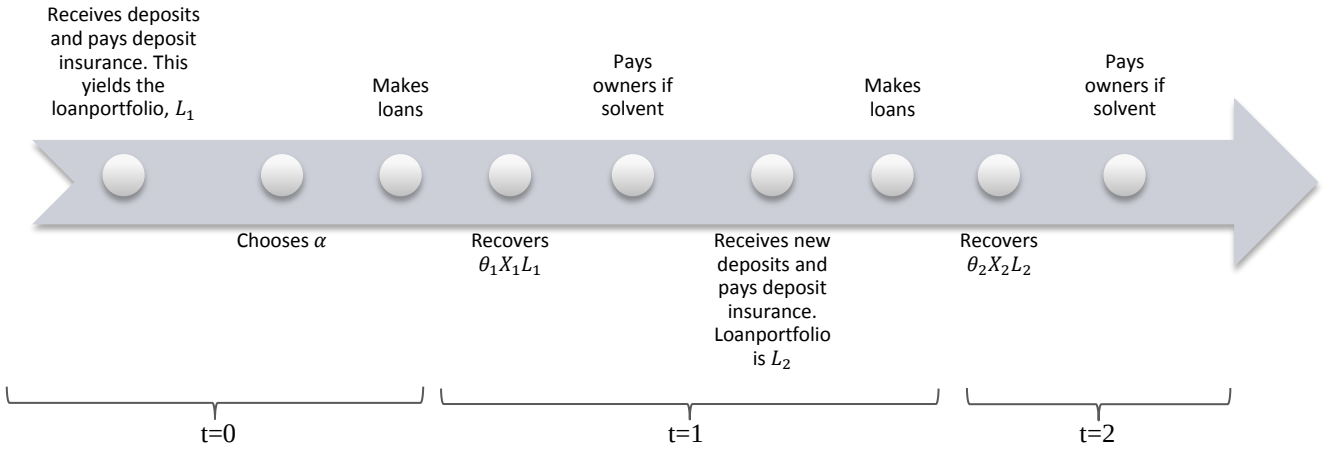

Figure 2. The timeline of the bank in the negative model.

Let D be the amount of dollars of deposits the bank obtains. The deposits are insured by insurers at a price p per dollar, paid by the bank at the beginning of each period. The deposits are the bank's only funding, and constitutes the amount it is capable of lending. At $t = 0$, the bank's loan portfolio is thus $L_1 = D(1 - p)$. The rate paid on these deposits is a single period, riskless rate, r. The good-quality borrowers repay with unknown probability at $t = 1$. Ex ante, the type of the borrower is unknown, but the bank can screen the applicants to try to distinguish the good from the bad. The efficiency of the screening is given by α, $\alpha \in (0, \overline{\alpha})$. The more the bank screens, the more accurately it can predict the borrower's type. If it does not screen at all, $\alpha = 0$, and the bank gets no additional information about the borrower. Perfect screening, $\overline{\alpha}$, which would make the bank able to predict the borrowers' type with

[55] The borrowers who defaulted in period 1 exit the game.
[56] This is a simplifying assumption to focus on the reusability, avoiding the issue of how new applicants are screened.

certainty, is however not possible because of the costs of screening, given by $V(\alpha)$, where $V'(\alpha) > 0$, and $V''(\alpha) > 0$.[57] As there will always be some noise, perfect screening, $\overline{\alpha}$, would be prohibitively costly.

The fraction of good borrowers that repays in the first period is given by θ_1, a random variable with cumulative distribution function $F(\theta_1, \alpha)$, that is, contingent on bank's choice of screening. The cdf is declining in α. With time, the borrower's type could change, implying that repayment in the first period does not necessarily imply repayment in the second period. This assumption reflects the durability of information. If the information about the borrower is durable, the likelihood that her type changes from period one to period two is small. Greater durability then in turn implies that the fraction of borrowers repaying their loans in the second period, θ_2, will increase. The latter variable has cdf $G(\theta_2, \beta)$, where β indicate the durability of the information. Higher β indicates higher durability, so that if $\beta_1 \geq \beta_2$, then $G(\theta_2, \beta_1) \leq G(\theta_2, \beta_2)$, that is, the higher the durability of the information, the less likely it is that the borrower changes type, and the higher becomes the fraction of repaying borrowers in $t = 2$. Hence, the probability that the borrowers default decreases.

The bank charges principal plus interest on every dollar lent. This is a positive scalar X_1 and the same for all borrowers. The bank's interest spread is then $X_1 - r$. We assume that the bank is in a position where it can dictate the rate charged on the loans it makes, hence it has market power on the loan side. On the deposit side, however, it has to accept the rates determined in the market.[58]

After having received deposits and made loans at $t = 1$, the bank recovers an amount of $\theta_1 L_1 X_1$ dollars. For the bank to be solvent, this amount must be sufficiently high to repay depositors, i.e. $\theta_1 L_1 X_1 \geq D(1 + r)$. If this is not the case, the deposit insurance repays the depositors, and the bank is declared insolvent. The process terminates. This happens if $\theta_1 \leq \theta_1^*$, where

[57] Screening is financed with bank equity, not deposits. We assume that the insurer cannot observe α or the screening expenditure, as this could lead to dictation of the level of α.
[58] In a competitive environment, one might argue that a bank cannot earn monopoly rents on loans. However, the assumption is here done deliberately as a certain degree of market power is a good starting point when we want to investigate what happens when competition increases.

$$\theta_1^* = \frac{(1+r)}{X_1(1-p)} \tag{1}$$

θ_1^* is the minimum level of repaying borrowers there has to be at $t = 1$ for the bank to be able to continue the process. Given that the bank is solvent, it pays its owners a dividend, $\theta_1 L_1 X_1 - D(1+r)$.

At $t = 1$, the bank extends $\theta_1 X_1 = L_2$ dollars of second period loans, i.e. it extends credit to those who repaid. To be able to do this it needs $\frac{\theta_1 L_1}{(1-p)}$ dollars of deposits,[59] for which it charges interest factor X_2, and the process from the first period is repeated. At $t = 2$, the bank then recovers $\theta_1 L_1 \theta_2 X_2$ and has to repay $\frac{\theta_1 L_1 (1+r)}{(1-p)}$ to its depositors. As in period 1, the bank is insolvent if $\theta_2 \leq \theta_2^*$, where

$$\theta_2^* = \frac{(1+r)}{X_2(1-p)} \tag{2}$$

Given solvency, the final payoff to the owners is

$$max\left\{0, \theta_1 L_1 \theta_2 X_2 - \frac{\theta_1 L_1 (1+r)}{(1-p)}\right\} \tag{3}$$

Now, the bank's maximization problem is to choose the level of screening, α, to maximize the expected discounted value of total payoff to the owners. Define $\Pi_1 = \theta_1 X_1 - \frac{(1+r)}{(1-p)}$ and $\Pi_2 = \theta_2 X_2 - \frac{(1+r)}{(1-p)}$ where Π_1 and Π_2 are profits to owners in period 1 and 2 respectively. The objective function then becomes:

$$\begin{aligned} \max_{\alpha \in (0,\overline{\alpha})} J \equiv \frac{L_1}{(1+r)} \Bigg\{ & \int_{\theta_1^*}^{1} \Pi_1 dF(\theta_1, \alpha) \\ & + \frac{1}{(1+r)} \int_{\theta_1^*}^{1} \theta_1 \, dF(\theta_1, \alpha) \int_{\theta_2^*}^{1} \Pi_2 dG(\theta_2, \beta) \Bigg\} - V(\alpha) \end{aligned} \tag{4}$$

Differentiating (4), setting the solution equal to zero and solving for α, yields the first order condition for the optimal level of screening, α^*. To do comparative static analysis on this

[59] Because $D(1-p)$ now has to equal $\theta_1 L_1$.

optimal solution, Chan et al. (1986) partially differentiate the first order condition with respect to the various parameters, which generates the following results:

(i) $\frac{\partial \alpha^*}{\partial \beta} > 0$, (ii) $\frac{\partial \alpha^*}{\partial r} < 0$, (iii) $\frac{\partial \alpha^*}{\partial X_1} > 0$, (iv) $\frac{\partial \alpha^*}{\partial p} < 0$

These results can be interpreted as follows:

β expresses the durability of information. In this model, high durability of information means that the information does not lose value over time, and is thus reusable. The correlation between durability and reusability is positive, meaning that the more durable the information the easier it is to reuse it. Monopolist banks have more to gain from reusable information than banks in competitive markets because they do not lose borrowers to outside banks and can reuse the information about *all* their borrowers. Non-durable information, i.e. information that is no longer valid, is never reusable, even if the bank is a monopolist, because it does not add any additional knowledge about the borrower. Increased durability means in practice that the likelihood that the borrower switches type between periods is low and the prediction about the borrowers in the second period becomes more precise. Then the bank can increase the fraction of repaying borrowers in $t = 2$, θ_2, and this, in turn, increases profits in the end. The increase will be bigger for a monopolist bank than for a bank in a competitive market. It pays off at the margin to increase the optimal level of screening when the informational durability increases, and more so for the monopolist than for a competing bank. The durability of information can be interpreted as indirect parameter for competition, assuming that increased durability yields increased reusability, and a high degree of reusability means that the market is concentrated, for reasons discussed above. Therefore, increased competition in the market can be represented by a decrease in β, yielding a lower α^*.

r, X_1 and p are all parameters that are directly influenced by the competition in the market. r is the one-period risk-free rate that the bank has to pay its depositors. An increase in this rate is associated with increased competition in the market, because with many players, banks will have to increase it to attract the depositors it needs. The depositors will always go to the bank that pays the highest deposit rates.[60] However, paying higher deposit rates will have a

[60] Under perfect competition, the deposit rate will have to be the same between the banks, because a higher bank would lose all its depositors if it paid a lower deposit rate than other banks. Because there is no perfect competition in the banking market, these rates do however vary.

negative impact on the expected total payoff to the owners, and the bank will then have to cut down on the resources devoted to screening. Increased competition represented by a higher r, will then lower α^*, ceteris paribus.

X_1 is the rate the bank charges on the loans it makes. Borrowers will usually prefer a low X_1,[61] so increased competition among the banks will lead to a reduction of this parameter, to attract or keep borrowers. When X_1 decreases, so does the spread between this rate and the interest rates the bank has to pay to its depositors, $X_1 - r$, and profits fall. As with a higher r, the bank will have to cut down on the resources devoted to screening. Increased competition represented by a lower X_1 will lower α^*, ceteris paribus.

p is the price the bank has to pay for the deposit insurance. If interbank competition increases in terms of the number of banks in the market, so does the demand for deposit insurance, and the insurers raise the prices to increase their profits. Again, this affects the bank's final profits in a negative way, and it will be left with fewer resources to spend on relationship lending. Increased competition represented by an increase in p will lead to a lower α^*, ceteris paribus.

3.2 The positive theory

This model is presented in Karapetyan and Stacescu (2014) and is based on previous work by von Thadden (2004) and Hauswald and Marques (2006). The model is a principal agent model of asymmetric information with screening possibilities for the principal.

As argued all the way through this thesis, information acquisition is the banks' specialty, their comparative advantage, and their source for making profits. But with today's information technology, "everyone" has access to information, and some of the banks' comparative advantage is lost. But the easy access to information is limited to hard information, as described in section 1, and this is why soft information has come to play an increasingly important role for the banks. Getting proprietary knowledge about the borrower has become their exclusive domain. Not only are the banks willing to collect information to attract clients, they may also use the advantage of already knowing borrowers to keep them away from the rival banks when the access to (hard) information increases for others, by offering customized services and products.

[61] In some cases, other things are more important for the borrower than the price when choosing a bank. It could be other services, customized products etc.

3.2.1 Information sharing institutions

One way hard information can be more accessible to the public, is by the presence of rating agencies, credit bureaus etc. These institutions were established with the objective of alleviating the asymmetric information problems between borrowers and lenders by collecting and spreading financial and risk information about agents. At the time of their emergence, the purpose was to facilitate trade over geographical distances, while today, they allow both borrowers and lenders to go directly into the capital market. By doing so, a costly intermediary can be cut. Karapetyan & Stacescu (2014) use the presence of such institutions in society as a proxy for competition in the banking market. They compare two different situations, one in which there are no information sharing in the market, and one in which this kind of institutions are present. Information sharing institutions pose a threat to the traditional bank-role because they are capable of offering many of the same services that traditionally were reserved to banks. Increased sharing of information thus represents increased competition.

3.2.2 The model

Karapetyan & Stacescu's model consists of two banks and a continuum of borrowers that interact over two periods. The banks compete in interest rates offered to the borrowers. The information that the bank has about the borrower determines which rate they offer. Some groups of borrowers are more attractive to the bank than other groups, and to these groups, the bank wants to offer an interest rate that is lower than that of the other bank. Simultaneously, the bank wants this rate to be as high as possible, because this is where it can make profits.

There are two types of borrowers, good-quality borrowers and bad-quality borrowers, labeled $\overline{\theta}$ and $\underline{\theta}$, respectively. The good-quality borrowers have a higher probability of success than the bad-quality borrowers, whose probability of success is zero. Success means that the borrower's project yields a payoff, R, and she repays her loan. The probability that the good-quality borrowers succeed is p, $0 < p < 1$, and the probability that they fail is $(1 - p)$. The fraction of good-quality borrowers in the population is λ and the fraction of bad-quality borrowers is thus $(1 - \lambda)$. This fraction always defaults, yielding zero profit. [62] The borrowers borrow the total amount for the investment, I. The discount factor between the

[62] The same type of borrowers invest in identical projects, yielding identical profits.

periods is 1 for simplicity. The success probabilities for each type of borrower and the distribution of the borrowers' type are known, but borrowers do not know their own type.

In period 1, there is no asymmetric information between the banks, and as a result they offer the same interest rates to all borrowers. However, during a loan relationship, the bank learns about its borrowers, through monitoring, interaction and/or communication, and when period 2 arrives, the incumbent bank has more information about his clients than what the outside bank has.

The monitoring in period 1 results in a signal, η, about the borrowers' type. This is only an indication, of varying quality, depending on the level of monitoring, the quality of the monitoring etc. The quality of the signal, i.e. how precise it is, is given by φ:

$$\Pr\left(\eta = G \middle| type = \overline{\theta}\right) = Pr\left(\eta = B \middle| type = \underline{\theta}\right) = \varphi > \frac{1}{2} \tag{5}$$

$$\Pr\left(\eta = G \middle| type = \underline{\theta}\right) = Pr\left(\eta = B \middle| type = \overline{\theta}\right) = 1 - \varphi \tag{6}$$

where G=good signal and B=bad signal.

The interpretation of (5) and (6) is that the probability that the monitoring results in a good signal when the borrower actually is of the good type equals the probability that the monitoring results in a bad signal when the type actually is of the bad type, and this probability is greater than the probability of observing a good sign when the borrower is of bad quality or a bad sign when the borrower is of good quality. So with $\varphi > \frac{1}{2}$, the accuracy of the sign, i.e. its ability to predict the feature of the borrower in a precise manner, is greater. φ can be called the "informativeness" of the signal. Obtaining a signal is costly for the bank, and a function of the quality; $C(\varphi)$. $C(\varphi)$ is increasing in φ. The higher quality the bank wants the sign to have, the more costly it is to obtain it.

At the end of the first period, the incumbent bank knows whether the borrower has defaulted or not (hard information), but in addition, it has spent resources on obtaining a signal about its borrowers. The goal is to use this signal to distinguish between the different types of borrowers in the next period, so that it can offer adjusted interest rates and this way attract the borrowers it wants, i.e. the borrowers that can generate profits in period 2. The incumbent has enough information to divide its borrowers into three groups:

1) DB: Defaulters who have generated a bad signal. These borrowers rank the lowest and should have the highest interest rates in the next period, if at all they are creditworthy.

2) DG: Also defaulters, but who generated a good signal in the first period. These are creditworthy borrowers, but should still have to pay higher interest rates than the non-defaulters.

3) N: Non-defaulters. Whether these borrowers generated a good or a bad sign does not matter; they are under all circumstances borrowers of good quality.

There is a break-even interest rate, $\overline{r}_i$, for each borrower group, such that the bank breaks even. Subscript i denotes the borrower group. When the bank lends an amount I to a borrower, this interest rate is given by

$$\overline{r}_i \lambda p_i = I \implies \overline{r}_i = \frac{I}{\lambda p_i} \qquad (7)$$

where p_i is the success probability of borrower group i,[63] and λ is the fraction of good quality borrowers.[64] The higher the success probability, the lower the interest rate. Because the success probability is positively correlated with the borrower's type, the good types face lower interest rates than the bad types. In addition, if the fraction of good types in the population increases, the all-over break-even interest rate will fall.

The authors assume $p_D R > I$, i.e. it is efficient to grant loans to defaulters in the second period. This is because the group of defaulters consists of both high and low quality borrowers, and one assumes thus that the overall capability of repayment in the group is sufficiently high to recover the amount of loans the bank has made. However, we establish a minimum level of monitoring, $\underline{\varphi}$, defined such that $p_{DB} R = I$. This is the lowest level of monitoring that yields creditworthy borrowers. The explanation is that more thorough monitoring will yield better signals, and the bank will - with a higher degree of certainty than at a lower level of monitoring – be able to determine the borrower's type and thus her success probability. So if monitoring exceeds this certain level, $\varphi > \underline{\varphi}$, the lowest ranked group of

[63] For instance, p_{DG}=the success probability of a defaulter that has generated a good sign.
[64] Remember that the bad quality borrowers always default, while the good quality borrower may default *or* succeed.

borrowers is no longer creditworthy. Karapetyan & Stacescu (2014) show that in this case, the bank will choose not to lend to these borrowers, as it will yield zero profit.

The timeline of the game gives an overview of the process (figure 6):

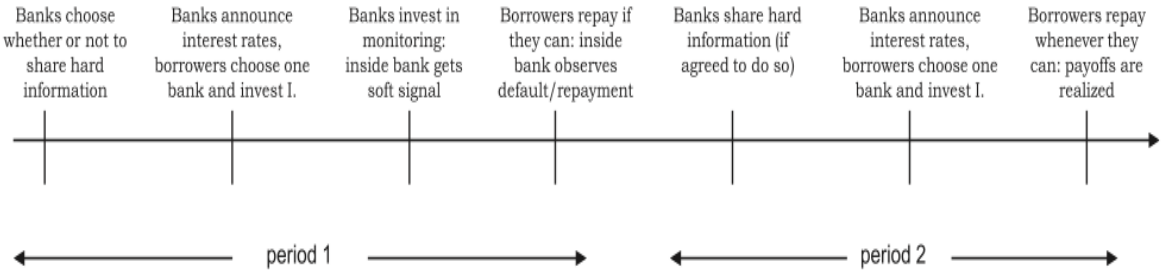

Figure 3. The timeline of the bank in the positive model. Source: Karapetyan and Stacescu (2014), p. 1591

The authors then turn to the two scenarios:

(i) With information sharing (i.e. competition in the market):

In this scenario, the outside bank has access to hard information about the other bank's borrowers through the information sharing institutions. This means that it knows whether a borrower has defaulted or not during the first period, and can thus distinguish between *two* different groups of borrowers in period 2; defaulters (D) and non-defaulters (N). The banks compete à la Bertrand, meaning that they set the rates they offer simultaneously, without knowing what the other bank does. The borrowers go to the bank that offers the lowest rates. Because both banks can separate the non-defaulters from the defaulters, and the group of non-defaulters consists only of good-quality borrowers, the banks offer the same interest rate to this group; the break-even interest rate. A lower interest rate would yield losses for both banks, and a higher interest rate would chase all the borrowers to the other bank. Both banks break even on this group, and are indifferent to the number of borrowers they attract from this group. This break-even interest rate for the non-defaulters is given by $\overline{r}_N = \frac{I}{p}$, because the success probability for the non-defaulting group is p and $\lambda = 1$. When it comes to determining the rates to the defaulting borrowers, the process goes as follows:

The outside bank can only distinguish between non-defaulters and defaulters because this is all the information it has. The lowest interest rate it can offer to the defaulters without

making a loss is thus the break-even interest rate for this group; $\overline{r}_D = \frac{I}{p_D}$, where $p_D = \frac{\lambda p(1-p)}{\lambda(1-p)+(1-\lambda)}$. [65]

The incumbent bank can divide the group of defaulting borrowers into two sub-groups. The group of defaulters that have generated a bad signal is the lowest ranked, and should have the highest interest rate. Their break-even interest rate is $\overline{r}_{DB}$, and the bank has no interest in offering a lower interest rate to this group, as that would generate losses. If it were to offer an interest rate higher than this, it would easily be outbid by the outside bank. As for the DG-group, offering a lower interest rate than $\overline{r}_D$ would give this group an interest rate closer to its break-even rate. This would reduce the spread between the offered rate and the break-even rate and yield less profit. Together, this tells us that the interest rates offered to the *overall group* of period one defaulting borrowers have to be in the interval $[\overline{r}_D, \overline{r}_{DB}]$.

There is no equilibrium in pure strategies in this model, and here is why: For each rate on the interval defined above that the outside bank offers – which can only offer *one* rate to the entire pool of defaulting borrowers, the incumbent bank can offer a slightly lower interest rate and only lend to the good signal borrowers. The outside bank ends up with only bad signal borrowers who get a lower rate than their break-even rate and thus generate losses. Hence, the equilibrium of the model is in mixed strategies. Given that the bad signal defaulters are creditworthy, i.e. $\varphi \leq \underline{\varphi}$, the incumbent bank offers $\overline{r}_{DB}$ to them, and makes no profits on this group. If $\varphi > \underline{\varphi}$ it does not offer them a loan at all because it has enough information to know that they are not creditworthy.

To attract the DG-borrowers, the incumbent bank wants to offer an interest rate that is just below the one that the outside bank offers. At the same time, it should be as high as possible to maximize the spread between the actual rate and the break-even rate. This is the incumbent bank's source for profits. It faces a balancing decision between offering a low interest rate and forgo potential profit, and offering a higher interest rate and potentially lose borrowers to the outside bank - whose offer is better. However, the group of good sign borrowers will end up paying an interest rate that is higher than its break-even interest rate regardless of which bank they end up with. Because the incumbent bank, based on its information set, is able to

[65] The numerator is the expected outcome for the fraction of good quality borrowers among the defaulters, and the denominator is the total mass of defaulters.

separate the bad signal borrowers from the good signal borrowers, and does not have to worry about the losses bad signal borrowers entail, these profits are called informational rents.

The incumbent bank's informational rents in period 2 stem thus solely from the defaulting, good signal borrowers, and is given by $\Pi^{i}_{sharing} = M_{DG}(\overline{r}_D p_{DG} - I)$, where the superscript denotes the incumbent bank, and the subscript the information regime we are in. M_{DG} is the mass of defaulting, good signal borrowers, given by $M_{DG} = \lambda\varphi(1-p) + (1-\lambda)$. With $\overline{r}_D$ as defined above and $p_{DG} = \frac{\lambda\varphi p(1-p)}{\lambda\varphi(1-p)+(1-\lambda)(1-\varphi)}$,[66] we have:

$$\Pi^{i}_{sharing} = (2\varphi - 1)(1-\lambda)I \tag{8}$$

Net profits can be obtained by subtracting the cost of monitoring, which is given by:

$$C(\varphi) = c\left(\phi - \frac{1}{2}\right)^2 \tag{9}$$

This cost function is the same for both banks and under both regimes; competition and no competition.

Differentiating (8) with respect to the level of monitoring, φ, yields the marginal benefit of monitoring. This is given by

$$\frac{\partial \Pi^{i}_{sharing}}{\partial \varphi} = 2I(1-\lambda) \geq 0 \tag{10}$$

The marginal benefit of monitoring is positive, meaning that a marginal increase in monitoring, which yields a better quality signal of the borrower, will increase profits. The outside bank's potential profit would be $\Pi^{o}_{sharing} = M_D(\overline{r}_D p_D - I)$ which equals zero on average.

(ii) Without information sharing (no competition):

If there is no information sharing in the economy, the outside bank will know nothing about the borrowers when it is offering rates for the second period, while the situation is unchanged for the incumbent bank – it still has both soft and hard information, and can distinguish

[66] The numerator is the expected outcome for the good quality borrowers that have generated a good sign, while the denominator is the total mass of defaulters that have generated a good sign.

between the three types of borrowers. This situation is similar to previous situation, with the exception that the uninformed bank has to offer the break-even interest rate for the *whole* pool of borrowers. The incumbent bank will then offer lower interest rates than the outside bank both for the non-defaulting, good quality borrowers and for the defaulters who generated a positive signal. It does no longer have to offer the break-even interest rate to the non-defaulting borrowers, as the uninformed bank cannot separate this group from the rest. Hence, the informational rents the incumbent bank gets stem from both the non-defaulting borrowers *and* the defaulting, good sign borrowers. The outside bank breaks even on average, just as before. The profits generated by the non-defaulting borrowers is given by $\Pi^{i}_{no\ sharing,N} = M_N(\overline{r}p_N - I)$. M_N is here the mass of non-defaulting borrowers, given by λp. $\overline{r}$ is defined by (7) and this yields $\Pi^{i}_{no\ sharing,N} = Ip(1-\lambda)$.

The informational rents from the defaulting, good signal group is in this case given by $\Pi^{i}_{no\ sharing,DG} = (2\varphi - 1)(1-\lambda)(1-p)I$. This is similar to (8), only with one extra term, $(1-p)$. This reflects the chances that the outside bank offers an interest rate that is lower than the break-even interest rate for the defaulting borrowers, and thus attracts them.

The total profit for the incumbent bank with no information sharing is then:

$$\Pi^{i}_{no\ sharing} = Ip(1-\lambda) + (2\varphi - 1)(1-\lambda)(1-p)I \qquad (11)$$

As before, differentiating (11) gives the marginal benefit from monitoring, which is

$$\frac{\partial \Pi^{i}_{no\ sharing}}{\partial \varphi} = 2I(1-\lambda)(1-p) \geq 0 \qquad (12)$$

Again, the marginal benefit from monitoring is positive, but smaller than in the case with information sharing.[67]

Which are the optimal levels of monitoring?

Obtaining the soft information is costly, and how costly it is depends on the quality of the signal the bank wants to obtain. The optimal level of monitoring is where the marginal benefit from monitoring equals the marginal cost of monitoring.

[67] $2I(1-\lambda) > 2I(1-\lambda)(1-p)$

The marginal cost is obtained by differentiating the cost function with respect to the level of monitoring, φ. This yields:

$$\frac{\partial C(\varphi)}{\partial \varphi} = c(2\varphi - 1) \tag{13}$$

Setting the marginal benefit from monitoring under information sharing and no information sharing, (10) and (12), respectively, equal to the marginal cost of monitoring, (13), and solving for φ, gives the optimal levels of monitoring:
$\varphi^*_{sharing} = \frac{1}{2} + \frac{1}{c}(1-\lambda)$ and $\varphi^*_{no\ sharing} = \frac{1}{2} + \frac{1}{c}(1-\lambda)(1-p)$.

Hence; $\varphi^*_{sharing} > \varphi^*_{no\ sharing}$. The optimal level of monitoring is higher under competition than under no competition. The reason for this is that it becomes more valuable on the margin to have soft information about the borrower when the hard information is easily accessible for everyone. The soft information and "personal knowledge" is the source to the incumbent bank's profits. Under no information sharing, the outside bank can only offer one interest rate to the whole pool of borrowers, and the risk that this rate is lower than $\overline{r}_D$ - which is the minimum rate the incumbent bank want to offer to the non-defaulting good signal borrowers - is higher than when the outside bank can offer two different rates. [68] If this is the case, the incumbent bank will lose these borrowers - and the potential profit from them - to the outside bank. This loss would not happen under information sharing, as the outside bank then would be able to separate the defaulting borrowers from the non-defaulting borrowers, and offer two different rates. The marginal benefit from monitoring, and in a more precise manner being able to differentiate the defaulting borrowers, therefore becomes higher under information sharing.

There might be several reasons for why an economy is an information-sharing regime or not. In some cases, the authorities put in place credit bureaus because it enhances the efficiency and social welfare, in other cases the banks voluntarily share the hard information, knowing that this will increase the value of the soft information and increase profits.

[68] Because it has no information about the borrowers what so ever, the only strategy it has is to offer the break-even interest rate for the whole pool, and thus break even on average.

4 A comparison of the models

The two models are different in many aspects, yet some commonalities are present. They are both reflections of the time in which they are published, the first in 1986 before the "digital revolution", and the second in 2014, when information technology is accessible to everyone. The main consequence of this "time-difference" is the distinction between hard and soft information. In the time of Chan et al. (1986), there was no such distinction; information was information, and it was soft, as explained earlier. The capability of separating the quantitative information - available to everyone - from the qualitative and non-transferable information is the main reason for why the two models predict such different results. Technological development has led to changes in communication of information, financial markets' structure and evolution of economic theory, as described in section 1.1, and the circumstances in which the banks operate have changed significantly between the publishing dates of the two papers I have presented. However, both theories emphasize the importance of information acquisition by financial intermediaries, and how a widespread use of this may allocate capital in the economy and improve welfare more efficiently, by sorting out bad-quality borrowers, avoiding defaulting clients and making sure that viable and profitable projects get finance.

I will compare the two models on different themes and aspects. First, I compare the modeling of competition. I continue with a comparison of how profits arise. Third, I compare how the results differ, and finally I address some issues related to the realism of the models.

4.1 The modeling of competition

How competition is modeled is a crucial element in models that try to explain consequences, costs or other impacts of competition. Though simplifying assumptions are necessary to obtain an understandable model, it is desirable to get as close to the reality as possible. Intuitively, it is easy to think that increased competition equals more players, but this is not necessarily the case. Neither in Chan et al. (1986) nor in Karapetyan & Stacescu (2014) is competition represented by an increase in the number of players. Instead, the models focus on what happens to certain variables when competition increases, and how this affects the banks' profits. In the negative model, Chan et al. (1986), the main variable of interest is β; the durability of information. But interbank competition is also expressed through the prices the bank faces; p and r. According to standard economic theory, these prices will increase

when competition becomes tougher. They are exogenous variables, and as a price taker, the bank has to take them for granted. The loan rate X_i, on the other hand, is determined by the bank itself. As a monopolist, it will search to charge the highest possible rate, as this will lead to high profits because the borrowers have no other bank to turn to. Under competition, this rate cannot diverge too much from what the other banks' rates, as this would make borrowers flee.[69] In Chan et al. (1986), the bank is thus a price taker on the one side, but has market power on the other. This assumption is a model simplification that has been put in place to make it clear how the bank's profit is affected by more competition. When competition increases, the reusability of information declines, and so does the bank's power to impact on the loan rate. These are two important factors impacting the bank's profit, and the model succeeds in explaining this fact in a trustworthy way.

In Karapetyan and Stacescu (2014), competition in the market is expressed by the degree to which other banks have access to information about the borrowers, i.e. if there are information sharing institutions in the economy. Again, competition in terms of the *number of players* is not modeled. There are two banks in this model, and this does not change. The banks compete *à la Bertrand*, where interest rate offers are given simultaneously, and borrowers always go to the bank that offers the lowest rates. It is the effect of increased accessibility to information for *the other bank* the authors are interested in. Regardless of the number of banks in the market, in an information sharing regime, a higher number of banks will be capable of distinguishing the different borrowers from one another than in a no information sharing regime. This enhances competition because more banks will be able to offer customized interest rates, in accordance with the information they have about the borrower, and the borrowers have several banks to choose among. The results will hold for any number of banks above 2. However, a large number of banks complicates the model significantly, and two banks are sufficient to emphasize the effect we are looking for.

Though not explicitly modeled by increasing the number of banks from 1 to 2, the negative model implicitly assumes an increase in the number of banks giving offers to the borrowers when the competition increases. This is the reason for the poorer reusability of information,

[69] The extent to which the bank can impact on the prices it charges (in this case the loan rate) is measured by the Lerner index, a common measure for an economic agent's market power. It is given by the amount by which the price exceeds the marginal cost, relative to the price: $LI = \frac{P-MC}{P}$. Higher values of the Lerner index indicate less competition.

and a realistic assumption. In the positive model, technological development has the same effect as it makes information accessible. However, technological development may indeed also increase the number of players, as the market for lending becomes less and less confined and geographical boundaries disappear.

The latter way of contemplating competition is probably the most compatible with today's financial markets and market structure. New information technology is already in place, and will only continue to develop. Even if the number of lending institutions does not change, the accessibility to information will increase, with the same impact as if there were more players.

4.2 The source for profits

In both models that I have presented, the banks strive for the highest possible profits. However, *how* these profits arise differs. This difference is important to understand when we want to improve or correct the results of the models.

Chan et al. (1986) describe a model based on profit maximization. The object for the bank is to maximize the profits paid to owners, by increasing the fraction of non-defaulting borrowers in its loan portfolio. To do this, the bank has to find the optimal level of (costly) screening, α. The fraction of non-defaulting borrowers in period one, θ_1, is a function of the level of screening that the bank decided to do in $t = 0$. All screening is done in period 0, as no new borrowers enter the game at $t = 1$. More screening; higher α, increases the probability that the information it acquires about the client is correct, i.e. it is less likely that the bank thinks a borrower is good when it is actually bad and vice versa. The fraction of non-defaulting borrowers in period two, θ_2, is implicitly also a function of the level of screening in $t = 0$, in addition to a function of the durability of the information, i.e. if it can be reused when the bank makes new loans. In practice, if the information is durable, a smaller fraction of the borrowers change type between periods. The profits that the bank makes stem from it being able to increase the share of repaying borrowers in $t = 2$, θ_2.

In Karapetyan and Stacescu (2014), profits are generated differently. The goal with the screening is to be able to differentiate borrowers in the second period. The more precisely the bank can do this, the more targeted will the rates it offers to the borrowers be, and the higher will the profits be. The banks apply the learning-by-lending technology, meaning that the

screening takes place *during* the first period, and not before granting loans.[70] But just as in the negative model, more screening increases the probability that the obtained signal matches the actual type of the borrower. Subsequently, the bank can predict the borrower's type with a higher certainty, and thus attract the borrowers that will generate profits with a higher certainty. This is not too different from the negative model, as there, knowing the different borrower types increases the share of repaying borrowers. However, the profits do not arise because the borrowers repay *per se*, but because the bank with the most proprietary information can offer a lower interest rate than the outside bank to favorable borrowers, but simultaneously, this interest rate is higher than the break-even interest rate of that group. This spread is what constitutes the returns on the investment in information acquisition; the informational rents. Even in an information sharing regime, the incumbent and the outside bank have asymmetrical information about the borrowers, due to the distinction between hard and soft information. As described in section 1.1, only hard information is possible to share, and the informational differences are thus a result of the acquisition of the soft information by the incumbent bank. With no information sharing in the market, the asymmetric informational problems would be even greater, as the outside bank would have to put all borrowers in one big pool, like at $t = 0$, while the incumbent bank still could differentiate between three groups of borrowers.

An important difference between the models is that in the negative model, the borrower can change type during the game, while in the positive model, the borrower stays the same. Thus, in the positive model, the information acquired during period 1 will always be reusable and valuable. The monitoring during the first period yields a certain perception about the borrower, and the acquired signal is based on this perception. The signal can be of good or bad quality, but the bank can increase the chances of getting a good-quality signal by monitoring more. Once the signals have been established, they are used to differentiate the borrower types. The *quality of the signal* in this model, i.e. the probability that the sign gives correct information, plays thus the same role as the *durability of the information* in the negative model. Here, the higher the durability of the information, the more likely it is that the prediction about the borrowers is correct. Then it is possible for the bank to sort out the bad-quality borrowers, increasing the fraction of repaying borrowers. With more repaying and fewer defaulting borrowers, profits increase.

[70] Fischer (2000)

An alternative way of raising profits could be to lower the costs of screening. These models have given cost-functions. In Chan et al. (1986), the costs are a function of the level of screening, while in Karapetyan & Stacescu (2014), the costs are dependent on the quality of the signal the banks wants to obtain. To diminish costs, the productivity of screening would have to rise. This is what the advances in information technology have contributed to; the costs of acquiring hard information are lower than before. For the soft information, reducing the costs of collecting and processing information is a much more complicated affaire, and not a topic for this thesis. However, the use of "hybrid information", i.e. information that is soft in character but hard in accessibility, could be a starting point of this process.

4.3 Results

Discussing the results of the models may appear unnecessary. But knowing *why* the results differ is crucial when determining which model is the best fit for our purpose. As already pointed out, the divergent results that these models provide stem mainly from the ability to differentiate between the different information types. When there is no distinction, as in the negative model, and only soft information is available, the investment in information acquisition decreases when competition increases. This is as expected from standard economic theory; when the return from the investment falls and prices increase, it is necessary to reduce the costs. When the differentiation of information is introduced, however, having soft information becomes valuable, as this is what distinguishes one bank from another. This is the case in the positive model, where the final result arises from the fact that the marginal benefit from soft information increases when hard information is easily accessible to other lenders. Because having proprietary information makes the bank unique to the borrower, it might be just this that makes her stay with the bank. Then the returns from the bank's investment increase for two reasons. First, the duration of the relationship increases, increasing its value. (This is the same concept as in the negative model; more valuable relationships give incentives to collect information.) Second, the borrowers that the bank keeps are the defaulting, good signal borrowers. In an information-sharing regime, these are the borrowers who generate profits. So when the bank can distinguish between the different types of borrowers and keep only the attractive ones, the profits are higher.

An additional explanation for the divergent results is found in Presbitero and Zazzaro (2011) who introduce the concept "nature of relationship lending" and argue that the approach the

bank chooses to relationship lending also plays a role in predicting these different results. Being able to separate hard from soft information gives the banks the possibility to use the information they have with different intentions. The authors define two approaches to relationship lending; the *investment nature of relationship lending* and the *strategic nature of relationship lending*. For the banks who value the investment nature of relationship lending, increased competition will lead to a reduction in the resources devoted to information acquisition due to the fact that fiercer competition in the market reduces the value of the information and subsequently the relationship. The negative model follows this approach as the negative correlation between competition and reusability of information decreases the value of a relationship. As the object is to maximize the payment to the owners in the end, and the reduced value of information reduces expected future profits, fewer resources are devoted to information acquisition when competition increases.

The positive model, on the other hand, emphasizes the strategic nature of relationship lending. For the banks taking this approach, increased competition may lead to an increase in the allocation of resources to information acquisition. To obtain this result, differentiation of information is required, as it is only by acquiring soft information the bank can act strategically. When hard information is available to the whole market, it is by having proprietary information a bank can make itself unique to the borrower and insulate itself from the price competition. By acting strategically, we mean that the bank can use the information it has to impede entrance for new banks into the market. By investing more in information acquisition and relationship building with the clients, the first mover advantages may be so big that new banks will be reluctant to enter the market. This is in line with recent evidence on the reluctance of foreign banks to enter countries where strong bank-firm relationships are common.[71] This may also explain why already established concentrated banking market, with a high degree of relationship lending, do not change. It has a tendency to perpetuate itself.[72] To be able to model this, it is required that the model has at least two banks that compete with each other, which is the case in the positive model. There, the interplay between the banks plays a crucial role, and how one bank behaves influences the behavior of the other bank. This type of model seems to be better aligned with today's situation in financial markets, reflecting the reality in a better way than the negative model. In the negative model, the number of banks is normalized to 1, assuming they are all homogenous with identical

[71] Yafeh & Yosha (2001), p. 65
[72] An example is the German banking market.

preferences and thus behaving identically. Thus, the strategic interplay *between the banks* is not taken into consideration.

4.4 Issues

If there were no modeling issues in an economic model, it would not be a model. It would be reality. Knowing which issues are important and impact the results, versus those that can be ignored, is decisive in the work of finding the best possible model.

In the framework of the negative model, there is a continuum of borrowers, and only one bank. As already pointed out above, this makes it impossible to model the interplay between banks, which, in reality, is an important factor of the banks' decision making. The model is a theory of pure bank behavior where all the results follow from the bank's maximization problem. The model says nothing about moral hazard problems for the borrowers or the required level of collateral for the firms to obtain credit, which are both highly relevant factors to assess when an agent is applying for a loan.[73] The model is clear in predicting a negative correlation between information-acquisition and competition. All the four evaluated parameters have this effect, ceteris paribus. This yields a thorough analysis on isolated effects, but may not be very realistic. It is plausible to think that several variables in the economy would change at the same time, and that it therefore would be interesting to have a model that could evaluate combined changes. Imagine for example that the competition in the insurance market increased simultaneously as the competition in the bank market. This would lead to a fall in the prices of deposit insurance, p, and an increase in the deposit rates, r, that the banks would have to pay to attract depositors. Because a lower p advocates more screening and a higher r advocates less screening, the results would be ambiguous, and a more advanced model would be necessary to measure the strength of each change.

[73] For a model that captures these elements, the reader can read Petersen and Rajan (1995), where the authors develop a model in which a good borrower cannot distinguish herself from a bad borrower. Thus, the loan must be structured such that the borrower has incentives to choose a safe project over a risky project (that potentially could have given a higher profit, but with higher risk). Solving this model yields the "necessary level of quality" the borrower has to have to be able to get funding, plus it determines the highest and lowest level of interest rates the bank can charge on this loan. Their result predicts that lower quality firms have a higher chance of getting a loan in a more concentrated bank market than in a competitive bank market. This might seem illogical at first, as there in competitive markets will be many more agents, several offers and lower prices. However, as pointed out in section 2.7, in concentrated markets, the use of relationship lending is more widespread, as the borrower has no or very few other funding options. It is thus forced to stay with the bank, which can extract rents later in the relationship.

Another issue that is not being addressed in Chan et al. (1986) is the spiraling effects that reducing or increasing screening might have. If reducing the information acquisition when competition increases lowers the quality of the borrowers, the probability of default will increase. The value of expected profits will fall, and the bank enters a negative spiral of self-fulfilling downturns. One could argue that one way of turning this negative trend would be to maintain the level of screening, despite the decrease in expected profit that arises with interbank competition. One then assures the quality of the borrowers, and the probability of default falls. If this effect is bigger than the negative effects analyzed above, the bank could do better with maintaining, or even increasing, screening when competition becomes fiercer. Again, a more complicated model would be required to measure the strength of each effect.

A weakness in model of Karapetyan and Stacescu (2014) - the positive model - is that the *quality of the signal* is an abstract notion, and not measurable *ex ante*. The second period has to pass by and one has to observe the stochastic outcome of the first period (defaulting or not defaulting) before knowing whether the signal predicted correctly or not. Of course, more monitoring yields better quality signals, but perfect monitoring is never possible and therefore there will always be uncertainty about its quality. The *reusability* in Chan et al. (1986)'s model, on the other hand, is a concrete, observable variable. When the second period arrives, the bank knows whether the information is updated and can be reused or not.

There are also problems related to the funding of the banks, in both models. In the negative model, the bank makes loans without any other funding than the deposits it possesses. This makes the bank very unstable, and it is not a very realistic situation.[74] On the other hand, the funding of the banks in the positive model is not considered at all. If the banks do not operate solely with equity, there must be some costs related to having enough capital to make loans, and these are costs that can change the picture and the results significantly. Ignoring this when evaluating which level of monitoring that will yield the highest profits can lead to severe mistakes in the analysis.

There are several problems related to having only one bank in the model. No being able to model the interplay between banks has already been mentioned. Another is that one bank

[74] There are rules and regulations on how much equity and other types of funding a bank must have, and thus not likely that a bank operates solely on the basis of deposits. However, in the run up to the financial crisis in 2008, many of these rules and regulations had been lifted and removed, which led to the systemic impact and gravity of the problems. Thus, new standards have been made and instituted after the crisis (Basel III) to avoid, or mitigate, similar situations in the future.

means that it has full market power, which makes it powerful enough to freely dictate the loan rates. This does not reflect the reality in a very trustworthy manner. But the opposite - having no market power, and being obliged to blindly follow the market determined rates to depositors - is not a good reflection of the reality either. Banks will usually find themselves in between these two extremes, with a certain power to influence on both the loan rate and the deposit rate to attract clients, but where it also, to a certain degree, has to follow the market determined rates. Doing otherwise would chase all borrowers away. The situation among banks is more realistic in the positive model, as here, they do have an impact on the rates they offer, but still cannot differ too much from the other bank as they then would lose all the borrowers to it.

As there are two banks in the positive model, the timeline looks a little bit different than the one in Chan et al. (1986), as seen in section 3.1 and 3.2: At $t = 0$, there is no asymmetric information between the banks, and they both offer the break-even interest rate for the whole pool to the borrowers. Loans are being granted before any screening is done. Because the strategy of the banks is to offer break-even interest rates, which bank that ends up with which borrowers is a random process. In Bertrand competition, it is assumed that the borrowers are divided equally between the banks when they offer the same rate. Thus, the banks end up with equally many clients. It is during the first period, when loan relationships are established, that the bank acquires information about its clients. This process is what Fischer (2000) calls the "learning-by-lending" technology. He pledges that this is the most common and accepted screening technology, assumed in most of the theory of relationship lending. A problem with Bertrand competition is that it is assumed that the borrowers always go to the bank that offers the best price. In reality, banks compete in more than just prices, and clients can choose a bank based on numerous criteria.

4.5 Comparison conclusion

Making economic models with the goal to describe a social phenomenon is a difficult task. The closer to the reality we want the model to be, the more complicated and intricate it becomes. When investigating one particular issue, we have to compromise and find (or make) a model that explains the issue in question in a satisfactory way, while other factors may not be treated as well, or even ignored. This is a problem that economists encounter every day, and the two models presented here constitute a good example. A conclusion to

“which model is the best fit to explain how competition affects relationship lending”, is a question of many factors; both neutral and subjective considerations, and different people will always have different opinions about this.

As for the two models that I have presented, I consider Karapetyan & Stacescu (2014) as the most relevant for analyzing the connections between relationship lending and competition today and in the future. This conclusion is based on the opinion that the distinction between hard and soft information has come to stay, and that this distinction is decisive in obtaining a good result. Banks are constantly working on new ways to make themselves unique to the borrowers, a sign that the value of having soft information has increased.

5 Conclusion

As already emphasized many times in this thesis, the existing literature delivers various answers to the question about competition and relationship lending. Neither the theoretical nor the empirical camp has been able to come up with one, unanimous effect. This is due to the fact that there are a number of variables that have an impact on the banks' lending technology, and how the bank wants to position itself in the market. However, some general conclusions have been drawn:

1) Relationship lending and long-term relationships between banks and borrowers mitigate asymmetrical information problems. This assures a more effective allocation of credit in the market, especially benefiting young, de novo lenders who need to disclose a lot of information to get credit. That these firms do get credit is very important for the economy as a whole as they create jobs and dynamism in the economy.

2) It is the specialization in information acquisition that makes the banks unique over other lenders. Their ability to collect and use proprietary information differentiates them from other lenders in the market.

3) There is a higher level of relationship lending in concentrated markets than in competitive markets. A certain degree of market power is necessary for the banks to have incentives to do the information acquisition.

In addition, I would like to add a fourth point:

4) The differentiation of information, caused by newer technology and new ways of communication, yields different results on how competition in the banking market will affect relationship lending, than no differentiation.

Whether more or less resources are devoted to relationship lending when competition increases, is also a question on how the market is structured and organized. It seems plausible to assume that financial agents will concentrate more resources on their favorite lending technology, whether it is transactional lending based on hard information, or relationship lending based on soft information. If the market mainly consists of large and distant banks – specialists on transaction lending – tougher competition will make these banks put more effort

and resources into what they know and do best. Hence, there will be less relationship lending in such a market. If the market is dominated by smaller banks, an increase in the level of competition will make them spend resources where they have their competitive advantage – on relationship lending. Hence increased competition yields more relationship lending in this type of market.

As the globalization continues, and technology rapidly becomes more and more sophisticated, distant and impersonal lending becomes cheaper and easier to administrate. But relationship lending remains an essential feature of small business lending, even in market dominated financial systems, and the continuous and ongoing development will only amplify this importance. The differentiation between hard and soft information has come to stay, and the financial markets are adapting. Banks and other financial intermediaries have to find their niche, and stick to it when competition increases.

Many economists are worried that globalization - and the competition that follows - means the end to relationship lending. This would have adverse consequences, as the accessibility of capital for the (indispensable) SMEs, whose financial needs are covered mainly by relationship lending, would be deteriorated. Before the crisis of 2008, this may have been the general and most common view about competition and relationship lending. However, the situation has changed in the wake of the economic turbulence. Government interventions, mergers and acquisitions, new regulations and bankruptcies have partially changed the structure of the market, reducing the number of agents and leaving bigger institutions. Bigger sized agents would - according to standard economic theory - advocate for less relationship lending, while fewer agents and more concentrated markets would advocate for more. However, the banking market is not like other markets, and bigger actors in more concentrated markets may very well lead to more relationship lending, as the possibilities for making profits increase. Also, there seems to be a tendency towards the traditional way of banking, and exclusive and stable lending relationships are brought back to the center of banks' business model.[75] I.e. relationship lending does not seem to lose terrain. Due to the consequences that arose from having too little knowledge about the borrowers and their repayment capability, banks have realized that a minimum level of knowledge may create unwanted situations. In addition, due to the threat of increased competition from globalization, the banks need to make themselves unique and special to the lender. A

[75] Presbitero & Zazzaro (2011)

valuable relationship is exactly what might make the borrower stay, despite a tempting offer from another bank.

The development of technology also speaks in favor of the survival of relationship lending. As mentioned, the difference between hard and soft information has come to stay, and because the technology has rendered hard information so accessible, soft information has become a scarce resource that banks have learned to appreciate and value, and they use it to stand out among other competitors. Banks are continuously investigating new ways of using the information they have about their clients, but are also looking for new places to find information. If looking into the future was possible, a further development of information could possibly include the emergence of a new type of information; the "hybrid information". This would be information that is soft in character, but accessible online, especially in social media, where people disclose all kinds of proprietary information. If banks could find a way to use this information, they would be able to customize the total experience for the clients even more precisely, meeting their requirements and giving them incentives to stay. The competition will no longer be centered around prices, but rather around the complete package of offers and services the bank can offer to their clients. This is a tendency we already see clearly in society, and that banks work consciously towards.

When regulating the banking market, there are a number of factors that must be taken into account, and what is beneficial in one market may have negative consequences in another. The conclusion of this thesis is that the impact of increased competition on relationship lending varies with market structure, organizational form and technological development. Boundaries for relevant markets are not defined by default; they may vary between countries, between regions within a country, and even between cities. Therefore, each market has to be thoroughly evaluated before being regulated, and the regulators have to be very aware of the objectives they want to obtain. Measures have to be made according to desired outcomes, as increased competition will in some cases lead to more relationship lending, in other cases to less competition.

References

Baltzersen, M. (2013): *Bankregulering*. Innlegg på Valutaseminaret, Soria Moria, 8. februar 2013.

Boot, A. W. A. (2000): "Relationship Banking. What Do We Know?". *Journal of Financial Intermediation*, **9**, 7-25.

Chan, Y.-S., S. I. Greenbaum & A. J. Thakor (1986): "Information Reusability, Competition and Bank Asset Quality". *Journal of Banking and Finance*, **10**, 243-253.

Elysasiani, E. & L. G. Goldberg (2004): "Relationship Lending. A Survey of the Literature". *Journal of Economics and Business*, **56**, 315-330.

Fischer, K.-H. (2000): "Acquisition of Information in Loan Markets and Bank Market Power – An Empirical Investigation". *Working Paper Series, Goethe University, Frankfurt.*

Hauswald, R. & R. Marques (2006): "Competition and Strategic Information Acquisition in Credit Markets". *Review of Financial Studies,* **19**, 967-1000.

Hellmann, T. F., K. C. Murdock & J. E. Stiglitz (2000): "Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough?". *American Economic Review*, **90**, 147-165.

Holmström, B. & J. Tirole (1997): "Financial Intermediation, Loanable Funds, and the Real Sector". *Quarterly Journal of Economics,* **112**, 663-691.

Karapetyan, A. & B. Stacescu (2014): "Information Sharing and Information Acquisition in Credit Markets". *Review of Finance,* **18**, 1583-1615.

Krogh, T. S. H. (2010): "Credit Regulations in Norway, 1970-2008". *Statistics Norway, Report 37/2010.*

Machauer, A. & M. Weber (2000): "Number of bank relationships: An Indicator of Competition, Borrower Quality or just Size?". *CFS Working Paper Series*, 2000/06.

NOU 2011:1: *Bedre rustet mot finanskriser*. Finanskriseutvalgets utredning.

Nærings- og handelsdepartementet (2012): *Små bedrifter – store verdier.* Regjeringens strategi for små- og mellomstore bedrifter. https://www.regjeringen.no/globalassets/upload/nhd/vedlegg/rapporter_2012/102377_nhd_smb_web.pdf

OECD (2014): *France - Economic Forecast Summary*, November. http://www.oecd.org/economy/france-economic-forecast-summary.htm

Ogura, Y. (2007): "Lending Competition, Relationship Banking and Credit Availability for Entrepreneurs". *Research Institute of Economy, Trade and Industry (RIETI),* discussion paper no. 07036.

Ogura, Y. (2010): "Interbank Competition and Information Production: Evidence from the Interest Rate Difference". *Journal of Financial Intermediation,* **19**, 279-304.

Petersen, M. A. (2004): "Information: Hard and Soft". *Unpublished Working Paper,* Northwestern University.

Petersen, M. A. & Rajan, R. G. (1994): "The Benefits of Lending Relationships: Evidence from Small Business Data". *Journal of Finance,* **49**, 3-37.

Petersen, M. A. & Rajan, R. G. (1995): "The Effects of Credit Market Competition on Lending Relationships". *Quarterly Journal of Economics,* **110**, 407-443.

Petersen, M. A. & Rajan, R. G. (2002): "Does Distance Still Matter? The Information Revolution in Small Business Lending". *Journal of Finance,* **57**, 2533-2570.

Presbitero, A. & A. Zazzaro (2011): "Competition and Relationship Lending: Friends or Foes?". *Journal of Financial Intermediation,* **20**, 387-413.

Stein, J. C. (2002): "Information Production and Capital Allocation: Decentralized vs. Hierarchical Firms". *Journal of Finance,* **57**, 1891-1921.

St. Meld. Nr. 9 (2008-2009): *Perspektivmeldingen 2009.* Finansdepartementet.

Vislie, J. (2014): “Some Issues on the Microeconomics of Banking”. *Lecture Notes, ECON 4335.* University of Oslo.

Vives, X. (2010): “Competition and Stability in the Banking Market”. *Centre for Economic Policy Research (CEPR),* Policy Insight No. 50.

von Thadden, E. (1995): “Long-term Contracts, Short-term Investment and Monitoring”. *Review of Economic Studies*, **62**, 557-575.

von Thadden, E. (2004): “Asymmetric Information, Bank Lending and Implicit Contracts: The Winner’s Curse”. *Finance Research Letters*, **1**, 11-23.

Yafeh, Y. & O. Yosha (2001): “Industrial Organization of Financial Systems and Strategic Use of Relational Banking”. *European Finance Review*, **5**, 63-78.