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THE RESEARCH INSTITUTE OF THE FINNISH ECONOMY
Lönnrotinkatu 4 B 00120 Helsinki Finland Tel. 358-9-609 900
Telefax 358-9-601 753 World Wide Web: http://www.etla.fi/

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Pekka Mannonen*

THE STRATEGIC RESPONSE OF BANKS TO AN EXOGENOUS POSITIVE INFORMATION SHOCK IN THE CREDIT MARKETS**

* Turku School of Economics and Business Administration, Rehtorinpellonkatu 3, 20500 Turku, Finland, email. Pekka.Mannonen@tukkk.fi

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ABSTRACT: According to the contemporary banking theory, it is conceivable that the rapid advance of information technology has shifted the relative competitive status between the market-based and conventional intermediated finance. When trying to enter into the markets traditionally dominated by conventional banks, investment banks have faced an informational barrier to entry caused by the adverse selection effect. Better information technology reduces the signalling costs of direct finance, which lowers this informational barrier of direct finance. Improved information also lowers risk and liquidity premiums of market finance. This will further benefit the investment banks. The traditional incumbent bank could respond to this threat by sacrificing costs in order to improve its screening technology with the purpose of regaining its informational competitiveness end re-establishing the informational barrier. If this is done credibly it may deter the entry.

KEYWORDS: Banking, information technology, adverse selection, signalling, screening

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TIIVISTELMÄ: Modernista pankkiteorian perusteella voidaan päätellä, että informaatioteknologian nopea kehittyminen on voinut muuttaa markkinapohjaisen ja perinteisen pankkirahoituksen välistä kilpailuasemaa. Yrittäessään tunkeutua rahoitusmarkkinoille, jotka ovat olleet perinteisten talletuspankkien hallitsemia, investointipankit ovat kohdanneet informaatioperusteisen markkinoille tulon esteen, joka aiheutuu virheellisen valikoitumisen ongelmasta. Kehittyneempi informaatioteknologia alentaa suoran rahoituksen signalointikustannuksia, mikä alentaa edellä mainittua informaatioperusteista markkinoille tulon estettä. Parantunut informaatio myös pienentää markkinarahoitukseen liittyviä riski- ja likviditeettipreemioita. Tämä hyödyttää edelleen investointipankkeja. Perinteinen monopolipankki voisi vastata tähän uhkaan uhraamalla kustannuksia luottoarviontiteknologiansa parantamiseksi. Tällä tavoin se voisi palauttaa informaatioetuun perustuvan kilpailukykynsä ja pystyttää uudelleen markkinoille tulon esteen. Jos tämä tehdään uskottavasti se voi muodostaa uhan markkinoille tulolle.

AVAINSANAT: Pankkitoiminta, informaatioteknologia, virheellinen valikoituminen, signalointi, luottoarviointi

1 INTRODUCTION

In recent years financial markets has faced a remarkable structural change. One observable feature has been the shift from traditional relationship lending or bank loans to direct finance in the capital markets. In principle, there could be and probably is several contributing factors behind this development: financial deregulation and innovations, the liberalization of international capital movements, international financial integration. Also banking industry consolidation may create large banks that may be oriented towards transactions lending and providing capital market services. An additional contributing factor could also be the recent revolution in information technology. This argument can be justified by the fact that financial intermediation industry is essentially based on collecting and processing information. If the general informational structure in the credit market changes, it is logical that there has to be some effects also to the industry itself.

This paper is related to the literature that discusses the relative roles of capital market finance and bank loans[1]. Our special interest is how the recent revolution in information technology affects the credit markets in this respect. Are there any structural changes between capital market and relationship banking? Our intention is to model the effect of the shifting information technology to the credit market, and assess the potential strategic responses of commercial banks to the structural shift. The issue is discussed in light of the contemporary banking theory. We ask, how a positive information shock affects the relative roles of the different forms of finance, and how the banks could response to the change? In particular, it is assumed that the information shock is positive in nature. In other words, we assume explicitly that this ongoing information revolution generally improves the quality of information in the financial market. However, this is not self evident, because it can also be assumed that the mere access to more information may confuse the investors and, thus, deteriorate their informational status in the financial market. As information technology based on digital data processing can, in addition to collecting large quantities of data, also improve the methods of processing and filtering essential financial data from mere noises, it may be assumed that the net effect would be positive. Ultimately, this issue is an empirical question, and cannot be solved purely on theoretical grounds.

The present paper can be seen an extension to our earlier work (Mannonen, 2002), where we discussed the effects of an information shock to the relative market shares and profits of the different forms of finance. In that paper we found that theoretical arguments suggest that the relative market shares would shift from relationship lending to capital market finance. This is a development that has been observed also in reality. The next obvious question is, how the conventional banks could respond to this development. This is the main focus in this paper.

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[1] Pioneering works in this area has been e.g. Diamond (1991) and Harris and Holmström (1997)

We examine a setting where an incumbent conventional bank (offering relationship loans) initially has a monopoly in a segmented financial market. Then, after a structural shift in the informational conditions, an investment bank (offering market based finance) tries to enter the market. Our essential point of departure is that adverse selection problem (Ackerlof, 1970) caused by asymmetric information forms an informational barrier to entry for the entrant. New information technology then reduces this barrier, which gives the entrant a chance to enter the market. It is then assessed, under which conditions the entry will occur, and how the incumbent bank could deter the entry.

2 THEORETICAL BACKGROUND

The theory of financial intermediation is essentially based on stressing the role of asymmetric information[2] In case of corporate finance, the borrower or firm is generally more informed of the qualities of the project to be financed that the lender. This causes agency costs, and makes the negotiation of a financial contract problematic. The role of traditional banks is to solve these problems, reduce agency costs, and to offer savers or households better financial contracts than can be acquired from the market. It can be conceived that as information technology improves, the quality of public market information increases and information and agency costs generally decline. This downgrades the role of banks. In the theoretical extreme when market information is complete, and we know all future contingencies, contracts can be complete and there is no role for financial intermediaries such as conventional banks. Until we reach that point, there is a continuing struggle between direct and indirect financial intermediation.

We analyse explicitly the ex ante adverse selection problem which prevails before concluding the financial contract. Banks can also reduce agency costs caused by the borrower's moral hazard behaviour by ex post monitoring the firm. The extreme result of the Akerlof's ex ante adverse selection problem could be that the markets will collapse. In this theoretical case, do to asymmetric information only bad goods or financial projects stay in the market, and when the buyers or investors realize this, they withdraw from the market. The markets can be saved either by signalling or screening.

Signalling:

The pioneering work in signalling was done by Spence (1973). Leland and Pyle (1977) introduced a signalling model, where the share of the entrepreneur own equity capital in financing a project describes his personal trust concerning the project, and signals private information to

[2] Good surveys of this approach are Battacharya and Thakor (1993), Mayer (1994), and Van Damme (1994)

the market. In Diamond's model (1991) the reputation of the entrepreneur and in Von Thadden's model (1994) the firm's profits in the previous year signals market information of the quality of the firm. Holmström and Tirole (1997) have presented a model, where the equity capital the entrepreneur has invested in the project signals his own commitment to the project. Financial markets interpret that this commitment reduces the firm's ex post opportunistic behaviour and moral hazard problems. Consequently, entrepreneurs with high share of inside equity may obtain finance from the market while those with low equity must be monitored by banks.

It can be inferred from the above models that in general signals are information that is produced by the entrepreneur of firm, and that the financiers collect and transform into relevant financial information. The signalling costs are paid by the firm who applies the finance. These signals are public market information, and we can further argue that the direct arms length market based finance (equity, bonds and transaction loans) are based on this kind of information. The development of information technology has reduced the costs of collecting and processing these market signals. It is now easier to collect, distribute, and process financial information. This may also improve the opportunities of relatively small enterprises to credibly signal their characteristics into the market, so that it is easier for them to obtain market based finance. This kind of development will obviously create competitive pressures to banks that have traditionally financed small and medium size firms.

Screening:

In spite of the above reasoning signals are still often incomplete, and financial decisions based solely on signals cannot always solve the adverse selection problem. This is especially true with small, unknown, new, and locally operating firms. The adverse selection effect is particularly high in these cases. Then the only way for these borrowers is to apply for relationship loans and to become screened by a bank. In screening, the financier or bank sacrifices costs in order to obtain private information about the loan applicant and the feasibility of the project to be financed.

Because it is often impossible for individual investors to acquire adequate financial information from the market, there has been incentives to create institutions that specialize in collecting and processing information. According to Diamond (1984) high transaction and information costs motivate households to delegate the monitoring function to banks. Although Diamond defines monitoring in its narrow sense, which means only collecting ex post information of the loan applicant, monitoring can also be understood in a large meaning consisting of ex ante screening, ex post monitoring, and costly state verification (Hellwig, 1991, and Freixas and Rochet, (1998). As mentioned above, our focus is on the screening function of banks. According to Diamond, banks have incentives to sacrifice screening costs in order to screen properly because otherwise the depositors would direct sanctions to them. An addi-

tional incentive is that by proper screening they can acquire more market power than their less informed competitors. These costs can be for example investments in a branch network and to long term customer relationships, which improves customer familiarity and availability of private customer specific information.[3]

By producing new information and acquiring expertise a bank can even improve the project choice of a firm and its success probability (Sharpe, 1990). By specializing locally or by a customer segment a bank can acquire market power that is comparable to product differentiation in the goods market (Boot and Thakor, 1997). All in all, by screening a bank can acquire private information, which is not available in the market, and in addition it can obtain extra market power with the help of that information.

3 THE BASIC SETUP AND MODEL

3.1 The setup

We consider a market where an incumbent traditional bank has a monopoly in the first period of the game. This monopoly is protected by an informational barrier to entry and a consequent adverse selection effect. This barrier prevents the firms in that area from acquiring market based finance as it is not profitable for an investment bank to offer such finance because of insufficient information. The incumbent bank screens and sets monopoly interest rates. Then a positive information shock occurs so that the informational barrier is reduced. This opens up competition for market based finance in the second period. The investment bank has incentives to poach some of the incumbent bank's customers if it can earn positive profits from this poaching. In case of entry, there are now two types of financial contracts offered to the firms: a bank loan contract and a market based financial contract. The incumbent bank will then face a potential entry of an investment bank. It has incentives to try to block the entry by setting a credible threat to the entrant bank. Consequently, the entry will occur or not depending on the credibility of the threat and on the reactions of the conventional bank. This setting can be analyzed in a game theoretic framework. We borrow much of the technical approach from Bouckaert and Degryse (2001), but our actual model is essentially different because we address different issues and make different assumptions. The timing of the game is described in figure 1 bellow. Because in the fist period the outcome is the monopoly price for the incumbent bank, we analyze in detail only the second period of the game, which is more interesting.

[3] See Harris and Holmström (1982), Von Thadden (1990), Caminal and Matutes (1996), Battacharya and Chiesa (1995), and Manove, Padilla and Pagano (2000)

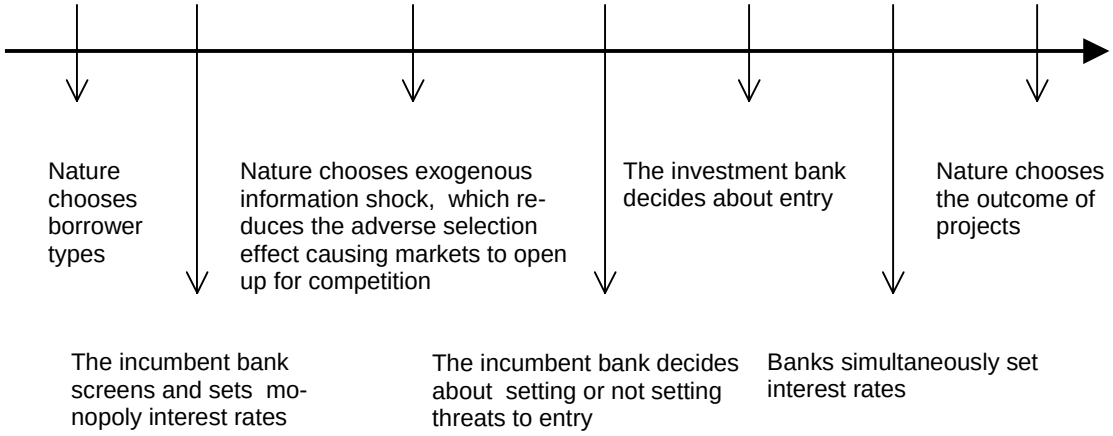

Figure 1: The timing of the game

3.2 The model

In the first period we have a conventional bank, which is protected by informational barrier to entry caused by a too severe adverse selection problem. The market size of the bank is normalized to one. There are two types of borrowers or firms: a proportion $0 \leq \mu \leq 1$ high quality borrowers (F_H) that yield return Y with probability $0 \leq p \leq 1$ and 0 otherwise. The remaining part $0 \leq 1-\mu \leq 1$ consists of low ability borrowers (F_L). These firms have zero outcomes for certainty. In spite of this they also apply for credit since they enjoy non-pecuniary private benefits from having access to finance. μ is common knowledge to the financial markets.

Screening and signalling are devices through which the party who provides finance can have better information than the common view. The efficiency of screening is dependent on the screening technology (ϕ) of a commercial bank. The quality of this technology is a concave function of the costs (M) it sacrifices in screening $[\phi = f(M)]$. We assume that the screening technology of the incumbent bank is always adequate in the sense that it successfully avoids the low quality loan applicants although it is not inevitably able to capture all the high quality firms (F_H). However, the bank can increase the size of its market for the high quality customers by a more efficient screening technology. In addition, the efficiency if screening is negatively dependent on the physical distance between the bank and its customers (γ). The distance reflects the idea that if $\gamma = 0$, the firm is very local, and the bank has better prerequisites to assess its quality. As a consequence, the bank's potential market for the high quality customers can be defined as $\phi(1-\gamma)\mu$, where $0 \leq \phi(1-\gamma) \leq 1$.

On the other hand, if the high quality firm chooses to apply for finance from the market, it can sacrifice signalling costs (S) in order to make itself more transparent to the investors and to

increase the markets' comprehension that the firm is credibly a high quality firm. The transparency parameter is (q), and it is a concave function of the signalling costs $[q = f(S)]$. We expect that the screening of banks is generally more efficient than signalling in defining the quality of the firm. In this point we refer to the quite common view that when announcing public information the firms do not in general reveal their private information such as business secrets for example. In addition, the most opaque sector of the enterprises does not even have the capability to credibly signal their most relevant properties to the market. Instead, through screening banks can have an access to more detailed private proprietary information. This gives the bank an informational advantage over the market based finance, and contributes to the informational barrier to entry in the market.

We further assume that a firm apply for finance with only one bank (conventional bank or investment bank), because applications with several banks are too costly. This implies that signalling costs occur only to those firms who have decided to apply for market based finance. Our model also implies that the signalling costs and the informational barrier to entry in general is so high in the period one that it is not profitable for the borrower to apply for market based finance, and consequently, the incumbent conventional bank has an initial monopoly. The possible entrant bank is not able offer finance at a competitive interest rate then.

In the event of failure the incumbent bank forgives the debt, and suffers loan losses. The investment bank suffers no loan losses, because unlike the commercial bank, it does not keep the securities in its balance sheet until the maturity date. It typically sells them to the public, who ultimately bears the risk. However, the risk and the magnitude of the adverse selection problem is reflected to the financing costs of the investment bank in the form of the risk premium demanded by the households, who invest in securities. This premium is discussed later bellow. We next define the behaviour of the market participants: the demand for finance by the firm, and the supply of finance by the incumbent conventional bank and the entrant investment bank.

The demand for finance or the firm:

Because the aim of the banks is to allure only the high quality firms (F_H), we examine only their behaviour.

Profit function of a high quality firm:

$$\Pi_F = p_i Y - \left(R_i^F + S\right) \qquad (1)$$

Firms are risk neutral and $p_i Y$ is the expected outcome of the project of a high quality firm. R_i^F is the financing cost charged for either capital market financing or a bank loan. S is the

signalling cost and concerns only capital market finance. (i=C) in case of capital market finance and (i=M) in case of monitored or screened bank loans.

In case of monitored bank loans the banks may improve the expected outcome of the project through screening so that in this case $p_M = p + \phi(1-\gamma)$, where the parameters ϕ and γ reflect the quality of the bank's screening technology and its distance to the firm as explained earlier. If γ is small, the firm is both managed near the bank and its markets are near the bank. In this case the bank is in a relatively good position to evaluate both the quality of the management of the firm and its markets. If γ is large the bank cannot improve much the success probability of the project. Long distance reduces a bank's capability to evaluate the firm's success probability giving an informational advantage to local banks.

The factor $\phi(1-\gamma)$describes the bank's expertise in project evaluation or screening. Consequently, by screening banks can improve the success probability of firms' projects. It is expected that through project screening a bank can obtain such private information on firms that cannot be observed in the market. In addition, as banks finance large numbers of investment projects in a specific sector or area in the economy, they collect experience and expertise which makes them well placed to appraise the potential performance of those projects. In many such cases banks may be equipped with even better information than firms themselves. Especially, this may be the case with new and small enterprises who's transparency to the market is low. In other words conventional banks mitigate the adverse selection problem of finance, and decrease the agency costs of financial contracting.

The supply of finance or the banks:

There are two banks: a) A traditional commercial bank, which is the incumbent bank, and grants relationship loans and also screen their loan customers. b) An investment bank, which is the entrant bank, and grants market-based finance in the capital market including their close substitutes transaction loans. These loans are based solely on public market information signalled by the firms.

The incumbent bank's profits from its high ability firms is

$$\Pi_M\left(R_M^F, R_C^F\right) = \left[p_M R_M^F - i_M^H - M\right] D_M \qquad (2)$$

where R_M^F is the interest the monitoring incumbent bank charges from its high ability customers. R_C^F the interest rate charged by the entrant bank. i_M^H is the financing cost the bank must pay to its depositors, and M is the bank's average monitoring or screening cost. D_M is the demand for the incumbent bank's credit. In the monopoly situation $D_M = \phi(1-\gamma)\mu$. If the investment bank does not enter, the commercial bank enjoys a local monopoly and will set

$R_M^F = Y$ and its profits in the second period will be $\left[pY - i_M^H - M\right]\phi(1-\gamma)\mu$. If the new bank enters, it offers interest rate R_C^F .

The profit function of the investment bank is:

$$\Pi_C\left(R_M^F, R_C^F\right) = \left[pR_C^F - i_C^H\right](\mu - D_M) \qquad (3)$$

The financing costs of the banks is based on the households' time preference, and risk and liquidity premiums, which differ between the investment and the commercial banks. Time preference is the real interest rate (*r*). The risk premium depends on the probability that the firm where the saving are invested is a high quality firm (μ), the transparency of the firm (*q*) and the information technology prevailing in the market (*I*). To keep it simple, we assume that there is some risk premium *A*[4], which we do not model here explicitly, and that this risk premium is reduced by the known share of high quality firms, their transparency, and the state of the information technology. With these parameters the risk premium (*s*) is:

$$s = A - \mu(1+qI)$$

Since $0 \le \mu \le 1$, $0 \le q \le 1$, and $0 \le I \le 1$, we make a simplifying assumption that $A > 2$. This reflect the idea that the risk premium is always positive even in the theoretical extreme where all firms are high quality firms, their transparency is perfect and that information technology is complete. This is because there is always the possibility of systemic risks, which are independent of the firm specific factors.

The average share of high quality firms is common knowledge and thus known to the market. The equation also indicates that the investors can obtain better information on firms that are more transparent than average firms. The firms themselves can improve their transparency and decrease their risk premium through signalling, which raises *q* as explained above. Better information technology (*I*) makes it easier to filter high quality firms from the bad ones, which also reduces the risk premium. The factor $\mu(1+qI)$ also reflects the adverse selection problem prevailing in the market. The higher the share of high quality firms, the more transparent are the firms, and the more advanced is the state of the information technology in the market, the smaller the adverse selection problem is.

The liquidity premium (l) is modelled:

$l = 1 - IE$,

4 A more appropriate way to define the risk premium would be e.g. to model it as variance of some future expected outcomes, but defining it simply as A does not affect the qualitative conclusions of the analysis.

where E reflects the size of the firm. The securities of a larger firm are more liquid. Larger issue size guarantees deeper secondary markets.

We simplify the model by the following assumptions. Firstly, because bank deposits are completely liquid no liquidity premium is required for them. Secondly, banks diversify away idiosyncratic risks and the deposit insurance eliminates systematic risks. This means that neither risk or liquidity premium is required for bank deposits. Taking into account the above considerations the financing costs of investment and commercial banks can be determined:

Investment bank: $i_C^H = r + [A - \mu(1 + Iq)] + (1 - IE)$ (4)

Commercial bank: $i_M^H = r$ (5)

4 ANALYSIS

4.1 Demand analysis

We assume that there are no switching costs for the firms, so that all they have to consider is those factors that have been defined in equation (1) above. In the first period the incumbent commercial bank has a monopoly and will set a monopoly price for its loans: $R_M^F = Y$. In the second period, a high quality borrower is indifferent between a bank loan (commercial bank) and capital market finance (investment bank) if the following conditions are met:

$$p_M R_M^F = p_C R_C^F + S + \phi(1-\gamma)Y, \text{ or} \quad (6)$$

$$[p_C + \tau\phi(1-\gamma)]R_M^F = p_C R_C^F + S + \phi(1-\gamma)Y \quad (7)$$

Parameter τ describes the part of the incumbent bank's contribution to the project choice that is transferred to the interest rate. If $\tau = 0$, the bank does not charge extra interest rate from its contribution, and consequently, all the benefits will go to the firm, and the bank gets some monopoly power through its positive contribution to the project. If $\tau = 1$, the firm does not get any benefits from the improved project choice. Instead, they will go to the bank in form of higher interest rates, and the bank will loose this source of market power. Generally, it can be expected that $0 < \tau < 1$, so that the benefits of the improved project choice will be shared by the bank and the entrepreneur. We can further transform the equation (5) and get

$$p_C R_M^F = p_C R_C^F + S + \phi(1-\gamma)Y - [\tau\phi(1-\gamma)]R_M^F \quad (8)$$

The factor $S + \phi(1-\gamma)Y - [\tau\phi(1-\gamma)]R_M^F$ has similar effects than switching costs. I captures the idea that if the firms switches from traditional monitored bank loans into capital market

finance it will face signalling cost, and in addition it will loose the difference between the banks contribution to better project outcome and its higher interest rate. For simplicity, we define that

$$S + \phi(1-\gamma)Y - [\tau\phi(1-\gamma)]R_M^F = \theta$$

There is threshold point for θ^* under which certain firms switch to capital market finance and above which they continue with the incumbent bank. We assume that the customers are uniformly distributed with respect to the factor θ between some parameter values $\underline{\theta}$ and $\overline{\theta}$. We restrict the parameter θ to satisfy the assumption that $\overline{\theta} > 2\underline{\theta}$ and that $\overline{\theta} > 0$. This is to ensure that the firms differ sufficiently in terms of this factor.

The incumbent bank's market share of the high ability firms is then defined as

$$a \equiv \frac{\overline{\theta} - \theta^*}{\overline{\theta} - \underline{\theta}}$$

The second-period demand curve of high quality borrowers for the incumbent bank can now be defined as

$$D_M\left(R_M^F, R_C^F\right) \equiv \begin{cases} 0 \quad if \quad \dfrac{\left(p_C R_C^F + \overline{\theta}\right)}{p_C} < R_M^F \\ \phi(1-\gamma)\mu a \quad if \quad \dfrac{\left(p_C R_C^F + \underline{\theta}\right)}{p_C} \le R_M^F \le \dfrac{\left(p_C R_C^F + \overline{\theta}\right)}{p_C} \\ \phi(1-\gamma)\mu \qquad otherwise \end{cases} \qquad (9)$$

The factor $\phi(1-\gamma)$ captures the idea that the demand is confined to those firms that the bank has screened successfully.

4.2 The best responses of the banks without threat

This analysis is based on the profit functions of the banks, which were defined in equations (2) and (3) above. According to them the incumbent bank's profits would be $\Pi_M\left(R_M^F, R_C^F\right) = \left[p_M R_M^F - i_M^H - M\right]D_M$ and the entrant bank' profits correspondently $\Pi_C\left(R_M^F, R_C^F\right) = \left[pR_C^F - i_C^H\right](\mu - D_M)$.

If the incumbent bank does not set any credible threats to the entrant, the investment bank enters into the market and banks simultaneously se interest rates. Then the best responses will look like the following. The incumbent bank sets its interest rates so that

$$R_M^F = \begin{cases} \dfrac{i_M^H + M}{p_C} & \text{if} \quad \dfrac{i_M^H + M - \overline{\theta}}{p_C} > R_C^F \\ \dfrac{i_M^H + M + \overline{\theta} + pR_C^F}{2p_C} & \text{if} \quad \dfrac{i_M^H + M - \overline{\theta}}{p_C} \le R_C^F \le \dfrac{i_M^H + M + \overline{\theta} - 2\underline{\theta}}{p_C} \\ \dfrac{pR_C^F + \overline{\theta}}{p_C} & \text{otherwise} \end{cases} \qquad (10)$$

The entrant bank will set the following interest rates

$$R_C^F = \begin{cases} \dfrac{i_C^H}{p_C} & \text{if} \quad \dfrac{i_C^H + \underline{\theta}}{p_C} > R_M^F \\ \dfrac{i_C^H - \underline{\theta} + pR_M^F}{2p_C} & \text{if} \quad \dfrac{i_C^H + \underline{\theta}}{p_C} \le R_M^F \le \dfrac{i_C^H + 2\overline{\theta} - \underline{\theta}}{p_C} \\ \dfrac{pR_M^F - \overline{\theta}}{p_C} & \text{otherwise} \end{cases} \qquad (11)$$

It is obvious that the incumbent bank will set

$$R_M^F = \frac{i_M^H + M + \overline{\theta} + pR_C^F}{2p_C} \qquad (12)$$

and the entrant bank will set

$$R_C^F = \frac{i_C^H - \underline{\theta} + pR_M^F}{2p_C} \qquad (13)$$

In this case both banks enjoy a positive market share and are able to set an interest rate above the subsistence levels $\left(i_M^H + M\right)/p_C$ and i_C^H / p_C. In higher interest rates the either bank would lose its customers to the competitor.

The equations (10) and (11) yield the following solutions:

$$R_M^F = \frac{2\left(i_M^H + M\right) + i_C^H + 2\overline{\theta} - \underline{\theta}}{3p_C} \quad \text{and} \tag{14}$$

$$R_C^F = \frac{2i_C^H + i_M^H + M - 2\overline{\theta} + \underline{\theta}}{3p_C} \tag{15}$$

The market shares of the commercial and investment banks are

$$D_M = \frac{\phi(1-\gamma)\mu\left(2\overline{\theta} - \underline{\theta}\right)}{3\left(\overline{\theta} - \underline{\theta}\right)}$$

$$D_C = \frac{\phi(1-\gamma)\mu\left(\overline{\theta} - 2\underline{\theta}\right)}{3\left(\overline{\theta} - \underline{\theta}\right)}$$

The profits then become

$$\Pi_M = \left\{ \frac{2\left(i_M^H + M\right) + i_C^H + 2\overline{\theta} - \underline{\theta}}{3} - i_M^H - M \right\} \frac{\phi(1-\gamma)\mu\left(2\overline{\theta} - \underline{\theta}\right)}{3\left(\overline{\theta} - \underline{\theta}\right)} \tag{16}$$

and

$$\Pi_C = \left\{ \frac{2i_C^H + i_M^H + M - 2\overline{\theta} + \underline{\theta}}{3} - i_C^H \right\} \frac{\phi(1-\gamma)\mu\left(\overline{\theta} - 2\underline{\theta}\right)}{3\left(\overline{\theta} - \underline{\theta}\right)} \tag{17}$$

The incumbent banks market share, interest rate, and profits are clearly lower than in the monopoly situation. Consequently, it has obvious incentives to set credible threats to the potential entrant.

4.2 Credible threat set by the incumbent bank

The investment bank will enter as long as its profits are non-negative. In other words, entry occurs whenever $\Pi_C \geq 0$. The incumbent bank's strategic response to the entry is to set threats that would result in a situation where $\Pi_C < 0$. The potential solution can be searched from the contents of the factor θ, crucial in defining the indifference of the firms between the two banks. We have earlier defined that $\theta = S + \phi(1-\gamma)Y - \left[\tau\phi(1-\gamma)\right]R_M^F$. This factor consists of two strategic parameters that the bank can influence. These are obviously ϕ and τ. In other words, the incumbent banks can improve its screening technology (ϕ) so that the firms will benefit even more than previously from improved project choice. However,

raising ϕ would raise monitoring costs, and the obvious precondition for this strategy is that $\partial\phi > \partial M$. Alternatively it can reduce its own share (and interest rates) of the improved project choice (τ). These responses would raise the value of θ, and increase the market power of the incumbent bank. This setting can be illustrated graphically in figures 2. bellow.

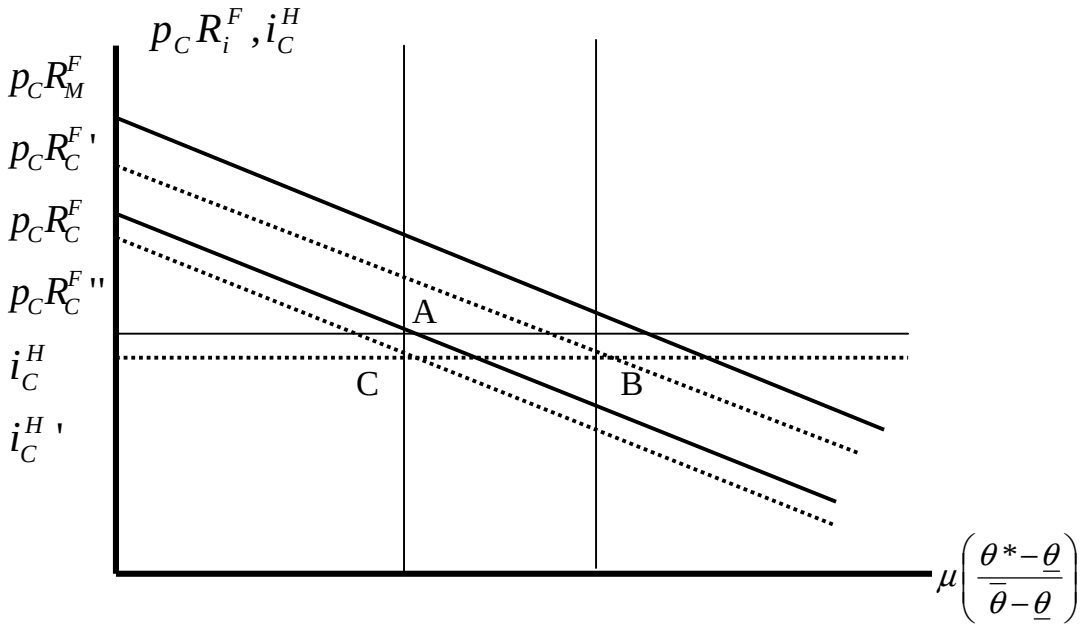

Figure 2: The effects of a positive information shock and the incumbent bank's strategic response to the investment bank's choice

According to equation (6) above the difference between the $p_C R_M^F$- and $p_C R_C^F$-curves is θ. The above figure indicates that the market share is a declining function of the entrant's interest rate. In the first period we are in point A where the investment bank's expected profits are zero because $p_C R_C^F = i_C^H$.

We identify two channels through which the positive information shock affects the competitive status in the market. Firstly, a positive information shock reduces the signalling costs of the firms, because cheaper and more efficient information and communication technology enables the firms to signal their properties more efficiently and widely into the financial markets. This reduces θ causing the $p_C R_C^F$-curve to shift upwards into $p_C R_C^F{}'$. Secondly, the shock raises I in equation (4). This reduces the risk and liquidity premiums in financing costs of the investment bank. The risk premium is reduced because now the households can obtain more accurate information about the properties of the firms they are interested to invest in. The liquidity premium is reduced because better technology makes it easier for households to transfer relatively illiquid securities into liquid purchasing power. As a consequence, the i_C^H-curve shifts downwards into $i_C^H{}'$. The break-even point of the investment bank's profits has moved from A to B. These developments make it possible for the investment bank to en-

ter the market. It can reduce it interest rates to a more competitive level, increase its market share and still make positive profits.

As noticed earlier, the incumbent bank could response to the above development by increasing ϕ or decreasing τ. This increases θ. In figure 2 above the increase is large enough so that the $p_C R_C^F$-curve has shifted downwards into $p_C R_C^F$'' . The break-even point is now in C, in which the monopoly of the incumbent bank is restored. We can infer from this analysis that if the incumbent bank sacrifices costs (M) in order improve its screening and monitoring technology and quality, this would signal to the entrant that it is going to struggle for its initial market share, and set a credible threat. The greater the bank's investments in a better screening technology, the more credible the threat.

Investments in a better screening technology has also other positive effects in our model. More efficient screening increases the quantity of the high quality firms the incumbent bank qualifies for its loans. Accordingly, the banks effective demand will be increased

$$\text{from } \phi\,(1-\gamma)\frac{\bar{\theta}-\theta^*}{\bar{\theta}-\underline{\theta}} \quad \text{to} \quad \phi'\,(1-\gamma)\frac{\bar{\theta}-\theta^*}{\bar{\theta}-\underline{\theta}} \ .$$

This means that even if the incumbent bank looses some customers to the entrant bank, it can at least partly compensate this by expanding its markets into a more opaque part of the loan applicants by more efficient screening.

5 DISCUSSION AND CONCLUSIONS

The observed general development indicates that there has for a long been an ongoing shift from indirect to direct finance. Contemporary banking theory gives evidence that the simultaneous revolution in information and communication technology may be one contributing factor to this development, although there are potentially also other factors. This development creates pressures and incentives for traditional banks to response somehow to this challenge.

Our starting point has been that the adverse selection effect, caused by asymmetric information forms a barrier to entry to possible entrants. This concerns especially markets based finance, which do not screen the applicants of finance. Locally oriented banks, which know their customers, and are oriented towards relationship banking are in a much better informational position. This is particularly true with respect to locally operating, small, new, and otherwise opaque firms, whose capability to signal their properties into the market is weak. If the development of information technology leads to improved informational structure in the fi-

nancial markets, the adverse selection effect decreases, and the transparency of some of these firms may increase enough, so that they will have access to market based finance.

When facing a situation, where their market share would be diminished, the traditional banks have to consider strategic responses to the threat. One potential response would be to restore their comparative informational advantage by investing more in their screening technology and quality. In practice, this could mean better professional skills in evaluating the projects of their loan applicants. The borrowers would also benefit from this in the form of their improved project choice and success probability. This would improve the attraction of conventional banks. More efficient screening would also make if worthwhile for the incumbent bank to expand its markets to the more opaque sector of its potential customers. This would compensate at least part of the lost customers, in case the entrant bank entered into the market. In this sense the banks could – to a certain extent - approach the business idea of venture capitalist, who typically finance and even consult the most opaque sector of the firms. The general economic function of banks is to screen the talented entrepreneurs from the less talented ones so that the scarce financial resources will be productively allocated. This sets certain requirements to the quality and screening technology of the banks. If banks fail to fulfil this basic task, they will loose markets to other forms of finance.

The above analysis concerning the banks' potential response to an exogenous information shock in the financial markets can be – to a certain degree – generalized to apply also to other shocks which are responsible for the deterioration of the status of traditional relationship banking. Whether the basic reason is deregulation, financial innovations, the liberalization of international capital markets, international financial integration or information technology, banks could always increase their efficiency and attractiveness to the applicants of finance by improving their own quality and monitoring technology.

REFERENCES:

Ackelof, G. (1970), “The market for lemons: qualitative uncertainty and the market mechanism”, Quarterly Journal of Economics, 485-500.

Bhattacharya, S. and Chiesa, G. (1995), ”Proprietary Information, Financial Intermediation, and Research Incentives”, Journal of Financial Intermediation.

Bhattacharya, S. and Thakor, A. V. (1993), “Contemporary Banking Theory”, Journal of Financial Intermediation 3.

Boot, A. and Thakor, A. (1997), ”Can Relationship Banking Survive Competition?”, CEPR Discussion Paper no. 1592.

Bouckaert, J. and Degryse, H. (2001), “Borrower Poaching and Information Display in Credit Markets”, CEPR Discussion Paper no. 2936.

Caminal, R. and Matutes C. (1997), ”Can Competition in the Credit Market be Excessive”, CEPR Discussion Paper no. 1725.

Diamond, D. (1991), ”Monitoring and Reputation: The Choice Between Bank Loans and Privately Placed Debt”, Journal of Political Economy.

Freixas, X. ja Rochet, J-C. (1998), Microeconomics of Banking, London.

Harris, M. and Holmström, B. (1982), ”A theory of Wage Dynamics”, Review of Economic Studies.

Hellwig, M. (1991), “Banking, financial intermediation and corporate finance, in European financial intermediation, toim. A. Giovannini ja C. Mayer, Cambridge.

Holmström, B. and J. Tirole (1997), ”Financial Intermediation, Loanable Funds and the Real Sector”, Quarterly Journal of Economics CX, 663-692.

Leland and Pyle (1977), “Informational asymmetries, financial structure and financial intermediation”, Journal of Finance.

Mannonen, Pekka (2001), “Advancing information technology and financial intermediation”, ETLA discussion papers No. 770.

Manove, M., Padilla A. J., and Pagano M. (2000), ”Collateral vs. Project Screening: A Model of Lazy Banks”, CEPR Discussion Paper no. 2439.

Mayer, Colin (1994), “The Assessment: Money and Banking: Theory and Evidence”, Oxford Review of Economic Policy, Vol. 10, No 4.

Sharpe, S. (1990), ”Asymmetric Information, Bank Lending and Implicit Contracts: a Stylized Model of Customer Relationships”, Journal of Finance.

Spence, M. (1973), “Job market signalling”, Quarterly Journal of Economics 87, 355-374.

Van Damme, E. (1994), “Banking: A Survey of Recent Microeconomic Theory”, Oxford Review of Economic Policy, Vol. 10, No 4.

Von Thadden, E. L. (1990), ”Bank Finance and Long-term Investment” WWZ Discussion Paper no. 9010, University of Basel.

Von Thadden, E. L. (1994), “The commitment of finance, duplicated monitoring and the investment horizon”, University of Basel.

E L I N K E I N O E L Ä M Ä N T U T K I M U S L A I T O S (ETLA)
THE RESEARCH INSTITUTE OF THE FINNISH ECONOMY
LÖNNROTINKATU 4 B, FIN-00120 HELSINKI

Puh./Tel. (09) 609 900 Telefax (09) 601753
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