No. 2013

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INDUSTRIAL ORGANIZATION, FINANCIAL ECONOMICS AND TRANSITION ECONOMICS

ISSN 0265-8003

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Discussion Paper No. 2013
November 1998

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CEPR Discussion Paper No. 2013

November 1998

ABSTRACT

On the Role of Bank Competition for Corporate Finance and Corporate Control in Transition Economies*

Banks play a central role in financing and monitoring firms in transition economies. This study examines how bank competition affects the efficiency of credit allocation; monitoring of firms; and the firms' restructuring effort. In our model, banks compete to finance an investment project with uncertain return. By screening the firm a bank learns about its profitability. Surprisingly, it is found that an increase in bank competition need not reduce a bank's screening incentive even though it lowers its expected profits. Furthermore, competition has a positive impact on the firms restructuring efforts. This suggests a positive role for bank competition in transition economies.

JEL Classification: D43, G21, G34, L13, P31
Keywords: transition economies, bank competition, corporate governance, corporate finance, screening, restructuring

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*The author would like to thank Patrick Bolton, Gunter Dufey, Christa Hainz, Klaus Schmidt, Alan Schwarz, seminar audiences at the sixteenth international seminar on the New Institutional Economics at Wallerfangen and at the European Summer Symposium in Economic Theory for helpful comments and suggestions. This paper is part of the ACE–PHARE project P96–6053–R on Organizational Restructuring in Central and Eastern Europe.

Submitted 17 August 1998

NON-TECHNICAL SUMMARY

For many years economic researchers focused their attention on the privatization procedure in Eastern Europe. Now that the privatization process has made considerable progress in many transition economies it is becoming increasingly obvious that private ownership alone is not sufficient to guarantee the economic success of firms. The crucial questions now are: how much do the new owners engage in restructuring their firms; and how easily can they attract financial resources to undertake the necessary investments? The answer to these questions depends decisively on the efficiency of the market for corporate finance and corporate control in Eastern Europe.

In this paper we argue that banks play a central role in financing and monitoring firms in transition economies, due to poorly developed capital markets, a lack of accumulated profits for internal financing and a dominance of strongly insider-controlled firms. As we show in this paper, the banking sector itself has undergone dramatic changes in some countries, with many new commercial banks being set up, while it is still dominated by a few state-owned banks in others. Thus, to evaluate the economic prospects of firms in transition economies, it is important to investigate what incentives banks have to fulfil this function of monitoring and of allocating credits and how their incentives are influenced by the environment in which they operate.

Our paper contributes to these questions by focusing on two effects. First of all we study how the banks' incentives are effected by the degree of competition in the banking sector. Secondly, we analyse the relationship between banks' bargaining power and the restructuring efforts of potential debtors.

To study these questions we set up a very simple model with one firm that needs a credit to finance an investment project with uncertain return. We distinguish two competitive scenarios in the banking sector, one with a monopolistic bank that can make a take-it-or-leave-it offer and one with two banks that compete in Bertrand fashion for a credit contract with the firm. Before making an offer, each bank can engage in costly screening activities to find out the profitability of the investment project.

A priori, one might expect a negative relationship since competition reduces the rents a bank can earn which in turn may have a negative impact on its incentive to gather information. Perhaps surprisingly, we find that this need not be the case.

We show first that a monopolistic bank has efficient incentives to screen the project and that the resulting credit allocation is efficient. In the case of

competitive banks the screening incentives depend on whether or not the information acquisition leads to an information spillover. If this is the case, then a typical free-rider problem arises and no bank engages in screening which then implies an inefficient credit allocation because too many bad projects are financed in equilibrium.

If screening does not generate information spillovers, however, then we find that a competitive bank also has efficient incentives to engage in information aquisition provided the competitor does not do so. The reason is that the informed bank can avoid losses due to financing bad projects, which is exactly the efficiency gain generated by the information acquisition. The resulting resource allocation is less efficient than under a monopolistic banking structure, however, because if not all banks are informed it may happen that uninformed banks inefficiently provide credits for bad projects.

In a second step we include the possibility that the manager of the firm engages in restructuring his firm. The idea is that the manager can spend some effort that increases the returns of good projects. How much he restructures depends, of course, on his share of the pay-off of the project if it is financed by the bank. Since a monopolistic bank appropriates all the rents of the project the manager has no incentive to engage in restructuring whereas he has efficient restructuring incentives in a competitive banking sector. We identify situations where the overall efficiency of credit allocation, monitoring and restructuring in a competitive banking sector is larger than in a monopolistic banking sector and *vice versa*.

Our analysis shows that an overall appraisal of the efficiency implications of bank competition must include both effects, on banks' monitoring incentives and on firms' restructuring efforts.

1 Introduction

The transition process in Eastern Europe has stimulated an extensive discussion on how to transform the large number of state enterprises into Western-style profit-maximizing firms. The question that for many years attracted most attention was when and how to privatize these firms. Now that the privatization process has made considerable progress in many transition economies it is becoming increasingly obvious that private ownership alone is not sufficient to guarantee the economic success of firms. The crucial questions now are: how much do the new owners engage in restructuring their firms and how easily can they attract financial resources to undertake the necessary investments? The answer to these questions depends decisively on the efficiency of the market for corporate finance and corporate control in Eastern Europe.

In this paper we argue that banks play a central role in financing and monitoring firms in transition economies, due to poorly developed capital markets, a lack of accumulated profits for internal financing and a dominance of strongly insider-controlled firms. As we will report below, the banking sector itself has undergone dramatic changes in some countries, with many new commercial banks being set up, while in others it is still dominated by a few state-owned banks. Thus, to evaluate the economic prospects of firms in transition economies, it is important to investigate what incentives banks do have to fulfill this function of monitoring and of allocating credits and how their incentives are influenced by the environment in which they operate. Our paper contributes to these questions by focussing on two effects. First of all we study how the banks' incentives are affected by the degree of competition in the banking sector. A priori, one might expect a negative relationship since competition reduces the rents a bank can earn which in turn may have a negative impact on its incentive to gather information. Perhaps surprisingly, we find that this need not be the case, but that the information acquisition incentives of a competitive bank can be as high as those of a monopolistic bank. Secondly, we analyze the relationship between banks' bargaining power and the restructuring efforts of potential debtors. We find that more competition in the banking sector can have a positive impact on the firms' restructuring incentives because they expect to keep a larger share of the surplus to be generated. Our analysis shows that an overall appraisal of the efficiency implications of bank competition must include both effects, on banks' monitoring incentives and on firms' restructuring efforts.

Bank competition, banks' bargaining power and the impact on monitoring incentives have received surprisingly little attention in the theoretical literature on banks and financial intermediation. Most authors assume that banks compete in Bertrand fashion and thus cannot generate any rents (DIAMOND [1984], SHARPE [1990], VON THADDEN [1995]). Empirically, this is clearly not true, in particular not in the case of transition economies.[1] As we shall see in Section 2, the banking sector of some transition economies is still dominated by a few state banks or previously state-owned banks. A recent article by YANELLE [1997] suggests that the competitive structure of the credit market depends on the outcome of the banks' competition for deposits. As we will point out below, in most transition economies this competition for deposits does not play a significant role yet.

In the literature on financial intermediaries, monitoring is seen as a device to collect information about a firm, either before a credit contract is signed, in which case it is called screening, or after the contract is signed and the investment is taking place. But it is little understood how bank competition affects the monitoring incentives of banks'. If a bank's screening activities generate information spillovers then one obvious problem that arises in a competitive banking sector is that all banks prefer to free ride on the information acquisition of their competitors. No bank wants to incur the screening costs if it can rely on the information provided by others (HELLWIG [1991]).

What if the information is private? BROECKER [1990] and RIORDAN [1993] investigate the implications of bank competition when banks engage in screening, but assume that screening is costless and thus not subject to incentive problems. BROECKER analyzes a competitive credit market where banks receive costless independent binary signals about the creditworthiness of a potential creditor. The banks are engaged in Bertrand competition. His analysis shows that the number of bad loans provided increases with the number of banks which has a negative impact on the average credit-worthiness. RIORDAN considers a similar model of bank competition in which a firm asks for a loan for an investment project that can be either profitable or not. Each bank receives a costless continuous signal about the probability of success of the investment project. RIORDAN shows that an increase in the number of banks has two effects. It increases the number of

[1]HELLWIG [1997] reports of another example, the relationship between banks and depositors in Germany in the 19th century, where competition was not very intense.

signals observed but it also increases the number of bad loans provided which can reduce social welfare. Furthermore, more competition makes the winner's curse problem more severe which induces banks to adopt a more conservative rule for loan approval. This greater conservativeness can also result in a significant welfare reduction.

The impact of bank competition (with and without monitoring) on social welfare is also subject of papers by MATUTES and VIVES [1996] and CAMINAL and MATUTES [1997]. MATUTES and VIVES [1996] study banking competition for deposits. Monitoring plays no role in their model. Their analysis suggests that the probability of bank failure increases with the degree of rivalry because of the lower profit margins banks can obtain which implies a negative impact of bank competition on social welfare.

CAMINAL and MATUTES [1997] analyze both effects, the impact of bank competition on monitoring incentives and credit rationing, and on the probability of bankruptcy. In their model, a monopolistic bank has a higher incentive to monitor managerial effort because it obtains higher rents. But more information reduces the credit rationing and thus a monopolistic bank provides more credits. Since by assumption larger loans are more sensitive to aggregate uncertainty the riskiness of a loan increases with its size. Thus, the relationship of competition and potential bank failure is ambiguous. On the one hand, a monopolistic bank enjoys higher profit margins which should reduce the risk of bankruptcy. On the other hand, a monopolistic bank gives larger credits and thus may actually face a higher risk of going bankrupt.

An important drawback of the papers by BROECKER and RIORDAN is their assumption that signals are costlessly available. If information acquisition is costly instead, then the interesting question is how the banks' incentives to invest in screening depend on the market structure. Furthermore, none of the above papers takes into account what impact the banks' screening activities and bargaining power may have on the behavior of the firms to be financed. However, a full appraisal of the efficiency implications of banking competition requires to evaluate how firms react to different banking environments in their investment or restructuring decision.

To study these questions we set up a very simple model with one firm that needs a credit to finance an investment project with uncertain return. We distinguish two competitive scenarios in the banking sector, one with a monopolistic bank that can make

a take-it-or-leave-it offer and one with two banks that compete in Bertrand fashion for a credit contract with the firm. Before making an offer, each bank can engage in costly screening activities to find out about the profitability of the investment project.

We show first that a monopolistic bank has efficient incentives to screen the project and that the resulting credit allocation is efficient. In case of competitive banks the screening incentives depend on whether or not the information acquisition leads to an information spillover. If this is the case, then a typical free-rider problem arises and no bank engages in screening which then implies an inefficient credit allocation because too many bad projects are financed in equilibrium.

However, if screening does not generate information spillovers then we find that a competitive bank has also efficient incentives to engage in information acquisition provided the competitor does not do so. In a symmetric equilibrium both banks engage in screening with positive probability and the resource allocation is less efficient than under a monopolistic banking structure due to three effects. With positive probability no screening takes place which leads to inefficient credit allocation, with positive probability both banks engage in screening which implies an inefficient duplication of information cost, and with positive probability competition results in an uninformed bank providing credits for bad projects which again is inefficient.

In a second step we include the possibility that the manager of the firm engages in restructuring his firm. The idea is that the manager can spend some effort which increases the returns of good projects. How much he restructures depends of course on his share of the payoff of the project if it is financed by the bank. Since a monopolistic bank appropriates all the rents of the project the manager has no incentive to engage in restructuring whereas he has efficient restructuring incentives in a competitive banking sector. We identify situations where the overall efficiency of credit allocation, monitoring, and restructuring in a competitive banking sector is larger than in a monopolistic banking sector, and vice versa.

The paper is organized as follows. In section 2 we briefly review the current status of the market for corporate finance and corporate control in Eastern Europe, including a short description of the banking sector. Section 3 presents a very simple model of bank competition and studies the banks' incentive to screen investment projects as a

function of the degree of competition in the banking sector. In Section 4 we include the restructuring efforts of the manager of the firm and investigate the overall efficiency of credit allocation, monitoring and restructuring. In Section 5 we conclude with a discussion of the assumptions and implications of our analysis and their particular relevance for the banking sector in transition economies.

2 Corporate finance and corporate control in Eastern Europe

A large number of firms in Eastern Europe and the former Soviet Union have emerged from the transition process with a corporate governance structure that is dominated by insider control. In Russia, both the enterprise reforms in the late 1980s and the privatization procedure in the 1990s strongly favored insiders, in particular managers, to gain control. In Poland and Hungary the picture is similar, with the notable difference that here it is more the workers who are in fact controlling their firms. Only in the Czech Republic and Slovakia is the occurence of insider control less pronounced (BERGLÖF [1995]).

The problem of insider-control seems to be not so much that managers are tempted to mismanage the firm. On the contrary, they should have an interest in maximizing profits since managers are often de facto and de jure owners of the firms they control. This also includes firing workers given that reducing labor costs is often the only way to increase profits if it is impossible to attract new capital from outside. And indeed, while many economists warned that insider-control would result in widespread asset stripping and too little layoffs, the empirical evidence draws another, less pessimistic picture (BERGLÖF).

The real problem of insider-controlled firms is rather that they find it difficult to raise new capital for restructuring their firms. In principle, a firm has several alternatives to finance its investments, either internally, using accumulated profits, or externally via banks or the capital market. Anglo-American or European firms finance 70 percent of their investments by retained earnings, 25 percent by bank loans and the rest by trade credits, equity issues and bond issues (MAYER [1988]).[2] In Eastern Europe, however, firms have not accumulated enough profits to rely on internal financing. Stock markets and bond

[2]See also MYERS and MAJLUF [1984] for a theoretical analysis of the managers' decision when to use retained earnings instead of credits and credits instead of issuing equity for the financing of investments.

markets do not play a major role in the provision of funds, either. Potential shareholders fear that insider-controlled firms have a low propensity to pay dividends to outsiders but are much more likely to distribute its profits among insiders. Bond markets holders on the other hand find that their rights are too little protected to make this alternative attractive (BELYANOVA and ROZINSKY [1995]).This leaves outside-financing by banks as the only relevant alternative.

In case of outside-financing an efficient capital transfer is hindered by asymmetric information. The problems are threefold: at an ex ante stage there exists a problem of adverse selection because the manager has better information about the profitability of his project than the investor does. At an interim stage there exists a moral hazard problem because the manager may use the capital in a way that is not optimal from the point of view of the investor. Finally, at the ex post stage there exists the problem that the manager may withhold repayment of the credit.

In view of these problems, outside-financing by banks can take two forms: either as an *arm's length relationship* in which the bank securs its investment with collaterals provided by the firm or as a *control-oriented relationship* in which the bank monitors and controls the firm. The problem with arm's-length relationships in Eastern Europe is that firms have no collaterals to offer, in particular since markets for collateral goods are very illiquid due to strong insider-control and poor enforcement of property rights (BERGLÖF, BELYANOVA and ROZINSKY).

This leaves control-oriented financing by banks as the only realistic alternative for insider-controlled firms in transition economies. Of course, controlling firms is difficult because of insufficient accounting systems or other sources of publicly available information. Banks do, however, have a comparative advantage in controlling firms because of their on-going relationship with firms as their creditor and payment agent. In Russia, for example, enterprises are forbidden to open more than one current account which gives banks the chance to observe all financial transactions of their customers (DITTUS [1996]). In the Ukraine, the information problem is "solved" by relying on personal contacts to obtain information about potential borrowers and by giving priority to debtors which are personally known (JOHNSON et. al. [1993]). In principle, banks can provide funds either in form of debt or equity. With regard to a bank's monitoring incentives the two forms play a different and to some extend complementary role. As long as a firm can

serve its credits control remains with equity holders, but in case of bankruptcy it shifts to debt holders. For this reason, control by equity holders is usually considered to be more appropriate for normal, i.e. profitable times, whereas control by debt holders seems more indicated in times of financial distress (AGHION and BOLTON [1992]).

In Eastern Europe, DITTUS argues, banks have so far been reluctant to take an active role in firms' corporate governance by becoming large equity holders.[3] Interviews with bank managers reveal that they consider active monitoring as equity holder as extremely costly in terms of human capital and management time while the payoff is relatively low. They also want to avoid the conflict of being tempted to provide credits to firms in which they own a part of the shares. They do not see that ownership would create synergy gains for credit approvals. Instead they think that their relationship with their customers due to running their current accounts provides them with enough information (DITTUS).

In the remainder of this section we give a short overview of the current status of the banking system in several transition economies. Russia restructured and corporatized its state banking system in the early 1990s. Two types of commercial banks are now working in Russia: formerly state owned banks and new banks. The major difference is the source of their funds. Former state banks rely primarily on funds from the current accounts of enterprises and on centrally provided loans while new banks rely more on deposits by enterprises and interbank loans (BELYANOVA and ROZINSKY).

Competition for depositors was for a long time negligible. Prior to the banking reform neither firms nor individuals could choose where to place their deposits and there was a strong persistance of these old ties between banks and their customers. As this is changing the new commercial banks struggle with the problem that they still lack the facilities to deal with a large number of depositors. Due to the increasing number of banks competition for reliable borrowers is becoming more intense. But the strong growth of the banking sector is coming to an end because the minimum size of initial statutory capital of newly registered banks was considerably increased. Furthermore, banks are now subject to more active supervision and may lose their licence if found to be in financial distress (BELYANOVA and ROZINSKY).

[3]DITTUS reports examples from Poland and the Czech Republic where banks seem to prefer holding small stakes in a large number of firms. One of the reasons suggested for this behavior is that banks hope to attract banking business through these relationships (COFFEE [1996]).

So far banks seem to have played no active role in controlling firms, with one notable exception, the socalled "export-sector-banks" (ESB). They specialize in hard currency operations of Russian exporters. Since high inflation restricts all other banks to providing short-term credits they are the only banks that can provide middle-term credits. The ESB banks are likely to monitor their debtors because their credits are commercial, not government-directed, and so they have to enforce repayment. Furthermore, they can afford to pay salaries high enough to attract experts in monitoring firms (BELYANOVA and ROZINSKY).

The Czech Republic established a two tier banking system in 1990, and in 1992, the parliament passed a law regulating the privatization of state-owned banks, the creation of new private banks and the establishment of subsidiaries of foreign banks. The following years have witnessed a rapid expansion of the banking sector. In 1995 there were 55 banks active (see Table 1). The Czech Republic is the only transition country that has successfully privatized a substantial part of its banking sector. However, the state still controls large parts of the banking activities through its majority ownership of the three largest private banks. These three banks dominate the market for deposits and credits, covering 75 % of all private deposits of households and firms (almost 70% are attracted by the Bank Ceska Sporitelna) and 60 % of all credits. The reasons for this are mostly historical. Ceska Sporitelna used to have a monopoly position as an institution to collect the savings of private households and still benefits from an extensive network of branches. For similar reasons the other two largest banks, Kommercni banka and Investicni a Postovni banka, benefit from the fact that they are the successors of the commercial banking activities of the former monobank (OECD [1996]).

Poland established a two-tier banking system with its new banking law in 1989. Shortly afterwards new commercial banks were established, some of them state-owned and some of them new. In Hungary, the picture looks similar, starting with the creation of a two-tier banking system in 1987. In the following years a substantial number of new banks started business in both countries (see Table 1). In 1992, however, many of the state-owned commercial banks in Hungary and Poland were insolvent if measured by Western standards. On the one hand they suffered from bad loans inherited from the socialist "monobank", on the other hand they had experienced losses due to defaults on new loans. The problems resulted partly from the lack of a hard budget constraint for banks.

Table 1: Numbers of commercial banks

	1988	1989	1990	1991	1992	1993	1994	1995
Hungary	24	24	31	37	35	42	42	42
Poland	6	14	75	86	87	95	85	75
Czech Republic	n.a.	5	21	33	45	57	58	55

Source: ANDERSON and KEGELS [1998, 233].

Governments guaranteed the deposits of state-owned banks (explicitly or implicitly) and (repeatedly) recapitalized banks. In Hungary, banks were effectively recapitalized four times between 1991 and 1994. In this period there were no clear plans for bank privatization and bank managers were not given performance-based incentive contracts. Also, banking supervision has been weak. Poland instead recapitalized its commercial state banks only once, in 1993. Furthermore, the government took a number of other measures that were intended to change incentives and promote privatization in commercial banks.[4] Although, compared to Hungary, Poland gave more attention to incentive problems, a number of problems remained. Not all banks were part of the program, there were no explicit criteria for the dismissal of incompetent managers and in fact there has been little turnover in senior management of banks. There are also few measures to correct deficient lending procedures which resulted in more bad loans (BAER and GRAY [1996]).

Like in The Czech Republic, bank competition in Poland and Hungary is not as intensive as the numbers in Table 1 suggest. Table 2 indicates that despite the increase in numbers banking business in all three countries is still dominated by the old state-controlled banks. The asset concentration of the five largest banks even underrepresents the extend to which bank business is concentrated because in Poland for example markets are segmented regionally which leaves only two or three effective competitors in each region outside Warsaw (ANDERSON and KEGELS [1998]) .

[4]The Polish Enterprise and Bank Restructuring Program in 1993 prohibited to give credits to problem debtors, and gave incentives to bank managers to maximize the value of the bank.

Table 2: Asset concentration 1993 (as % of commercial bank assets)

	National bank offshoots	Five largest banks
Hungary	75.5	69.5
Poland	85.1	56.3
Czech Republic	75.6	82.7

Source: ANDERSON and KEGELS [1998, 234].

Other reasons why competition may be less intense than the number of competitors suggests are the large number of cross shareholdings among banks and the fact that most bank managers know each other from their previous employment in the former state bank, which may facilitate collusive behavior.

Table 3: Banks with foreign ownership

	1990	1991	1992	1993	1994	1995
Hungary	n.a.	n.a.	15	19	23	23
Poland	n.a.	n.a.	n.a.	8	11	15
Czech Republic	6	13	20	25	25	25

Source: ANDERSON and KEGELS [1998, 235].

Foreign banks have not played a major role for bank competition yet. The numbers of foreign banks are still rather small, as Table 3 shows. Of course, they cannot rely on an extensive network of branches like the state-owned and formerly state-owned banks and thus suffer from a competitive disadvantage. Poland and the Czech Republic have been reluctant to grant licences to foreign banks because they prefer foreign banks to acquire small domestic banks instead of opening new subsidiaries. Hungary instead has

been more open to foreign banks. Nevertheless, competition is far from being intense, which is reflected by the large spread between interest rates on deposits and on loans.

3 Bank competition and screening incentives

In this section we set up a model of banking competition to determine the banks' incentives to engage in screening and the resulting efficiency of credit allocation. Consider a firm that has a potentially profitable investment opportunity. The investment costs of the project are i, $i > 0$. This project can be either good in which case it generates a return of v, $v > i$, or it can be bad and its return is zero. The ex ante probability of the project being good is q, $0 < q < 1$. We restrict attention to parameter values such that the expected payoff of the project is positive; i.e. $qv - i > 0$.

The firm has no funds to finance the project itself and therefore has to look for outside financing. We assume that outside financing is provided only by banks in form of credits. Since the firm cannot provide any collateral repayment of the credit can be enforced only if the returns from the project are positive.[5] In the following we distinguish two different cases for competition in the banking sector.

I **Monopolistic banking sector:** If the monopolistic bank offers a credit it makes a take-it-or-leave-it offer z to the firm, which means that the firm has to repay z if the project is successful.

II **Bertrand competition with two identical banks:** The banks make simultaneous offers z_1 and z_2. The bank making the lowest offer will finance the project. If both firms ask for the same repayment, then each bank finances the project with equal probability.

A well known result from the Industrial Organization literature is that even with just two firms Bertrand competition leads to outcomes of perfect competition if products are not differentiated. Thus, our two cases represent two extreme forms of competition, no competition in case I, and perfect competition in case II.

[5]Even if returns are positive it may be difficult to enforce repayment. This problem of ex post moral hazard is analyzed e.g. in HART and MOORE [1994]. Since the focus of our paper is on different issues we abstract from this problem of repayment enforcement.

To keep our analysis as simple as possible we do not model competition on the market for deposits but take it as given that each bank has enough funds to finance the project. The recent literature on banks as financial intermediaries suggests that the competitive structure of the credit market depends on the outcome of the banks' competition for deposits (YANELLE [1997]). However, as we have seen above, in many transition economies banks do not actively compete for deposits. Thus, it seems justified to neglect this competition for deposits in our context.

Before a bank decides whether or not to make a credit offer to the firm it can engage in screening activities. If the bank spends e it can find out whether the project to be financed is good or bad. The time structure of the game is thus as follows. At stage 1 the bank(s) (simultaneously) decide(s) whether or not to engage in screening. At stage 2 the bank(s) (simultaneously) decide(s) what credit offer to make to the firm, after having observed the screening decision of its competitor. At stage 3, the returns of the project are realized and the repayment is made, if possible.

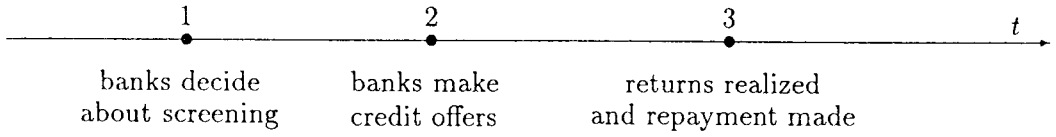

Figure 1: Time structure

The firm and each bank is run by an owner-manager who maximizes the profits of its enterprise. In the conclusions we will discuss why this assumption makes sense in the context of transition economies and how the results may change if we allow for different payoff functions.

Before we investigate how bank competition affects the incentives to screen the project we consider first as a benchmark the efficient rule for screening the project, given that there is asymmetric information about its profitability. For this purpose, we have to compare the social surplus in case of screening and in case of no screening. Note that without screening the expected surplus of the investment is, from an ex ante point of view,

$$q(v-i)+(1-q)(0-i)=qv-i. \tag{1}$$

In case of screening, the project is carried out only if it is found to be good. From an ex ante point of view the expected social surplus is

$$q(v-i)-e. \tag{2}$$

Thus, screening is efficient if and only if

$$q(v-i)-e \;>\; qv-i \iff i(1-q) \;>\; e\,; \tag{3}$$

i.e. if and only if the cost of screening are outweighed by the expected loss if a bad project is financed. To make our analysis interesting we restrict attention to parameter cases such that screening is indeed efficient.

Case I: A monopolistic bank

Consider the bank's decision whether or not to screen the project. Suppose it screens the project and learns that the project is good. Then the unique subgame-perfect-equilibrium offer is $z = v$ which the firm, being indifferent, accepts. If the project is found to be bad no offer is made at all. Thus, the bank's expected payoff in case of screening is

$$q(v-i)-e. \tag{4}$$

Suppose next that the bank does not engage in screening. In this case it has two options. It can either offer a credit and ask for a repayment z or not offer a credit at all. As we assumed above any repayment $z \leq v$ can be enforced if the project turns out to be good. If it is bad, then no repayment can be enforced because the firm has no collateral to offer. Naturally, if a credit is offered at all it is optimal for the bank to ask for $z = v$. The firm will accept this offer because it anticipates that it will have to pay z only if the project is indeed good. The bank prefers to offer a credit if and only if

$$q(v-i)+(1-q)(0-i) = qv-i > 0 \tag{5}$$

which is satisfied by assumption. The following Proposition summarizes the bank's optimal decision about screening.

Proposition 1 *Consider a banking sector with one monopolistic bank. The bank has first best incentives to engage in screening and the resulting resource allocation is efficient.*

Proof: Note that the bank extracts all the surplus from the firm. Thus, it prefers to screen if and only if

$$q(v-i)-e \;>\; qv-i \tag{6}$$

which is exactly the condition for efficient screening. Given this first best incentive to screen, screening takes place only if it is efficient which ensures an efficient resource allocation. *Q.E.D.*

Case IIA: Bertrand competition with information spillovers

Consider now the case with two banks competing in Bertrand fashion and suppose that all information about the project generated by screening activities becomes public before banks make credit offers. This is called the case with perfect information spillovers.

Suppose first that no bank engages in screening activities. Then the resulting Bertrand competition will drive the equilibrium price down to $z_1 = z_2 = z_{ns} = \frac{i}{q}$. At this price both banks finance the project with equal probability and the expected payoff of each bank is

$$\frac{1}{2}[q(z_{ns}-i)+(1-q)(-i)] = \frac{1}{2}[q\frac{i}{q}-i] = 0\ . \tag{7}$$

Note that if $z_{ns} > \frac{i}{q}$ both banks make positive profits with probability $1/2$ and each bank would have an incentive to undercut its competitor to get the contract with probability 1.

Suppose next that one bank engages in screening. Since its information becomes common knowledge no bank will make a credit offer if the project is found to be bad. If it turns out to be good then competition will drive down the equilibrium price to $z_1 = z_2 = z_s = i$ since now the winning bank can be sure of a return of $z_s - i$. The following Proposition summarizes the incentives of banks in Bertrand competition to engage in screening activities.

Proposition 2 *Consider a banking sector with two banks that engage in Bertrand competition. Suppose further that any screening activity generates perfect information spillovers. In this case, no bank engages in screening in equilibrium and the resulting resource allocation is inefficient.*

Proof: A firm that engages in screening incurs cost e but its expected payoff is zero, independent of its screening activity. Thus, screening does not pay even if it is efficient to do so. *Q.E.D.*

The inefficiency of information acquisition and resource allocation stated in Proposition 2 reflects the free-rider problem in information collection with spillover effects.

Case IIB: Bertrand competition without information spillovers

If a bank can exclude its competitor from using its information screening becomes more attractive. However, from our analysis above we can conclude that it cannot be an equilibrium that both banks simultaneously engage in screening. Like in the case of information spillovers price competition would drive prices down to marginal cost and the information cost which is sunk at the time the credit offers are made would not be recovered. What are the incentives of a bank to engage in screening when the other bank does not? Before we consider the incentives we first have to analyse the price competition between an informed and an uninformed bank. The following Proposition characterizes the outcome of this price competition.

Proposition 3 *Suppose bank 1 knows the profitability of the project and bank 2 does not (or vice versa). Then there exists no price equilibrium in pure strategies, but there exists a mixed strategy equilibrium with the following features:*

- *Bank 1 makes no offer if the project is bad. If it is good it chooses prices from the price range* $[\frac{i}{q}, v]$ *according to the following cumulative distribution function*

$$F(z_1) = \frac{qz_1 - i}{q(z_1 - i)} \quad \forall z_1 \in [\underline{z}_1, v) \quad \textit{and} \quad prob(z_1 = v) = \frac{(1-q)i}{q(v-i)} \,. \tag{8}$$

  Note that $F(\underline{z}_1 = \frac{i}{q}) = 0$ *and* $F(\overline{z}_1 = v) = 1$.

- *Bank 2 makes no offer at all with probability* $\pi = \frac{(1-q)i}{q(v-i)}$ *and with probability* $(1-\pi)$ *it chooses prices from the price range* $[\frac{i}{q}, v]$ *according to the following cumulative distribution function*

$$G(z_2) = \frac{(v-i)(qz_2 - i)}{(qv-i)(z_2 - i)} \tag{9}$$

  Note that $G(\underline{z}_2 = \frac{i}{q}) = 0$ *and* $G(\overline{z}_2 = v) = 1$.

- *If the banks make different offers the firm accepts the lowest of the two. If both banks charge the same price, the firm randomizes between the two with equal probability, unless they both charge v, in which case it chooses bank 2 to finance the project.*

The unique expected equilibrium payoffs of the two banks in any equilibrium are $i(1-q)-e$ *for bank 1 and zero for bank 2.*

Proof: See Appendix.

Not surprisingly, banks that are engaged in Bertrand competition make much lower profits than a monopolistic bank. Only if a bank is better informed than its competitor can it make positive profits at all. Intuitively, one would expect that therefore a competitive bank has much smaller incentives to engage in screening than a monopolistic bank. The following Proposition compares the incentives competitive banks have to engage in screening with those of a monopolistic bank. This comparison also tells us how the resulting screening equilibrium affects the efficiency of resource allocations. Proposition.

Proposition 4 *Consider a banking sector with two banks that engage in Bertrand competition. Suppose further that screening activities do not generate information spillovers.*

- *In this case a bank has first best incentives to engage in screening if the other bank does not.*
- *There exists a unique symmetric mixed strategy equilibrium where each bank screens with probability* $\mu \equiv \frac{i(1-q)-e}{i(1-q)}$, *with* $0 \leq \mu \leq 1$. *This probability* μ *decreases in the screening cost e and it increases in the benefit of screening* $i(1-q)$. *The resulting resource allocation is less efficient than in case of a monopolistic bank.*
- *Furthermore, there exist two asymmetric pure strategy equilibria in each of which one firm screens with probability 1 and the other does so with probability 0. The resulting resource allocation is less efficient than in case of a monopolistic bank.*

Proof: See Appendix.

Proposition 4 tells us that a competitive bank has exactly the same incentive to engage in screening as a monopolistic bank, provided its competitor does not screen.

This result may look surprising at first glance but the intuition is easy to explain. Note that in Bertrand competition with firms that have asymmetric cost the profits of the low cost firm reflect exactly its cost advantage. In our case the "cost advantage" of the informed bank is that it saves the expected investment cost in case the project is bad. Thus, if the informed bank competes against an uninformed bank its profit is equal to the investment cost saved due to its information advantage. This explains why it must have first best incentives to engage in screening.

However, the resulting resource allocation is less efficient than in case of a monopolistic bank. To see this consider first the case of the asymmetric equilibrium. Of course, the informed bank will never offer a credit to a firm with a bad project. But the uninformed bank cannot make its credit offer conditional on the type of the project. Since in equilibrium it makes a price offer with positive probability, there exists a positive probability that a bad project will be financed by the uninformed bank. This is of course inefficient.

Consider next the case of the symmetric equilibrium, where both firms engage in screening with positive probability less than one. In this case there are two additional sources for inefficiencies. First of all with positive probability no bank engages in screening which by assumption is inefficient because the screening cost saved are outweighed by the losses incurred by bad projects. Second, with positive probability both firms engage in screening. In this case screening costs are duplicated which is inefficient.

To summarize: A competitive bank has efficient incentives to engage in screening provided its competitor does not do so. However, the equilibrium resource allocation is less efficient than in case of a monopolistic bank because in equilibrium banks may screen too little or too much and it can happen that bad projects are financed even if one bank engages in screening.

4 Bank competition and restructuring incentives

In this section we study how bank competition affects the firm's incentive to invest in its project. We will call this investment the manager's restructuring effort.

Consider a manager who can make the project more profitable by spending some unobservable effort. We distinguish two possible restructuring technologies:

- **Technology A**: The manager can increase payoff v of a good project from $\underline{v}$ to $\overline{v}$, $\overline{v} > \underline{v} > i$, if he spends an unobservable effort a.

- **Technology B**: The manager can increase the probability of the project being good from $\underline{q}$ to $\overline{q}$ if he spends an unobservable effort b.

The time structure of the game is now as follows. At stage 0 the manager of the firm decides whether or not to spend effort on restructuring his firm. At stage 1 the banks decide (simultaneously) whether or not to engage in screening. At stage 2 the banks decide (simultaneously) what offer to make to the firm. At stage 3 the returns of the project are realized and the repayment is made.

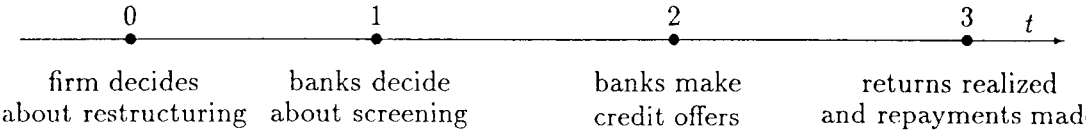

Figure 2: Time structure with ex ante restructuring

We start by analyzing the restructuring incentives in case of technology A. Consider first a monopolistic bank. Note that the bank's incentive to screen the firm is unaffected by the possibility to invest in restructuring. In any case it will ask for the maximum possible price $z = \overline{v}$ and the firm pays $\overline{v}$ if it has restructured and $\underline{v}$ if it has not. The potential benefit of screening is again to avoid financing a bad project, i.e. $i(1-q)$, which by assumption is bigger than e, the cost of screening and the project is considered for screening and financing only if $q(\underline{v}-i)-e > 0$. In this case the manager has no incentive to invest in restructuring his firm. Since his restructuring effort is unobservable it has no effect on the bank's financing or screening decision and no effect on his monetary payoff either since the bank will appropriate all the returns anyway with its take-it-or-leave-it offer. Thus, restructuring is not profitable for the manager.

This is different in case of competition with information spillovers. Recall that in this case banks never screen in equilibrium. The equilibrium price which is asked, $z = \frac{i}{q}$, is independent of the value of a good project and thus not affected by the manager's restructuring effort. If the manager knows the project to be good and invests in restructuring

his monetary payoff is $\overline{v} - z - a$, if he does not his payoff is $\underline{v} - z$. Thus, he chooses to restructure if $\overline{v} - \underline{v} > a$; i.e. when it is efficient to do so. This implies that the manager has first best incentives to engage in restructuring.

Consider finally the case of competition without information spillover and suppose again that the manager knows that the project is good. In this case the price he expects to pay for a credit depends on whether banks screen or not. However, since his restructuring effort is unobservable until the returns of the project are realized this price cannot depend on his actual restructuring effort, only on the firms expectations about his restructuring efforts. This implies that again, the manager has efficient restructuring incentives. These considerations are summarized in the following Proposition.

Proposition 5 *Suppose the manager of the firm can restructure the firm according to technology A. Then he has efficient incentives to restructure in case of a competitive banking sector and no incentives to restructure in case of a monopolistic banking sector.*

Let us turn now to restructuring technology B and consider again first the case of a monopolistic bank. Since the manager's effort is unobservable this case is interesting only if the monopolist is willing to screen the project if he expects that no restructuring has taken place; i.e., $(1 - \underline{q})i > e$, and if the expected payoff is positive; i.e., $\underline{q}(v - i) > e$. What is the manager's incentive to invest in an increase of the probability of a good project? Since he is held down to a zero payoff by the monopolistic bank in any case he does not benefit from this restructuring effort and therefore, as with technology A, no restructuring takes place.

In a competitive banking sector this is different. Let us examine first the case of competition with information spillovers. If the banks expect that the manager did engage in restructuring, they will compete each other down to an equilibrium price of $z_{ns} = \frac{i}{\overline{q}}$. The manager's payoff if he restructures is thus $\overline{q}\left(v - \frac{i}{\overline{q}}\right)$ whereas it is $\underline{q}\left(v - \frac{i}{\overline{q}}\right)$ if he does not. He will do so if

$$(\overline{q} - \underline{q})\left(v - \frac{i}{\overline{q}}\right) > b \tag{10}$$

in which case the banks' expectation is correct.[6] Note that here the manager's incentives to restructure are not first best because the banks ask a price $z_{ns} = \frac{i}{\overline{q}} > i$. In case of

[6] If $(\overline{q} - \underline{q})(v - \frac{i}{\overline{q}}) < b$ there exists a second equilibrium where the manager does not engage in restructuring and the banks correctly think that he did not.

competition without information spillovers the situation is similar, only the prices the manager expects to pay for the credit differ according to which of the banks is informed about the profitability of the project and accordingly so does his incentive to restructure. Our discussion is again summarized in the following Proposition.

Proposition 6 *Suppose the manager of the firm can restructure the firm according to technology B. Then he has positive, but not first-best incentives to restructure in case of a competitive banking sector and no incentives to restructure in case of a monopolistic banking sector.*

Let us now turn to the question which competitive setting does best if we take both incentive problems, screening and restructuring, into account. A comparison with our analysis in the previous section reveals that there is a tradeoff. A monopolistic bank guarantees efficient resource allocation with respect to screening but destroys all incentives of the firm to engage in restructuring. Competition means less efficient resource allocation with respect to screening activities but better, in some cases even efficient incentives to restructure the firm. The following proposition considers some extreme cases for which we can establish a clear hierarchy among these different competitive cases.

Proposition 7 *(i) Suppose the benefits of restructuring according to technology A or B are negligible. Then social welfare is highest under a monopolistic banking sector.*

(ii) Suppose the benefits of restructuring according to technology A or B are nonnegligible and the costs of screening are negligible; i.e., $e \longrightarrow 0$. Then social welfare is highest under competition without information spillovers.

(iii) Suppose the benefits of restructuring according to technology A or B are nonnegligible but the benefits of screening are negligible; i.e. $e \longrightarrow i(1-q)$. Then social welfare is highest under competition with information spillovers.

Proof: See Appendix

Our analysis so far shows that competition in the banking sector stimulates restructuring of firms because firms receive a larger share of the additional surplus they generate.

At the same time the disadvantages of a competitive banking sector are smaller the smaller the screening cost but only if information spillovers can be prevented. This suggests a positive role of competition for the efficiency of the credit allocation and restructuring of firms in transition economies.

An interesting issue to explore is how restructuring incentives of the firm's manager change if the restructuring investment is made only after screening has taken place. One would expect that in this case a monopolistic bank would refrain from appropriating the entire surplus in order to give some incentives to the manager to increase the value of his company. However, compared to competitive pricing the monopolistic price will still be too high to give first best restructuring incentives. A formal analysis of this possibility is left for future research.

5 Discussion and Conclusions

In this paper we have focussed on two incentive problems that play a crucial role for the efficiency of corporate finance and corporate control in transition economies: screening activities by banks that provide credits and restructuring activities by firms that need credits. This kind of two-sided incentive problems typically suffer from the problem that the two parties involved have to share the joint surplus. This makes it often impossible to give efficient incentives to both sides at the same time. In our set-up one might therefore expect that screening is efficient if the bank can appropriate all the returns in the monopolistic banking sector and that restructuring is efficient if the firm can appropriate all the returns in the competitive banking sector but that no market structure can provide efficient incentives to both sides. Surprisingly, our analysis showed that this intuition is not entirely correct. Even in a competitive banking sector banks have an incentive to engage in screening although their overall payoff is much smaller. Thus, if screening is not too costly total welfare is maximized in a competitive banking sector. This is due to the fact that the screening incentives depend on the difference between payoffs with and without screening rather than on the absolute payoff in case of screening alone.

Before we conclude that countries in transition should encourage competition in the banking sector we want to discuss some issues not considered in our analyis that may be of relevance for the overall appraisal.

First of all, we have not modelled competition for deposits and assumed instead that each bank has enough resources to finance the project in question. As we have argued above, this seems to be justified as long as most banks in transition economies rely on central bank money or the money market to provide credits. But as this will change the question arises how the competition for deposits affects the total amount of deposits available and the competitive structure of the banking sector. In this context, another interesting question is how the presence of foreign banks does affect the availability of financial resources, i.e. to what extend there will be an inflow of capital from abroad.

Second, throughout the paper we have assumed that the screening incentives of bank managers and the restructuring incentives of the firm's manager are driven by the monetary payoff of their enterprise. It is often argued that this is not a realistic assumption in the presence of a separation of ownership and control of a firm. But as long as the managers' incentives are at least positively related to their firm's profits our analyis still leads to the right conclusions as far as the relative efficiency of different market structures for the banking sector is concernced.[7]

The results of our analysis might change, however, if we allow motives other than profit maximization to play a role. Consider first the case of banks. Here an important issue that could affect bank managers' behavior is the possibility of bankruptcy of banks. It seems reasonable to assume that the likelihood of a bank's bankruptcy increases with the degree of competition in the banking sector (see MATUTES and VIVES). Theoretically, allowing for bankruptcy could have two opposing effects. If the manager is negatively affected by bankruptcy because he loses his job then the threat of potential bankruptcy induces managers in the competitive banking sector to engage more in screening activities. If, however, he is not negatively affected by a bankruptcy and cares only about the profits of the bank the possibility of bankruptcy makes him willing to take on a higher risk by screening less. The point is that a potential bankruptcy makes a competitive bank less likely to actually suffer from the losses of a bad project than a monopolistic bank.

A priori, it is not clear which effect is more relevant for transition economies. It seems that bank managers so far have suffered little if their bank got in financial distress.[8] In

[7]SCHMIDT [1997] analyzes whether a manager's incentive scheme designed by the owners of a firm varies systematically with the market structure in which the firm operates. He gives sufficient conditions for this relationship to be monotonic.

[8]AGHION, BOLTON and FRIES [1998] point out another problem that may arise if bank managers

many countries banks still face a soft budget constraint and are recapitalized if they are in danger of bankruptcy. This suggests that the threat of bankruptcy does not increase the banks' screening incentives.

Consider next the manager of the firm and suppose that his restructuring incentives are not driven by the profits of the firm but rather by the fact whether or not his firm does indeed obtain a credit and is thus able to carry out the investment project. Think of a manager who is not given any monetary incentives by the owners of the firm but instead enjoys rents and perquisites if the investment project is financed and carried out. In this case competition in the banking sector would be bad for his restructuring incentives because it would imply less screening and thus a higher chance to obtain a credit even in case of a bad project. Here, a monopolistic banking sector would lead to more screening and thus indirectly also to more restructuring.

Despite these arguments we feel confident that the assumptions and conclusions of our model are relevant for transition economies. The point is that in many transition economies the problem of diverging interests due to a separation of ownership and control is still less prevalent precisely because of the dominance of insider control. As our discussion in Section 2 shows, if managers control and appropriate large parts of a firm's profits it seems not too unrealistic to assume that they are interested in maximizing the firm's monetary payoff. We also think that at the current state more weight should be given to restructuring incentives than to screening incentives because the most important problem seems to be to encourage firms to develop good projects at all. This again points to encouraging competition in the banking sector. Having said this one must acknowledge that encouraging bank competition is difficult, at least in the short run, in so far as the human capital necessary to monitor and screen firms is in scarce supply and cannot be quickly increased if the number of competing banks grows.

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have to fear sanctions in case of bankruptcy. In this case they may choose to misrepresent the true stat of profitability of their bank to avoid bankruptcy procedures.

Appendix

Proof of Proposition 3:

We show first that there cannot exist an equilibrium in pure strategies. To see this suppose first that there exists a symmetric equilibrium with $z_1 = z_2 > i$. If the project is good bank 1 has an incentive to undercut bank 2 to finance the project with probability 1. If the project is bad bank 1 is better off not making a credit offer at all. Suppose next $z_1 = z_2 = i$. Then bank 2 is sure to make losses if the project is bad and cannot make any profits if the project is good. Thus, it would be better off not to make an offer at all.

It is also not possible that there exists an asymmetric equilibrium in pure strategies. To see this suppose $i \leq z_1 < z_2$. If the project is good bank 1 would prefer to increase its price such that $z_1 = z_2 - \epsilon$. If the project is bad bank 1 would prefer not to make any offer at all. Suppose next $i < z_2 < z_1$. If the project is good bank 1 prefers to deviate and offer $z_2 - \epsilon$. Suppose next $i = z_2 < z_1$. In this case bank 2 is sure to make losses if the project is bad and cannot compensate this by making profits if the project is good. Thus, it would be better not to make an offer at all.

To prove that there exists an equilibrium in mixed strategies as described in the proposition we have to check that these strategies are mutually best replies.

- Consider first bank 2: To be indifferent between the prices from the price range above and not making an offer at all it must be true that

$$q[(1 - F(z_2))(z_2 - i)] + (1 - q)(-i) = 0 \quad \forall z_2 \in [\frac{i}{q}, v) \tag{11}$$

  It is easy to check that the c.d.f. specified above satisfies this condition. Furthermore, it is easy to see that if bank 2 charges $z_2 = v$ its payoff is

$$q \cdot prob(z_1 = v)(v - i) + (1 - q)(-i) = 0 \; . \tag{12}$$

- Consider next bank 1: To be indifferent between the prices from the price range above it must hold that

$$\pi(z_1 - i) + (1 - \pi)(1 - G(z_1))(z_1 - i) \tag{13}$$

is the same for all prices from this price range. It is easy to check that this is indeed true given the probability functions specified above and that the expected payoff of bank 1 for any price from this price range is equal to $\frac{1}{q}(1-q)i$.

- Consider finally the firm. If both prices are the same it is indifferent which bank to choose and thus any choice is optimal. If the two offers differ then its strategy to choose the low price offer is also optimal.

To prove that the equilibrium payoffs of the game are unique we proceed as follows:

- In any equilibrium it must be the case that bank 1 makes no offer that is accepted with positive probability if the project is bad. Otherwise it would make losses with positive probability which could be avoided by not making an offer at all.

- The lowest possible price bank 2 offers, $\underline{z}_2$, cannot be lower than $\frac{i}{q}$. If bank 2 offers $\underline{z}_2$ it knows that with probability (1-q) the project is bad in which case bank 1 makes no offer that is accepted with positive probability. If the project is good, the best it can hope for is that its credit offer is accepted with probability 1. Thus, its expected payoff when offering $\underline{z}_2$ is at most $q(\underline{z}_2 - i) + (1-q)(-i)$. Thus, $\underline{z}_2 \geq \frac{i}{q}$ since otherwise bank 2 would better not make an offer at all.

- In a mixed strategy equilibrium it must be the case that the lowest price offered by each bank is the same for both. Suppose this were not the case, i.e. $\underline{z}_1 < \underline{z}_2$. Then bank 1 would be sure to be chosen as creditor when offering $\underline{z}_1$. But he would equally be sure when offering $\underline{z}_1 + \epsilon < \underline{z}_2$ and his profits would be higher, and vice versa for bank 2.

- If bank 1 chooses $\underline{z}_1 = \frac{i}{q}$ in case of a good project, this offer must be accepted with probability 1, otherwise it would be better to choose $\underline{z}_1 - \epsilon$ which is accepted with probability 1 since bank 2 never undercuts $\underline{z}_2 \geq \frac{i}{q}$. Thus, bank 1's expected payoff when choosing this price is $\frac{i}{q} - i = \frac{1}{q}(1-q)i$.

- It cannot be the case that the two banks both choose a particular price with positive probability. This would imply that with positive probability a draw would occur and they would have to split demand. In this case each bank would be better off by offering a price that is ϵ lower with the same probability and capture all of the demand instead.

- When bank 1 offers its highest price $\overline{z}_1$, its expected payoff must be the same as when it offers its lowest price, i.e. it must be positive. This implies that it cannot be the case that bank 2 offers prices smaller than $\overline{z}_1$ with probability 1 because in this case bank 1 would never succeed with its offer and its payoff would be zero. If bank 1 offers $\overline{z}_1$ with probability zero this implies that bank 2 must offer prices which are undercut by bank 1 with probability 1 and its expected payoff for these prices is zero. If instead bank 1 offers $\overline{z}_1$ with positive probability then bank 2 must offer higher prices or not make an offer at all with positive probability instead because it cannot be that both offer the same price with positive probability. Again, bank 2's payoff from these offers would then be zero. This implies that bank 2's expected payoff must be zero in equilibrium.

Bank 1's ex ante expected payoff when engaging in screening is thus $q(\frac{1}{q}(1-q)i) - e = (1-q)i - e$ since with probability q the project will turn out to be good in which case its profits are $\frac{1}{q}(1-q)i$ as shown above. The expected ex ante payoff of bank 2 which does not engage in screening is zero. *Q.E.D.*

Proof of Proposition 4:

Consider without loss of generality that bank 2 does not engage in screening. Then bank 1's expected payoff if it is does so is $(1-q)i - e$ as shown in Proposition 3. If bank 1 does not engage in screening the resulting Bertrand competition between two uninformed banks will lead to zero profits for bank 1. Thus, bank 1 has an incentive to screen if bank 2 does not if $(1-q)i - e > 0$ which is exactly the efficiency condition for screening.

If bank 2 engages in screening with probability μ then bank 1's payoff in case of screening is

$$\mu(-e) + (1-\mu)[i(1-q) - e] = \tag{14}$$

$$\left(1 - \frac{i(1-q)-e}{i(1-q)}\right)[i(1-q)] - e = 0 \tag{15}$$

which shows that bank 1 is just indifferent between screening and not screening and vice versa for bank 2.

Note that

$$\frac{d\mu}{de} = -\frac{1}{i(1-q)} < 0 \tag{16}$$

Furthermore

$$\frac{d\mu}{di(1-q)} = \frac{i(1-q) - [i(1-q) - e]}{i^2(1-q)^2} > 0 \ . \tag{17}$$

Note that with probability $(1-\mu)^2$ no bank gets informed in equilibrium which is inefficient. With probability μ^2 both banks get informed and the resulting duplication of screening costs is inefficient. With probability $2(1-\mu)\mu$ only one firm gets informed in which case there is still the problem that the uninformed bank makes an offer to a firm with a bad project with positive probability which is also inefficient.

Finally note that it is optimal for bank 1 to engage in screening if bank 2 does so with probability 0 and it is optimal for bank 2 not to engage in screening if bank 1 does so with probability 1 (and vice versa). However, given the mixed strategy price equilibrium described in Proposition 3 the uninformed bank 2 makes a credit offer to a firm with a bad project with positive probability which is inefficient. However, there is no inefficiency due to a duplication of screening cost or due to no screening taking place at all like in the symmetric mixed strategy screening equilibrium.

Proof of Proposition 7:

Proof of Part (i): This follows from the Propositions 1-4.

Proof of Part (ii): Consider the case of a symmetric equilibrium in Case IIB. If the cost of screening $e \longrightarrow 0$, then the probability for each bank to engage in screening $\mu = \frac{i(1-q)-e}{i(1-q)}$ converges to 1 i.e. the probability of an uninformed bank making an offer to a firm with a bad project becomes negligible. Furthermore, the inefficiency resulting from a duplication of screening cost becomes negligible. Thus, social welfare under competition without information spillover is higher than in case of a monopolistic bank because it ensures first best restructuring incentives in case of technology A and nonnegligible positive restructuring incentives in case of technology B at negligible efficiency cost due to too little or too much screening. Similarly, social welfare under competition without information spillover is higher than under competition with information spillover because the restructuring incentives are the same in case of technology A and even higher in case of technology B. In the latter case the probability of both banks engaging in screening converges to 1. This implies that the manager pays a price of only i instead of $\frac{i}{q}$ like in competition with spillovers. Furthermore, the efficiency gain of screening in case of

competition without spillovers is positive. The potential inefficiencies from a duplication of screening cost or inefficient screening but still financing bad projects by an uninformed bank become negligible.

Proof of Part (iii):

If the benefits of screening become negligible then competition with information spillovers dominates monopolistic banking because the efficiency loss due to no screening becomes negligible while the potential gain from restructuring favors competition. The comparison with competition and information spillovers reveals that the advantages of the latter case with respect to screening become negligible as e converges to $i(1-q)$. At the same time the disadvantage of a duplication of screening costs if both banks engage in screening is still nonnegligible. In case of technology A, the restructuring incentives under both competitive cases are the same. In case of technology B any potential disadvantages of competition with spillovers become negligible as the probability of both banks being informed in competition without spillovers converges to zero. Hence competition with spillovers dominates.

Q.E.D.

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