Bank competition and enterprise restructuring in transition economies*

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Abstract: We investigate how bank competition affects the efficiency of credit allocation, using a model of spatial competition. Our analysis shows that bad loans are more likely the larger the number of banks competing for customers. We study further how many banks will be active if market entry is not regulated. Free entry can induce too much entry and thus too many bad loans compared to the social optimum. Finally, we analyze how bank competition affects the firms' restructuring effort. We find that restructuring has positive externalities which give rise to multiple equilibria, with either much or little restructuring activity.

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1 Introduction

The recent financial crisis in Russia has highlighted once more how much the economic prosperity of transition economies depends on a sound and well developed banking system. Over the last decade all countries in Eastern Europe have made attempts to restructure their banking sector. Previously state owned banks were split up, some of them privatized, new private banks have been set up. Looking at these countries more closely, three interesting observations can be made (see section 2).

(1) Many transition countries have experienced a huge increase in the number of banks, due to a rather liberal licencing policy at the beginning of the transition process.

(2) Many of these banks suffer from bad loans, not only those inherited from the former state banks but also loans granted after the restructuring of the banking sector.

(3) Restructuring of firms has not made much progress since the beginning of the transition.

In this paper we suggest one possible explanation for these observations, and argue how they may be related to each other. For this purpose, we investigate how banking competition affects the efficiency of credit allocation and how the market structure of the banking sector evolves endogenously if entry is not regulated. Furthermore, we study what implications the financial system has for the progress of enterprise restructuring. Our analysis suggests that bad loans are more likely the larger the number of banks active in the market. Free entry in turn results in too many banks entering the market which give rise to the bad loans problem. On the other hand, free entry lowers credit costs which has a positive impact on enterprise restructuring. The problem is, however, that through the financial system restructuring has positive externalities which implies that countries can be stuck in a bad equilibrium with too little restructuring if everyone is pessimistic about the restructuring activity of other enterprises.

What makes banks so crucial for the financing of new investments and hence the restructuring effort of firms in transition economies? It is well known that in Western industrialized countries firms rely mostly on retained earnings to finance their investments (70 percent), and only to a much smaller extent on bank loans (25 percent), while trade

credits, bond issues and equity issues play an even smaller role (Mayer, 1988). The problem in Eastern Europe is, however, that firms have not accumulated enough profits to rely on internal financing. Furthermore, institutions like stock markets and bond markets are not sufficiently developed to play a major role. This makes outside-financing by banks the only viable alternative.

Banks, however, face an adverse selection problem since they have less information about the profitability of investment projects than the manager of the firm applying for a credit. Given this problem, they can either engage in an arm's length relationship with their customers and protect their credits with collaterals. Alternatively, they can enter a control-oriented relationship and screen and control the firm they finance. In transition economies, the first alternative is problematic. Although loans are often collateralized, this does not have much meaning because of the legal and practical difficulties of taking possession of collateral goods in case of default. Furthermore, markets for collateral goods are very illiquid due to strong insider-control (Berglöf (1995), Fan, Lee and Schaffer (1996), Belyanova and Rozinsky (1995)). This implies that control-oriented financing must be the prominent mode of financing firms in transition economies.

The existing theoretical literature on bank competition is mainly concerned with the question what impact financial market liberalization has on the stability of the banking sector. In Matutes and Vives (1996), banks compete for deposits. In this model, 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. A similar effect can be observed in Hellmann, Murdock and Stiglitz (1998). They study a dynamic model in which competition for deposits erodes profits and thus promotes gambling in the banking sector because the ongoing concern value of the banks is lower. The problem here is that an increase in competition has little impact on the total amount of deposits, but mainly increases market stealing incentives.

Besanko and Thakor (1993) analyze the impact of competition in case of relationship banking. In their model, banks accumulate proprietary borrower-specific information through the relationship with their clients. This gives rise to information rents. If these rents are shared between bank and borrower both benefit from this relationship. More competition reduces rates for borrowers. But this also makes banks take on more risk and thus jeopardizes the bank-customer relationship. This is why restricting entry is not only

good for stability but may also make borrowers better off. Dell'Ariccia (1998) studies how the market structure of the banking sector evolves endogenously if market entry is not regulated. Like Besanko and Thakor, he considers the case where banks acquire proprietary information about their clients by lending to them. This gives existing banks an advantage over new entrants. Dell'Ariccia shows that even in the absence of exogenous fixed costs of entry only a finite number of banks enter due to adverse selection problems.

In both Besanko and Thakor and Dell'Ariccia, banks acquire information about their customers in the course of their lending relationship. This is different in Broecker (1990) and Riordan (1993) where banks acquire information about potential customers before entering a relationship with them. Broecker analyzes a competitive credit market where banks compete in prices and receive costless independent binary signals about the creditworthiness of a potential creditor. He 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 where banks compete for customers whose projects generate uncertain returns. Each bank receives a costless continuous signal about the profitability of the investment project. In his model an increase in the number of banks has two effects. It increases the number of 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 problem with the papers by Broecker and Riordan is that they assume that signals are costlessly available. However, if one takes into account that information acquisition is costly the interesting question arises how competition affects the banks' incentive to invest in screening potential clients. A first attempt to study this problem has been made in a companion paper (Schnitzer 1998) where we compare the screening incentives of banks in two extreme competitive scenarios, one with a monopolistic bank and one with duopolistic Bertrand competition, where banks offer homogenous goods. In the companion paper we show that the incentive of a competitive bank can be as high as that of a monopolistic bank, but that in general the credit allocation under Bertrand competition is less efficient than in case of a monopolistic bank because it is more likely that bad loans are given. On the other hand, we find that competition in the banking sector can have

a positive impact on the firms' restructuring incentives because lower credit rates allow them to keep a larger share of the surplus to be generated.

In this paper we study a more general framework with spatial bank competition. In this model, firms need credits for an investment project with uncertain return. Banks are located equidistantly around a circular road and compete in prices for customers. Before making price offers, each bank can investigate the profitability of the firms' projects to avoid the risk of giving bad loans. One advantage of this model with spatial competition is that it allows us to avoid the extreme results of Bertrand competition with homogeneous products. Another advantage is that it provides us with a suitable framework to study the effects of gradually changing the number of banks and to endogenize the number of banks active in the market. This allows us to study how the market structure of the banking sector evolves if entry is not regulated. Finally, in contrast to our companion paper, we assume that banks compete not just for one but for many firms. Thus, we can study the interaction of the firms' restructuring activity with the financial system and with each other.

We start our analysis by asking how bank competition affects the banks' incentive to screen firms applying for a credit. A priori one might expect that more competition leads to lower expected profits and hence to lower incentives to invest in screening. Surprisingly, we find that the incentive to screen does not depend on the number of competitors as such but rather on the number of uninformed competitors. The more informed competitors, the larger the incentive to screen because the greater the risk to end up with bad loans. This pressure to screen can result even in inefficiently high screening activity. However, in general we observe that the larger the number of competitors the more likely it becomes that in equilibrium banks give bad loans rather than to invest in screening.

Our next question is how the market structure of the banking sector evolves if market entry is not regulated. Interestingly, we find that even in the absence of exogenous entry costs only a finite number of banks can be active in the market. The reason is that due to the information asymmetries banks have to incur some endogenous entry costs, either because they have to invest in screening or because they risk a loss due to bad loans. However, compared to the optimal number of banks from a social welfare point of view, too many banks enter the market which can result in too little screening and hence too many bad loans being granted. This suggests that some entry regulation may be useful.

Our third question concerns the restructuring effort by enterprises. We model restructuring as some effort taken by entrepreneurs to increase the profitability of their investment projects. Naturally, entrepreneurs engage in restructuring only if they expect a positive return on this activity. This return is the higher, the lower their cost of financing their projects. For this reason, increasing bank competition has a positive impact on the restructuring effort of firms. With free entry, however, the number of active banks depends on the overall restructuring activity of the economy, because the more restructuring takes place the more profitable are the investment projects and hence the more profitable is it to give loans. Consequently, more banks will enter the market. Thus, the restructuring activity of firms has a positive externality on the restructuring incentives of the other firms because it induces more bank entry and hence lower credit costs. This implies that we can have multiple equilibria, a good one with all firms restructuring and many banks entering the market and a bad one with no firm restructuring and less entry of banks. Here, some coordination may be needed to achieve the good equilibrium where much restructuring takes place.

The paper is organized as follows. In section 2 we give a short overview of the restructuring of the banking sector in Eastern Europe. Section 3 introduces the model with spatial banking competition. In section 4 we study how banking competition affects the total screening activity in the banking sector. Section 5 endogenizes the market structure of the banking sector and compares the unregulated market structure with the socially optimal one. In section 6 we include the restructuring effort of firms and investigate the relationship of restructuring and the banking market structure. Section 7 concludes.

2 The banking sector in Eastern Europe

The Czech Republic introduced a two tier banking system in 1990. Since then it experienced a rapid expansion ot its banking sector. In 1995, there were 55 banks active (Anderson and Kegels, 1998). Although the Czech Republic is the only transition country that has successfully privatized substantial parts of its banking sector, the state still controls large parts of the banking activities. It holds a majority ownership of the three largest private banks which in turn dominate the market for deposits and credits, covering

75 % of all private deposits of households and firms (OECD, 1996).

Poland established a two-tier banking system in 1989, Hungary in 1997. In both countries, a large number of new banks started to operate. However, many banks soon got into trouble, suffering from bad loans inherited from the socialist 'monobank' and from defaults on new loans. Banks had little incentive to avoid giving bad loans, partly because they did not face a hard budget constraint. Poland recapitalized its commercial state banks once, in 1993, Hungary did so four times between 1991 and 1994 (Baer and Gray, 1996). In 1995, 75 banks were active in Poland, and 42 in Hungary (Anderson and Kegels). But, like in the Czech Republic, price competition is not very intensive because the banking sector is still dominated by the old state-controlled banks. Another problem is that markets are segmented regionally which sometimes leaves only two or three effective competitors in one region (Anderson and Kegels).

Russia restructured and corporatized its state banking system in the early 1990s. This process resulted in a fragmentation of the specialized banks. At the same time increasing numbers of independent, primarily small and poorly capitalized commercial banks emerged. By mid 1995, 2500 commercial banks were registered in Russia (Fan et al.). In the meantime the strong growth of the banking sector is coming to an end because the minimum size of intitial 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). Despite the large number of banks, competition is not perceived as very intense and firms perceive the cost of loans as too high. On the other hand, banks suffer from having granted bad loans and restructuring of firms is slow (Fan et. al.).

Bulgaria introduced a two tier system 1991. The liberalisation of the banking sector lead to a proliferation of commercial banks, since the legal framework allowed free entry and unchecked banking operations. In the meantime the Bulgarian National Bank has largely increased the minimum capital requirements. However, the entrance of new banks has not lead to increased price competition for loans or deposits. The competitive pressure has mainly resulted in more services and products being offered (OECD, 1997).

In Romania, a two tier system became operational in 1991. However, due to large capital requirements and rigorous licensing requirements, Romania experienced only mo-

derate entry of new banks. On the other hand, banks are not regionally based as in some of the other countries, but cover wider geographical areas. State banks still dominate the banking sector. Lately, entry of new private banks, especially well-known international banks, has been encouraged (OECD, 1997).

In almost all transition countries, foreign banks have not played a major role for bank competition yet and their numbers are still rather small. On the one hand they cannot rely on an extensive network of branches like the state-owned and formerly state-owened banks do. On the other hand, some countries like Poland and the Czech Republic have been reluctant to grant licences to foreign banks because they would like them to acquire small domestic banks instead of opening new subsidiaries. The most notable exception is Hungary, which has been more open to foreign banks (Anderson and Kegels).

The picture that emerges from this overview is that most countries have experienced a large increase in the number of banks. On the other hand, many of these banks are having trouble with bad loans. However, price competition is not as intensive as the number of competitors suggests due to the fact that markets are still dominated by a few (often state-controlled) large banks.

3 The model

Consider a banking sector with n banks that are allocated equidistantly along a circular road of length 1. Banks compete for customers, i.e. firms that need loans. We assume that firms are uniformly distributed along the road. The total mass of firms is normalized to 1. Each firm has a potentially profitable investment opportunity which requires an investment of size i, $i > 0$. The project can be either good in which case it generates a positive return v, $v > i$, or it can be bad and generate a return of zero. The fraction of good projects is known to be q, $0 < q < 1$. To make the analysis interesting we assume parameter values to be such that the expected payoff of financing all projects is positive; i.e. $qv - i > 0$. Firms and banks are run by risk-neutral owner-managers who maximize the profits of their enterprises.[1] The time structure of the game is the following.

[1]This assumption does not seem to be unrealistic given the dominance of insider control and insider ownership in many transition economies. Even if managers cannot fully appropriate the returns of the firm, the qualitative results of our model do not change. Schmidt (1997) analyzes whether a manager's incentive scheme designed by the owners of a firm varies systematically with the market structure in which

At stage 1, the banks can invest in a screening procedure. If a bank decides to do so it can learn at cost e which of the firms applying for a credit have good projects and which ones do not. The banks take this decision simultaneously and the information they receive is proprietary, i.e. there are no information spillovers.[2]

At stage 2, the banks compete for customers by simultaneously setting prices z_j, $j = 1, ..., n$. These prices specify the payment a firm has to make if the project generates a positive return v. In case of no returns no repayments are made. 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.[3] The main purpose of this assumption is to abstract from problems of capacity constraints. One possible interpretation would be that banks can finance themselves unlimitedly at constant cost on the money market.

At stage 3, firms decide from which bank to take their credit. To avoid the extreme results of Bertrand competition with homogeneous products we assume that banks offer differentiated products, represented by their location on the circular road. "Good" firms, i.e. firms with good projects, condition their decision on the prices offered by the banks and on their location. The idea is that they have preferences for a particular type of bank and that they incur some disutility by making business with a different type of bank. This is captured by a "transportation" cost t proportional to the distance x to their bank. However, "bad" firms, i.e. firms with bad projects, are indifferent at which prices loans are offered since they are not going to repay the credit anyway. Without loss of generality we assume that they do not care about the location of the bank either. The idea is that they do not count on an ongoing relationship with the bank and thus do not care about the particular characteristics of the bank they are dealing with. This implies

the firm operates and gives sufficient conditions for this relationship to be monotonic. An interesting extension would be to include the possibility of bankruptcy to see how this affects the managers' incentives. Presently, however, the threat of liquidating firms or banks seems to be not very real.

[2]It is straightforward to see that in case of information spillovers no bank would have an incentive to engage in screening if it expected other banks to do so.

[3]The recent theoretical 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, in many transition economies banks do not actively compete for deposits but rely instead on central bank money or the money market. Belyanova and Rozinsky e.g. report that in Russia competition for depositors was for a long time negligible. Even now new commercial banks struggle with the problem that they still lack the facilities to deal with a large number of depositors. Thus, it seems justified to neglect this competition for deposits in our context.

that all uninformed banks share bad loans equally.[4] At the end of this stage, returns are realized and payments are made, if possible.[5]

The time structure of the model is illustrated in the following figure.

Figure 1: Time structure

4 Bank competition, screening and credit allocation

As a benchmark, consider first the case of a monopolistic bank. For a given price z the marginal good firm that is willing to take a credit is characterized by the following condition

$$z + tx = v \quad \longleftrightarrow \quad x = \frac{v - z}{t} \tag{1}$$

if $z \geq v - t/2$. If instead $z \leq v - t/2$ then all firms with good projects will take a credit from the monopolistic bank. Firms with bad projects will take the credit under any conditions.

If the monopolist does not invest in screening then his profit function is

$$\pi = \begin{cases} q2x(z-i) + (1-q)(-i) = q2\frac{v-z}{t}(z-i) + (1-q)(-i) & \text{for all} \quad z \geq v - \frac{t}{2} \\ q(z-i) + (1-q)(-i) & \text{for all} \quad z \leq v - \frac{t}{2} \end{cases} \tag{2}$$

Note that the costs that arise from giving credits to bad firms enter the bank's profit function as fixed costs, i.e. do not depend on the price choice of the monopolist. This is due to the fact that bad firms need not care about the price since they are not going to

[4]Suppose bad firms did care about the location of their bank. In this case the number of bad loans an uninformed bank would receive would depend not only on the number of uninformed banks, but also on the bank's location relative to the location of all other uninformed banks. However, if a priori all possible locations are considered to be equally likely, then the expected number of bad loans again depends only on the number of uninformed banks.

[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.

pay it anyway. It is a standard exercise to calculate the monopolist's optimal prices and profits. If the value of the investment project is high, i.e. $v > t + i$, then the monopolist charges a price $z = v - t/2$ and serves the whole market. His expected profit is thus

$$\pi = q(v - \frac{t}{2} - i) + (1 - q)(-i) \ . \tag{3}$$

If instead the value of the project is low, i.e. $v < t + i$, then the monopolist charges a price $z = \frac{v+i}{2}$ and does not serve the whole market. His expected profit in this case is

$$\pi = q\frac{(v - i)^2}{2t} + (1 - q)(-i) \ . \tag{4}$$

Thus, if the value is low, monopolistic pricing implies that inefficiently few credits are given.

What is the incentive of a monopolistic bank to engage in screening? By spending an amount e it can find out which of the projects are good and avoid losses of size $(1 - q)i$. Thus, the bank decides to invest in screening if and only if

$$e \leq (1 - q)i \tag{5}$$

Note that the monopolist has first-best incentives to invest in screening since he bears the full cost of acquiring information in case of screening and the full cost of misallocating credits in case of no screening. Thus, he fully internalizes the social cost of misallocating credits. In the following we restrict attention to parameter cases where (5) holds, i.e. it is efficient to invest in screening.

Consider now the situation where $n > 1$ banks are present, making price offers z_j, $j = 1, ..., n$. Recall that good firms choose the bank offering the lowest price, including transportation cost. Thus, given z_j and z_{j+1}, bank j and $j + 1$ share the demand of good firms located between the two, which is $q\frac{1}{n}$, as follows. Bank j serves a number of qx firms, where x denotes the marginal firm, characterized by the following equation

$$z_j + tx = z_{j+1} + t(\frac{1}{n} - x) \quad \longleftrightarrow \quad x = \frac{z_{j+1} - z_j}{2t} + \frac{1}{2n} \tag{6}$$

Bad firms are indifferent which of those banks willing to offer a credit to choose. Of course, a bank that has invested in screening never offers a credit to bad firms. Thus, as indicated above, the demand of bad firms is shared equally by all uninformed banks since they are willing to give a loan to all firms applying for a credit.

To determine the symmetric price equilibrium consider the profit function of bank j, given symmetric price offers z by all other banks. If bank j did not invest in screening, but m other banks have done so, where $0 \leq m < n$, bank j's profit is equal to

$$\begin{aligned} \pi_j &= q(z_j - i)2x + (1-q)\tfrac{1}{n-m}(-i) \\ &= q(z_j - i)2\left[\tfrac{z-z_j}{2t} + \tfrac{1}{n^2}\right] + (1-q)\tfrac{1}{n-m}(-i) \end{aligned} \tag{7}$$

If bank j did invest in screening, its profit instead is equal to

$$\begin{aligned} \pi_j &= q(z_j - i)2x - e \\ &= q(z_j - i)2\left[\tfrac{z-z_j}{2t} + \tfrac{1}{n^2}\right] - e \end{aligned} \tag{8}$$

Note that the number of informed banks m and the screening decision of bank j affect only the fixed cost term in the profit functions above. This implies that the price equilibrium is unaffected by the ex ante screening decision of the banks.[6] It is straightforward to determine the symmetric price equilibrium to be

$$z_1 = ... = z_n = \frac{t}{n} + i \tag{9}$$

provided transaction costs are high enough so that all banks make non-negative profits. In the following we assume v to be sufficiently large such that $v \geq \frac{3t}{4} + i$. This guarantees that the price equilibrium just described is indeed the right equilibrium for any $n \geq 2$, because the whole market is covered given these prices. For a given number of informed banks, m, the resulting equilibrium profits for informed banks are

$$\frac{tq}{n^2} - e \tag{10}$$

whereas the profits for uninformed banks are

$$\frac{tq}{n^2} - \frac{1}{n-m}(1-q)i \tag{11}$$

Note that the larger the number of informed banks the smaller the profit of the remaining uninformed banks because the greater the share of bad firms they attract. This suggests that the incentive to invest in screening increases in the number of informed banks. This is confirmed by the following proposition.

[6] A straightforward extension of our analysis would be to study how price competition would be affected if bad firms were not indifferent from which bank to take the loan. Suppose bad projects had some positive probability of generating positive returns. In this case bad firms would care about the price offered by banks because they would expect to pay the price with positive probability. This would induce uninformed banks to be more conservative with their price offers because a lower price offer would attract not just more good risks but also more bad risks. Consequently, we would obtain asymmetric price equilibria, with informed banks offering lower, uninformed banks offering higher prices.

Proposition 1 *Suppose transportation costs are large enough such that* $\frac{tq}{n^2} > e$.[7]

(i) If $e < \frac{1}{n}(1-q)i$*, then there exists a unique subgame perfect equilibrium in which all banks invest in screening.*

(ii) If $e > \frac{1}{n}(1-q)i$*, then there exist two pure strategy subgame perfect equilibria, one in which all banks invest in screening and one in which no bank invests in screening. The no-screening equilibrium Pareto-dominates the screening equilibrium since the screening cost outweigh the potential loss due to financing bad projects.*

Proof: See Appendix.

Surprisingly, the incentive to screen does not depend on the number of competitors, but rather on the number of *uninformed* competitors. The smaller the number of uninformed banks, the larger the incentive to invest in screening oneself. If a bank expects all other banks to engage in screening, it has first best screening incentives because it risks to serve all bad firms in case of no screening. The resulting screening equilibrium, however, implies an inefficient duplication of screening costs. As long as $ne \leq (1-q)i$, this screening equilibrium is preferable to a situation without screening, despite the duplication of screening cost. Interestingly, in this parameter case it is also the only equilibrium. If instead $ne > (1-q)i$, the losses due to bad credits do not justify this duplication of screening costs and indeed in this case there exists a no-screening equilibrium which pareto-dominates the screening equilibrium.

5 Market entry and market structure of the banking sector

In this section we investigate how the market structure in the banking sector evolves if market entry is not regulated. We study furthermore, how this free-entry market structure

[7] Proposition 1 characterizes equilibria only for transportation cost t large enough such that all banks can make non-negative profits if they invest in screening. If t were smaller it could no longer be an equilibrium that all banks invest in screening and make price offers thereafter. In this case, there exist equilibria where banks use mixed strategies. Such cases are discussed extensively in Schnitzer (1998) for the duopoly case with homogenous goods. In the present paper we restrict attention to parameter cases that guarantee pure strategy equilibria.

can be judged from the point of view of social welfare and what conclusions we can draw for the need to regulate entry.

Consider first the case of unregulated entry. In this case, the equilibrium number of banks entering the market is determined by the zero profit condition (ignoring integer problems). Profits in turn depend on the banks' expectation whether or not to engage in screening after entering the market. An interesting question is whether or not there exist multiple entry equilibria for a given set of parameters, one in which only few banks enter and screen and one in which many banks enter and do not screen. This question is answered by the following proposition.

Proposition 2 *(i) Suppose* $e < \frac{[i(1-q)]^2}{tq}$. *Then there exists a unique subgame perfect equilibrium in which* $\hat{n} = \sqrt{\frac{tq}{e}}$ *banks enter the market and all of them invest in screening.*

(ii) Suppose $e > \frac{[i(1-q)]^2}{tq}$. *Then there exist two pure strategy subgame perfect equilibria,*

- *one in which* $\tilde{n} = \frac{tq}{i(1-q)}$ *banks enter the market and no bank invests in screening and*
- *one in which* $\hat{n} = \sqrt{\frac{tq}{e}} < \tilde{n}$ *banks enter the market and all invest in screening.*

In this case the screening equilibrium is Pareto-dominated by the no-screening equilibrium.

Proof: See Appendix.

An interesting observation is that market entry is finite even though there exist no exogenous entry cost. Thus, we do not have the fragmentation result that typically arises in this kind of spatial competition models with zero entry cost. The reason for our result is that even though there exist no exogenous entry cost banks have to incur some endogenous entry cost. A bank considering entry expects to either invest in screening at cost e or to suffer losses from bad projects. In the latter case of a no-screening equilibrium each bank serves $1/n$ of the good firms and $1/n$ of the bad firms. As n increases both shares shrink in the same way. But in addition, the equilibrium price paid by good firms, $\frac{t}{n} + i$, decreases. Thus, although the cost arising from loss making credits decreases as the number of banks

increases, total profits decrease even more. This is why there exists only a finite number of banks for which a bank can guarantee itself nonnegative profits.

The larger t, which measures the degree of product differentiation, the larger q, the ratio of good firms, and the smaller the investment cost i, the more banks will enter and the less likely it is that banks efficiently engage in screening. Instead, banks share the risk of attracting bad firms. However, if banks expect that all other banks engage in screening, only few banks enter and end up in a Pareto-dominated screening equilibrium. This is bad for prices (which are important for restructuring incentives to be discussed below) and it implies a waste of resources.

Smaller values of t instead make it more likely that few banks enter and efficiently engage in screening. The lower degree of product differentiation implies that banks compete more aggressively which leads to lower prices. This is why less banks enter the market.

What would be the socially optimal number of banks? Are there circumstances where the number of entrants should be restricted? This question is subject of the following Proposition.

Proposition 3 *(i) Suppose* $e \leq \frac{[i(1-q)]^2}{tq}$. *Then the socially optimal number of banks is* $\hat{n}^* = \frac{1}{2}\sqrt{\frac{tq}{e}}$ *which induces a screening equilibrium at stage 1. Note that* $\hat{n}^* < \hat{n} = \sqrt{\frac{tq}{e}}$, *the unique free-entry equilibrium number of banks for this parameter case, which also gives rise to a screening equilibrium.*

(ii) Suppose $\frac{[i(1-q)]^2}{tq} < e \leq \frac{25}{16}\frac{[i(1-q)]^2}{tq}$. *Then the socially optimal number of banks is* $\hat{n}^* = \frac{1}{2}\sqrt{\frac{tq}{e}}$ *which induces a screening equilibrium at stage 1. Note that* $\hat{n}^* < \tilde{n} = \frac{tq}{i(1-q)}$, *the Pareto-dominant free-entry equilibrium number of banks for this parameter case, which induces a no-screening equilibrium.*

(iii) Suppose $\frac{25}{16}\frac{[i(1-q)]^2}{tq} < e$. *Then the socially optimal number of banks is* $\tilde{n}^* = \frac{tq}{i(1-q)} = \tilde{n}$, *the Pareto-dominant free-entry equilibrium number of banks for this parameter case, which induces a no-screening equilibrium.*

Proof: See Appendix.

Proposition 3 suggests that unregulated entry may result in too many banks entering the market. In case (i), for low values of screening cost e, too many banks enter the market and waste resources because of too much screening activity. In case (ii), for intermediate values of e, free entry prevents screening altogether whereas it would be better to restrict entry and thus encourage screening. Only for very high levels of screening cost a social planner would not want to encourage screening either. In this case the best that can happen is to have as many banks as possible to benefit from product diversity, subject to the constraint that all banks make non-negative profits. The results indicate the potential dangers of unregulated entry. Only if screening costs are very high and thus a screening equilibrium is not likely anyway, unregulated entry is optimal. However, as screening costs get lower over time, it is important to regulate market entry because otherwise too many banks are active which do not engage in screening.

6 Bank competition and enterprise restructuring

In this section we want to endogenize the number of good firms by investigating the managers' incentive to restructure their firms. To fix ideas consider the following restructuring technology. Suppose each manager can influence the likelihood of having a good project by investing some effort in restructuring. If the manager invests r, the probability of the project to turn out good is $\overline{q}$, otherwise it is $\underline{q}$, with $\overline{q} > \underline{q}$, and $\overline{q}v - r > \underline{q}v$. By the law of large numbers, the total share of firms with good projects is $\overline{q}$ if all firms invest in restructuring, and it is $\underline{q}$ if no firm invests in restructuring.

Suppose banks can observe the restructuring efforts of firms but cannot judge which of the firms have been successful in restructuring. What is then the incentive of an individual manager to engage in restructuring? Of course, this incentive depends on the expected payoff of the firm in case the project turns out to be good. This in turn depends on the expected price to be paid for the credit and thus on the expected competition in the banking sector. Recall that market entry and hence competition in the banking sector depends on the share of good firms in the economy. Of course, the restructuring decision of the individual manager does not affect this share since each firm is infinitesimaly small. However each firm's restructuring incentive is affected by the restructuring effort of the other firms. In this sense, each firm's restructuring decision imposes a positive externality

on the other firms because it affects the profitability of the banking sector. The following Proposition characterizes the resulting restructuring equilibrium.

Before we state this Proposition, we need some further notation. Let $z^e(\overline{q}) = \frac{t}{n^e(\overline{q})} + i$ denote the expected equilibrium price if all firms restructure and hence entry of $n^e(\overline{q})$ banks is expected. Similarly, let $z^e(\underline{q}) = \frac{t}{n^e(\underline{q})} + i$ denote the expected equilibrium price if no firm restructures and hence entry of $n^e(\overline{q})$ banks is expected. The precise values of $z^e(\overline{q})$ and $z^e(\underline{q})$ for different parameter cases are given in the Appendix, in the Proof of Proposition 4. Recall that in Proposition 2 we have seen that n increases in q. This implies that $n(\overline{q}) > n(\underline{q})$, as is shown formally in the Appendix.

Proposition 4 *(i) Suppose the cost of restructuring are low, i.e.*

$$r < (\overline{q} - \underline{q})[v - z^e(\underline{q})] < (\overline{q} - \underline{q})[v - z^e(\overline{q})] \ . \tag{12}$$

Then there exists a unique equilibrium where all firms restructure and the resulting share of good firms in the economy is $\overline{q}$.

(ii) Suppose the cost of restructuring are intermediate, i.e.

$$(\overline{q} - \underline{q})[v - z^e(\underline{q})] < r < (\overline{q} - \underline{q})[v - z^e(\overline{q})] \ . \tag{13}$$

Then there exist two pure strategy equilibria

- *one in which all firms restructure and the resulting share of good firms in the economy is $\overline{q}$ and*
- *one in which no firm restructures and the resulting share of good firms in the economy is $\underline{q}$.*

(iii) Suppose the cost of restructuring are high, i.e.

$$(\overline{q} - \underline{q})[v - z^e(\underline{q})] < (\overline{q} - \underline{q})[v - z^e(\overline{q})] < r \ . \tag{14}$$

Then there exists a unique equilibrium where no firm restructures and the resulting share of good firms in the economy is $\underline{q}$.

Proof: See Appendix.

Proposition 4 indicates that for intermediate values of restructuring costs some coordination may be required to achieve the equilibrium where all firms restructure. Otherwise, the economy may suffer from too little restructuring activity simply because everybody expects the others not to restructure either.

7 Conclusion

We have started this paper with three observations about transition economies in Eastern Europe. How can we interpret them in the light of our theoretical analysis? The first two observations concerned the huge increase in the number of banks and the problem that many of these banks suffer from bad loans. Our preceding analysis suggests that unregulated entry results in too many banks entering the market. Unless screening costs are rather low, which is unlikely to be the case in Eastern Europe, this entry behavior in turn induces banks to take the risk of giving bad loans rather than to invest in screening. It is worth emphasizing that this result of our model obtains even though banks have to bear the full losses associated with bad loans. Naturally, their incentive to engage in screening and sort out good risks from bad risks is even lower if banks face a soft budget constraint, as is the case in many countries.

Prima facie, our third observation about the low restructuring activity seems to be more of a puzzle. One should expect that the large number of banks gives rise to intensive price competition and that low credit costs stimulate firms to engage in restructuring. We suggest two reasons why this is not case. First of all, even though the number of banks increased a lot it is widely perceived that price competition is not very intensive. In section 2 we reported that in most countries the banking sector is still dominated by a small number of large banks, which are often state-controlled. Thus, it is not surprising that firms report high credit costs as one of the main reasons for not investing (Fan et al.). But our analysis also points to another potential problem. Total restructuring activity has an impact on the profitability of the banking sector. This interaction of restructuring activity and financial system implies that restructuring has positive externalities. Thus, if all firms are pessimistic about the activity of other firms the economy can get stuck in a bad equilibrium where no one restructures because everyone expects that no one restructures. If this is the case, it may be useful to design some policy which increases

the incentive to restructure exogenously in order to improve expectations and thus helps to switch to the good equilibrium.

Appendix

Proof of Proposition 1:

(i) Suppose m banks are informed, where $0 \leq m < n$. If $\frac{tq}{n^2} > e$, a bank expects to make nonnegative profits if it engages in screening. Then the decision of bank j to screen depends on the comparison of e, the cost of screening, and $\frac{(1-q)i}{n-m}$, the expected loss from giving loans to bad firms. Since $e < \frac{1}{n}(1-q)i$ by assumption and $\frac{1}{n}(1-q)i \leq \frac{1}{n-m}(1-q)i$ for all m, $0 \leq m < n$, each bank prefers to screen, irrespective of the number of other banks that screen.

(ii) Consider a number k, $0 \leq k \leq n$, such that $e > \frac{(1-q)i}{n-k} \geq \frac{(1-q)i}{n}$ and $e < \frac{(1-q)i}{n-(k+1)} \leq (1-q)i$. Suppose now that $m \geq (k+1)$ banks are informed. Then each bank prefers to screen since $e < \frac{(1-q)i}{n-(k+1)}$ and since $\frac{tq}{n^2} > e$, i.e. the bank expects to make nonnegative profits. Suppose instead that $m \leq k$ banks are informed. Then no bank wants to screen since $e > \frac{(1-q)i}{n-k} \geq \frac{(1-q)i}{n}$.

Q.E.D.

Proof of Proposition 2: Suppose banks expect a screening equilibrium. Then the equilibrium number of banks is determined by the following zero profit condition.

$$\frac{tq}{\hat{n}^2} = e \iff \hat{n} = \sqrt{\frac{tq}{e}} \tag{15}$$

This number of banks is consistent with the expectation of a screening equilibrium if and only if

$$e < i(1-q) \tag{16}$$

which is true by assumption.

If instead banks expect a no-screening equilibrium the equilibrium number of banks is derived from the following zero profit condition.

$$\frac{tq}{\tilde{n}^2} = \frac{i(1-q)}{\tilde{n}} \iff \tilde{n} = \frac{tq}{i(1-q)} \tag{17}$$

This number of banks is consistent with the expectation of a no-screening equilibrium if and only if

$$e > \frac{i(1-q)}{\tilde{n}} \tag{18}$$

Note that (17) and (18) together imply

$$e > \frac{[i(1-q)]^2}{tq} \tag{19}$$

Thus, if $e < \frac{[i(1-q)]^2}{tq}$ there exists a unique equilibrium where the number of banks in the market is determined by (15). If instead $e > \frac{[i(1-q)]^2}{tq}$ there exist two equilibria, one with $\hat{n}$ banks and a screening equilibrium and one with $\tilde{n}$ banks and a no-screening equilibrium. The zero-profit condition guarantees that banks in both equilibria are equally well off. But since for this parameter case $\tilde{n} > \hat{n}$, firms are better off in the equilibrium with more market entry and no-screening. To see this define $\gamma > 1$ such that $e = \frac{[i(1-q)]^2}{tq}\gamma$. Then

$$\hat{n} = \sqrt{\frac{tq}{\frac{[i(1-q)]^2}{tq}\gamma}} = \frac{tq}{i(1-q)\sqrt{\gamma}} < \frac{tq}{i(1-q)} = \tilde{n} \tag{20}$$

Q.E.D.

Proof of Proposition 3:

A social planer can choose n such as to minimize total social cost

$$2nq\int_0^{\frac{1}{2n}} txdx + ne = \frac{tq}{4n} + ne \tag{21}$$

if banks play a screening equilibrium. The first order condition in this case is

$$-\frac{4tq}{16\hat{n}^{*2}} + e = 0 \tag{22}$$

which implies

$$\hat{n}^* = \frac{1}{2}\sqrt{\frac{tq}{e}} \tag{23}$$

In this case total social cost are $\sqrt{tqe}$.

Alternatively, the social planer can choose n such as to minimize

$$2nq\int_0^{\frac{1}{2n}} txdx + i(1-q) = \frac{tq}{4n} + i(1-q) \tag{24}$$

if banks play a no-screening equilibrium. In this case social cost are minimized by maximizing the number of banks, subject to the constraint that banks make nonnegative profits. This requires that

$$\frac{tq}{\tilde{n}^{*2}} - \frac{i(1-q)}{\tilde{n}^*} = 0 \tag{25}$$

which implies

$$\tilde{n}^* = \frac{tq}{i(1-q)}. \tag{26}$$

Recall that the existence of a no-screening equilibrium requires

$$e > \frac{i(1-q)}{\tilde{n}^*} \tag{27}$$

(26) and (27) together imply

$$e > \frac{[i(1-q)]^2}{tq} \tag{28}$$

In this case total social cost are $\frac{5i(1-q)}{4}$.

A comparison of the two expressions for total social cost show that

$$\sqrt{tqe} < \frac{5i(1-q)}{4} \quad \text{if and only if} \quad e < \frac{25}{16}\frac{[i(1-q)]^2}{tq} \tag{29}$$

Thus, if $e < \frac{25}{16}\frac{[i(1-q)]^2}{tq}$ it is socially optimal to have a screening equilibrium with $\hat{n}^* = \frac{1}{2}\sqrt{\frac{tq}{e}}$. If instead $e > \frac{25}{16}\frac{[i(1-q)]^2}{tq}$ social welfare is maximized with $\tilde{n}^*$ banks which induces a no-screening equilibrium. Note that this condition is consistent with (28). *Q.E.D.*

Proof of Proposition 4:

Consider a manager's decision whether or not to spend r on restructuring. He will do so if and only if

$$\overline{q}(v - z^e) - r > \underline{q}(v - z^e) \quad \longleftrightarrow \quad (\overline{q} - \underline{q})(v - z^e)\ r \tag{30}$$

where $z^e = \frac{t}{n^e} + i$ is the price he expects to pay for the credit. Note that this price depends on the number of banks, n^e, expected to enter the market which in turn depends on the restructuring decision of all other banks. In this proof we restrict attention to Pareto-dominant entry equilibria. However, it is straightforward to extend the proof and include Pareto-dominated entry equilibria as well. In this case the exact boundaries of our parameter ranges change but not the structure of the results.

- Suppose $e < \frac{[i(1-\overline{q})]^2}{t\overline{q}} < \frac{[i(1-\underline{q})]^2}{t\underline{q}}$. In this case the equilibrium number of banks is $\hat{n} = \sqrt{\frac{t\overline{q}}{e}}$ if all firms invest in restructuring and it is $\hat{n} = \sqrt{\frac{t\underline{q}}{e}}$ if no firm invests in restructuring.
  - If $r < (\overline{q} - \underline{q})(v - \sqrt{\frac{te}{\underline{q}}} - i) < (\overline{q} - \underline{q})(v - \sqrt{\frac{te}{\overline{q}}} - i)$ each manager prefers to restructure, no matter how many other firms intend to restructure. Thus, there exists a unique equilibrium where all firms restructure.

- If $(\overline{q}-\underline{q})(v-\sqrt{\frac{te}{\underline{q}}}-i) < r < (\overline{q}-\underline{q})(v-\sqrt{\frac{te}{\overline{q}}}-i)$ each manager prefers to restructure if all other firms restructure, but no firm wants to restructure if no other firm intends to restructure. Thus, there exits two equilibria, one in which all firms restructure and one in which no firm restructures.
- If $(\overline{q}-\underline{q})(v-\sqrt{\frac{te}{\underline{q}}}-i) < (\overline{q}-\underline{q})(v-\sqrt{\frac{te}{\overline{q}}}-i) < r$ no manager prefers to restructure, no matter how many other firms intend to restructure. Thus, there exists a unique equilibrium where no firm restructures.

- Suppose $\frac{[i(1-\overline{q})]^2}{t\overline{q}} < e < \frac{[i(1-\underline{q})]^2}{t\underline{q}}$. In this case the equilibrium number of banks is $\tilde{n} = \frac{t\overline{q}}{i(1-\overline{q})}$ if all firms invest in restructuring and it is $\hat{n} = \sqrt{\frac{t\underline{q}}{e}}$ if no firm invests in restructuring.
  - If $r < (\overline{q}-\underline{q})(v-\sqrt{\frac{te}{\underline{q}}}-i) < (\overline{q}-\underline{q})(v-\frac{i}{\overline{q}})$ each manager prefers to restructure, no matter how many other firms intend to restructure. Thus, there exists a unique equilibrium where all firms restructure.
  - If $(\overline{q}-\underline{q})(v-\sqrt{\frac{te}{\underline{q}}}-i) < r < (\overline{q}-\underline{q})(v-\frac{i}{\overline{q}})$ each manager prefers to restructure if all other firms restructure, but no firm wants to restructure if no other firm intends to restructure. Thus, there exits two equilibria, one in which all firms restructure and one in which no firm restructures.
  - If $(\overline{q}-\underline{q})(v-\sqrt{\frac{te}{\underline{q}}}-i) < (\overline{q}-\underline{q})(v-\frac{i}{\overline{q}}) < r$ no manager prefers to restructure, no matter how many other firms intend to restructure. Thus, there exists a unique equilibrium where no firm restructures.

- Suppose $\frac{[i(1-\overline{q})]^2}{t\overline{q}} < \frac{[i(1-\underline{q})]^2}{t\underline{q}} < e$. In this case the equilibrium number of banks is $\tilde{n} = \frac{t\overline{q}}{i(1-\overline{q})}$ if all firms invest in restructuring and it is $\tilde{n} = \frac{t\underline{q}}{i(1-\underline{q})}$ if no firm invests in restructuring.
  - If $r < (\overline{q}-\underline{q})(v-\frac{i}{\underline{q}}) < (\overline{q}-\underline{q})(v-\frac{i}{\overline{q}})$ each manager prefers to restructure, no matter how many other firms intend to restructure. Thus, there exists a unique equilibrium where all firms restructure.
  - If $(\overline{q}-\underline{q})(v-\frac{i}{\underline{q}}) < r < (\overline{q}-\underline{q})(v-\frac{i}{\overline{q}})$ each manager prefers to restructure if all other firms restructure, but no firm wants to restructure if no other firm intends to restructure. Thus, there exits two equilibria, one in which all firms restructure and one in which no firm restructures.

– If $(\overline{q} - \underline{q})(v - \frac{i}{\underline{q}}) < (\overline{q} - \underline{q})(v - \frac{i}{\overline{q}}) < r$ no manager prefers to restructure, no matter how many other firms intend to restructure. Thus, there exists a unique equilibrium where no firm restructures.

Q.E.D.

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