Working Paper

Information sharing and information acquisition in credit markets

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Information Sharing and Information Acquisition in Credit Markets*

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Abstract

Since information asymmetries have been identified as an important source of bank profits, it may seem that the establishment of information sharing (e.g., introducing credit bureaus or public registers) will lead to lower investment in acquiring information. However, banks base their decisions on both hard and soft information, and it is only the former type of data that can be communicated credibly. We show that when hard information is shared, banks will invest more in soft information. These will produce more accurate lending decisions, provide higher welfare, lead to an increased focus on relationship banking and favor informationally opaque borrowers. We test our theory using a large sample of firm-level data from 24 countries.

Keywords: Bank competition, information sharing, relationship bank, hard, soft

JEL classification numbers: G21, L13

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1 Introduction

Information acquisition by financial intermediaries is an essential function. It can improve the allocation of credit in the economy, and it is one of the main sources of bank profits. Better knowledge of their loan applicants allows banks to weed out low-quality projects. At the same time, the information acquired over the course of a lending relationship allows an incumbent bank to hold up its borrowers and extract information rents. Those rents compensate the bank for the cost of acquiring information.

Recent years have witnessed the spread of information sharing arrangements, such as private credit bureaus and public credit registers. When information is shared, incumbent banks lose some of their advantage over their competitors. It seems reasonable to think that the loss of informational rents will endanger the incentives to find out more, reducing the accuracy of credit decisions.

We examine the effect of information sharing on information acquisition. We show that, contrary to what may seem probable at first sight, establishing a credit bureau or a credit register is likely to increase banks' investment in information. The intuition behind this result is as follows. When hard, standardized and verifiable information becomes available to competitors, soft information, which is difficult to communicate reliably (Stein (2002), Petersen (2004)) will still remain the exclusive domain of the incumbent bank. We show that the sharing of hard information raises the marginal benefit from investing in the acquisition of soft information, the only remaining source of informational rents. This engenders a higher optimal investment in soft information, which acts as a substitute for hard information. As a result, the banks' overall knowledge of their borrowers may improve under information sharing, with likely positive welfare effects.

We build on the banking competition model in von Thadden (2004) and Hauswald and Marquez (2006). In each of two periods two banks compete in interest rates for borrowers of high ability (creditworthy) and low ability (uncreditworthy). In period 1, competition is based on symmetric information, and each bank wins a certain market share. At the end of that period borrowers repay if they can, and each incumbent bank faces two groups of its own clientele: *defaulting* borrowers, and *successful* borrowers (those who have repaid). This information can be used to update the bank's knowledge of the borrowers' likely types. At the same time, this is "hard" information that can be shared with the "uninformed" bank under an information sharing regime.

Because default information does not fully reveal a borrower's true type (high-ability borrowers may default due to bad luck), each bank may want to invest in the monitoring of its own borrowers during first-period lending.[1] The outcome of monitoring is a signal about the borrower's true type: *good* or *bad*. This information is "soft". For second-period lending, therefore, the incumbent bank differentiates bor-

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[1] We have also analyzed the model where information is acquired during ex-ante screening, and the results are qualitatively similar. We do not present those results for brevity.

rowers based on two sources of information: hard information - default or success of its borrowers, and soft information - good or bad signal. Monitoring is costly, but provides further rents for the bank, since it increases the asymmetric information problem faced by the outside bank.

When hard information is shared, the rents the inside bank would derive from being the only one able to tell defaulting from successful borrowers disappear. At the same time, however, the effectiveness of investing in the soft signal also changes. Under no information sharing, the defaulting borrowers are pooled the successful ones from the outside bank's point of view. This means they sometimes receive below-break-even interest rates from that bank. Thus a portion of the inside bank's investment in soft information goes to waste as it loses some of the unlucky high-type borrowers it had tried to identify. Under information sharing, the outside bank no longer bids so low for defaulting borrowers, and the inside bank is more likely to reap the fruits of its investment in monitoring. The result is that the marginal benefit from investing in the soft information is higher when hard information is higher.

The higher marginal benefit from monitoring results in a higher investment in soft information in the presence of a credit bureau. As a result, banks will have better knowledge of the borrowers' true quality. Uncreditworthy borrowers will be more likely to be denied credit, and this will improve welfare.

This is our core finding, that also shapes our main policy implication: the concern that sharing information will lead to insufficient information acquisition, and is therefore undesirable from a social point of view, is not founded. Supporting the establishment of information-sharing arrangements can be a good idea.

Our work has implications for relationship banking. We show that under information sharing - which is widely interpreted as an increase in competition - banks have incentives to invest more in acquiring proprietary information and deepen the relationship. This is because, paradoxically, they are more likely to retain their good relationship borrowers. The result is in contrast to Boot and Thakor (2000), where an increase in bank competition - modeled as an increase in the number of banks - means that existing borrowers are more likely to be lured away by the more abundant outside offers.[2]

Information about small firms is scarce, as most of them do not have audited financial statements and are not rated by rating agencies. Therefore information asymmetries are most acute for small firms (Petersen and Rajan (1994)). In our model, higher information asymmetry will increase the gap between optimal investment in soft information with and without information sharing. Our data confirm that the impact of information sharing is indeed stronger in the case of small firms.

Soft information may be difficult to communicate within the bank, not just across

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[2]When Boot and Thakor (2000) introduce competition from capital markets, banks invest more in the relationship because the lower entry into the banking industry means that there are fewer banks to make competing transactional bids.

banks. It has therefore been argued that large banks will usually rely on hard information, while small banks will be more likely to collect and use soft information (Stein (2002), Berger et al. 2005, Uchida et al. (2009)). Small banks have a lower cost of dealing with soft information, which in our model would mean that information sharing will lead to a higher bias towards soft information and increase the gap between them and large banks. Thus our model also has implications on the relationship between information sharing and the structure of the banking system.

We take our theoretical predictions to the data and examine their validity. We use survey data on firms and information sharing arrangements from 24 transition countries. We analyze the impact of introducing private credit bureaus and public credit registries sharing hard information on lenders' incentives to invest more in soft information. Our results show that information acquisition is higher in countries with an established information sharing.

We use several proxies to measure banks' investment in soft information. First, we use the time that banks spend to approve a loan application. Arguably, more investment in information acquisition requires more time. As a second measure, we utilize banks' reaction to a borrower's failure to repay. Banks may react strictly (i.e., resolve the case in courts), moderately (continue operations but increase interest rates, or be very lenient (i.e., do not change loan conditions). A more lenient reaction by banks shows a stronger relationship and less conditioning on hard information. Finally, we employ the use of checking account, based on previous evidence on the proprietary content of checking account data (see, for instance, Norden and Weber (2008), Puri et al. (2009)). We find that banks spend more time examining their borrowers, are more lenient in the case of delayed payment and are more likely to use checking accounts under information sharing.

Finally, using firm-level data allows us to test and confirm that the impact is indeed stronger for small firms. The findings concerning borrower switching and interest rates are also in line with our theoretical predictions.

Our papers adds to the recent but growing research on information sharing among lending institutions. The existence of credit bureaus has been shown to decrease adverse selection (Jappelli and Pagano (1993)), induce higher effort from borrowers (Padilla and Pagano (1997) and Padilla and Pagano (2000)), reduce excessive borrowing (Bennardo et al. (2009)). At the same time, information sharing may be used to reduce competition between banks (Bouckaert and Degryse (2006), Gehrig and Stenbacka (2007)). The establishment of information sharing arrangements is more likely if borrower mobility is higher (Jappelli and Pagano (1993)), and if asymmetric information problems are more important (Brown and Zehnder (2007)). The length of time data is kept in the common database matters (Vercammen (1995)). Empirically, information sharing is associated with better access to credit (Jappelli and Pagano (1993)), especially in developing countries with bad creditor rights (Djankov et al. (2007), Brown et al. (2009)), but lower lending to low-quality borrowers (Hertzberg

et al. (2009b)). To the best of our knowledge, we are the first to look at the strategic use of information acquisition in the context of information sharing.

Unlike some of the existing papers (Padilla and Pagano (1997), Padilla and Pagano (2000), Bennardo et al. (2009)), we do not look at moral hazard issues in the context of information sharing. However, in our model information sharing increases the gap between interest rates charged to successful and defaulting borrowers. One could think that the higher punishment for default will potentially induce borrowers to exert higher effort, and that intuition is in line with the results in Padilla and Pagano (2000).

An important element in the model is that information acquisition is costly. This sets our paper apart from existing papers (Jappelli and Pagano (1993), Padilla and Pagano (1997), Padilla and Pagano (2000), Boukaert and Degryse (2006)) where the incumbent is freely endowed with full information on borrower types.

The importance of the distinction between hard and soft information has been increasingly recognized in the literature (Stein (2002), Berger et al. (2005), Degryse and Ongena (2005), Uchida et al. (2009), Hertzberg et al. (2009a)). Agarwal and Hauswald (2006) find that soft information significantly impacts both interest rates and credit availability. While technological change has allowed the development of automated, online lending, classical, in-person applications relying on soft information are still vital and they cater for their own distinct clientele - that of the "average" borrower, where creditworthiness is not obvious from "hard" features (Agarwal and Hauswald (2009)). It is interesting to note that their measure of soft information is by construction orthogonal to the hard information contained in the credit reports on the firm and its owners. This means that, as in our model, soft information can improve upon the knowledge derived from hard information. Also consistent with our model, Chang et al. (2009) find that hard and soft information act as substitutes.

This article is also related to recent work on strategic information acquisition, such as Hauswald and Marquez (2003, 2006). Hauswald and Marquez (2003) discuss the effects of technological change on information acquisition. As the inside bank's screening technology becomes more efficient, optimal investment increases. On the contrary, if outside access to the same (hard) information improves, it erodes the inside bank's rents, and investment decreases. In contrast, we focus on two types of information, and show that the marginal benefit from acquiring soft information increases when hard information is shared. This interaction between hard information sharing and soft information acquisition, to the best of our knowledge, has not been studied before.

Hauswald and Marquez (2006) analyze the changes in optimal investment acquisition in response to an increasing number of banks and bank consolidation. In their location model, introducing more banks reduces the slice of the market available to each bank, and as a result banks' incentives to invest in screening borrowers decrease. Conversely, in our model, the sharing of some proprietary information (which could be interpreted as another way of increasing competition) increases the banks' incentives

to acquire information and may even lead to an increase in informational rents for incumbent banks.

The remainder of the article is organized as follows. Section 2 presents a model of banking competition and information acquisition. We first derive the equilibrium of the banking competition with and without information sharing (subsection 2.2 and 2.3). We then look at interest rates, switching and welfare (subsections 2.4, 2.5, and 2.6). Section 3 provides empirical evidence, and section 4 concludes. Proofs are mostly relegated to the Appendix.

2 The Model

We model the interaction between banks and borrowers over two periods. At the starting point, banks have symmetric information about the average ex-ante risk of the borrower population. During the lending relationship, each bank acquires both default and relationship information about those borrowers who contracted with it previously. Following Petersen and Rajan 2004, Stein 2002, we call the former *hard* and the latter *soft* information.[3] We call this the *informed* bank: it acquires soft information by investing in monitoring technology and observes the hard data-whether or not borrowers managed to repay their loans.

In what follows, we first present the general setup, and then study two competition environments: without information sharing, both types of information are unavailable to competitors -the *uninformed* bank. These provide informational rents for the informed bank. With information sharing, the success or default of each borrower becomes known to the uninformed bank. The soft information, however, cannot be shared and continues to generate a competitive advantage for informed bank.

2.1 The Setup

There are two banks and a continuum of borrowers in $[0, 1]$ who are active for two periods. In each period, each borrower has access to an investment project that requires $\$I$. Because they have no initial wealth, they borrow the money from one of the two banks.

There are two types of borrowers:

- High-type borrowers represent a proportion λ in the overall population. They have a probability p $(0 < p < 1)$ of producing a terminal cash flow $R > 0$, and large enough to repay principal and interest rates. With probability $1 - p$ they

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[3]We use default information here, since it is the most basic type of hard information and also the most commonly shared. Hard information can also obviously be any type of information that can be shared by means of a credit bureau.

produce 0.[4]

- Low-type borrowers represent a proportion $1 - \lambda$ in the overall population and they always fail, yielding 0.

The final cash flows are observable and contractible by the current lender. Under information sharing, the return is observable also to the uninformed lender. The proportions of borrowers and the success probabilities are common knowledge. Borrowers have identical (and independent) projects, no initial funds in both periods and are protected by limited liability. As in vcon Thadden (2004), borrowers do not know their own types.[5] Banks can raise capital at a gross interest rate 1 and compete in interest rates given their respective information sets. They offer one period contracts. [6] At the beginning of the first period, without any previous contact with the potential customers, banks only know the average risk of the population. As a result, they offer the same interest rate to all applicants.

During the first period banks can acquire information about their borrowers by monitoring them. The **monitoring** process begins after the first period loans have been extended. It results in a signal η of borrowers' types. The quality of the signal is given by φ:

$$Pr(\eta = G|type = H) = Pr(\eta = B|type = L) = \varphi > \frac{1}{2};$$
$$Pr(\eta = B|type = L) = Pr(\eta = B|type = H) = 1 - \varphi.$$

Thus, at the end of the first period banks have two types of information about their borrowers:

- the signal generated by monitoring, $\eta = G$ or $\eta = B$;

- the repayment history - i.e., whether borrowers have defaulted or not, $h = D$ or $h = N$.

The signal is costly: getting a signal of quality φ requires an outlay of

$$c(\varphi) = c(\varphi - \frac{1}{2})^2$$

We call φ *informativeness* of monitoring. As a result, banks have to decide how much to invest in the monitoring technology. The default information and information resulting

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[4]We assume a project's output cannot be stored, so that it does not generate resources for operations in the second period

[5]Alternatively, we could assume there are no sorting devices such as collateral, since, for example, the borrower has no wealth.

[6]As shown in Sharpe (1990), this absence is the interesting case to consider, since otherwise the analysis would reduce to standard competitive pricing and miss the important point in bank relationships (see also von Thadden 2004).

from monitoring can be used by banks to update their estimate of the borrowers' types and adjust their interest rates for the second period.

While default information is verifiable, the outcome of the monitoring process is "soft" information by assumption: it is prohibitively costly to communicate this information between banks. As a result, a credit bureau is only able to collect and share default information, and each bank will know which of the other bank's initial customers has defaulted. Without a credit bureau, both default and monitoring information are only available to incumbent banks.

Thus, incumbent banks can distinguish between three types among their first-period customers:

- borrowers that have defaulted and have also generated a bad signal when monitored;

- borrowers that have defaulted, but have generated a good signal when monitored;

- borrowers that have not defaulted (but generated either a good signal or a bad signal when monitored).

We assume that $p_D R > I$, where $p_D = P(h = D)$ is the success probability given the borrower has defaulted.

$$p_D = \frac{\lambda p(1-p)}{\lambda(1-p) + (1-\lambda)}.$$

This means it is efficient to grant a loan to defaulters.[7] As a result, banks can resort to discriminatory pricing through their interest rate offers as a function of the default history and the informativeness. The first type is obviously the least likely to produce a positive return in the second period, while the last one is the most likely to be successful.

Note, that our setup allows for the relationship scope of the banking firm: relationship lending allows informationally opaque firms with weak financial ratios, collateral, or credit scores to obtain loans by augmenting the weak hard information with good soft information gained through closer contacts over time (Berger and Udell (2002)). Indeed, if some of the borrowers are actually good who are just unlucky (our second group above), relying too much on the hard information provided by past defaults could lead to welfare losses (Jappelli and Pagano (2000), Berger and Udell (2002)).[8] Those who have not defaulted, are certainly good borrowers by assumption. Therefore the signal is not crucial, and banks can lend them safely based only on hard data. We therefore group them all together.

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[7]Obviously, it implies it is ex-ante efficient to grant a loan to an average risk.

[8]Algebraically, this amounts to the assumption we will make: the good signal defaulting borrowers are creditworthy, while the bad signal ones - are not, $p_{GD} R > I$.

2.2   Default information is shared

We start with the case where information is shared in the economy. The actions taken by the banks and borrowers are outlined below.

The timing of the game The timing of the game is illustrated in figure **??**

$T = 1$

- Information sharing regime is or is not established.

- Banks announce one term lending rates and compete à la Bertrand.

- Borrowers choose one of the banks and invest I.

- Banks invest in monitoring.

- Borrowers repay whenever they can do so.

$T = 2$

- Banks share payment/default history (hard information), if information sharing arrangement has been established.

- Simultaneously, the informed and the uninformed banks offer second period interest rates. Each bank has two types of information about its first period borrowers (and has received default information concerning its competitor's borrowers if information is shared).

- The firm chooses an offer and invests I. If indifferent, the firm chooses the bank randomly.[9]

- Borrowers repay whenever they can, banks' payoffs are realized.

In the next two subsections we derive the Perfect Bayesian Equilibrium of the informed and uninformed banks under information sharing, and no information sharing, respectively. We then see when information sharing is profitable for banks, whether borrowers win or lose, and whether welfare increases.

2.2.1   Preliminary steps

We first derive a borrower's success probability in light of the each bank's credit assessments based on their information sets. The informational advantage of the informed and the uninformed bank is illustrated in Figure 2.

If default information is shared, both the uninformed and the informed bank will learn which borrowers have been successful in the first period. Both banks will therefore learn the successful borrower's true type: because low ability borrowers never succeed, (bad) signal from monitoring is no longer important.

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[9]If there is only one offer, the firm takes it. If no offer, the firm does not get credit. We will see in the equilibrium that this may be the case when bad signal defaulting borrowers are not creditworthy.

Based on the acquired information and the initial data on the population, banks are able to update borrowers' success probabilities and use this to determine their interest rates. Both banks can condition their rates on default information, but only the incumbent bank can also use the soft information to differentiate the interest rates that it offers to its first-period borrowers.

Denoting $p_{GD} = P(\eta = G, h = D)$ the success probability when the borrower has produced signal G and history D (and following similar notations), the Bayesian updated probabilities of success are given by:

$$p_N = p;$$
$$p_{GD} = \frac{\lambda\varphi p(1-p)}{\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)};$$
$$p_{BD} = \frac{\lambda(1-\varphi)p(1-p)}{\lambda(1-\varphi)(1-p) + (1-\lambda)\varphi}$$

four the three types, and

$$p_D = \frac{\lambda p(1-p)}{\lambda(1-p) + (1-\lambda)};$$
$$\bar{p} = \lambda p.$$

for defaulting and the overall universe of borrowers respectively.

From Bayesian rules, *better types have higher updated probabilities.* We define the respective break-even gross interest rate for each of the groups to be equal to the investment I divided by the respective probability, $\bar{r}_K = \frac{I}{p_K}$, for $K = D, N, GD$ or BD, while for the overall population it is equal to $\bar{r} = \frac{I}{\bar{p}} = \frac{I}{\lambda p}$. The break-even interest rates will obviously be lower for better types.

We define $\bar{\varphi}$ such that $R p_{BD} = I$. That is, whenever $\varphi > \bar{\varphi}$, bad signal defaulting borrowers are not creditworthy. Thus, when $\varphi > \bar{\varphi}$ the incumbent will not bid for uncreditworthy BD group. Below we analyze the equilibrium in both cases.

2.2.2 Lending Competition

Banks move *simultaneously* to bid second period interest rates, and thus do not observe each other's rates. Uninformed banks do not know the signals borrowers received. As showed in von Thadden (2004), there is no pure strategy equilibrium in simultaneous-bid games where one lender knows more than the other. There is however a mixed-strategy equilibrium in which banks randomize over intervals of interest rates. The second period of the game thus has a unique Perfect Bayesian Nash equilibrium in mixed strategies, the properties of which we analyze below.

Each bank has five interest rate strategies: Let the cumulative density function $F_u^K(r)$ denote the probability that the uninformed bank chooses an interest rate less

or equal to r for defaulting ($K = D$) and non-defaulting ($K = N$) borrowers respectively. $F_i^J(r)$ describes the bidding strategies for the informed bank for the good-signal defaulting ($J = GD$), bad-signal defaulting($J = BD$) and the non-defaulting ($J = N$) borrowers.

For any interest rate for a given group, the informed bank will make a non-negative profit provided it has not been undercut by the competing bank. Thus the profit functions for the three types can be expressed as follows:

$$\pi_i^N(r) = 0$$
$$\pi_i^{GD}(r) = N_{GD}(p_{GD}r - I)(1 - F_u^D(r))$$
$$\pi_i^{BD}(r) = N_{BD}(p_{BD}r - I)(1 - F_u^D(r))$$

where N_{GD}, N_{BD} denote the expected number of the respective borrower group. The uninformed bank's profits on the two types it can distinguish (defaulters and non-defaulters) will be:

$$\pi_u^D(r) = N_{GD}(p_{GD}r - I)(1 - F_i^{GD}(r)) + N_{BD}(p_{BD}r - I)(1 - F_i^{BD}(r)) = 0;$$
$$\pi_u^N(r) = 0.$$

Proposition 2.1 *Equilibrium Strategy* *The competition between the informed and the uninformed bank has a mixed-strategy equilibrium for defaulters. In this equilibrium,*

1. $\varphi > \bar{\varphi}$: the informed bank bids

$$F_i^{GD} = 1 - \frac{N_{BD}(I - p_{BD}r)}{N_{GD}(p_{GD}r - I)}$$

where F_i^{GD} is defined on $[\bar{r}_D, R]$. It bids pure-strategy r_N for the non-defaulting group and refrains from bidding for the bad-signal, defaulting group.

The uninformed bank bids

$$F_u^D(r) = \varphi F_i^{GD},$$

on $[\bar{r}_D; R)$. It does not bid with probability $1 - F_u^D(R) = \frac{p_{GD}\bar{r}_D - I}{p_{GD}R - I}$ and bids pure-strategy $\bar{r}_N$ for the non-defaulting group.

2.$\varphi \leq \bar{\varphi}$: Both the informed and the uninformed bank always offer credit to all borrowers. The informed bank bids

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$$F_i^{GD} = 1 - \frac{N_{BD}(I - p_{BD}r)}{N_{GD}(p_{GD}r - I)}$$

where F_i^{GD} is defined on $[\bar{r}_D, \bar{r}_{BD}]$, and bids $\bar{r}_{BD}$ for the bad-signal, defaulting group. The uninformed bank bids

$$F_u^D(r) = \varphi F_i^{GD},$$

on $[\bar{r}_D; \bar{r}_{BD})$ with a point mass at $\bar{r}_{BD}$. Both banks bid pure-strategy $\bar{r}_N$ for the non-defaulting group.

Proof See Appendix.

The interest rates are depicted in figure **??**. The equilibrium bidding is similar to the one derived in Hauswald and Marquez (2006).

The informed bank chooses different rates for the good- and bad-signal borrowers, while the uninformed bank is unable to make that distinction. Both banks can distinguish between defaulting and non-defaulting borrowers, so we can think of the competition between the two banks as taking place on two separate markets (for defaulting and non-defaulting borrowers respectively). The proposition has an intuitive property that will hold throughout the analysis: *better types receive better loan terms (from the incumbent)*, where better is measured by a favorable hard or soft information. Indeed, the non-defaulters N get as low as $\bar{r}_N$: because the true type of successful borrowers is revealed to be high, banks compete purely a la Bertrand. At the same time, good signal defaulters get higher rates in $[\bar{r}_D; R]$ ($[\bar{r}_D; \bar{r}_{BD}]$ as in case 2), while bad signal ones are turned down (or receive highest rates $\bar{r}_{BD}$] in case 2).

The uninformed bank's bidding is intuitive, too: because it faces adverse selection from the borrower pool of the incumbent bank, its interest rate bids are not on average lower ($\varphi \leq 1$). Finally, the uninformed bank may sometimes deny credit when informativeness of the monitoring is high enough. Thus, some of the BD types, who under high informativeness can only resort to getting credit from the uninformed bank, may in fact be (rightly) denied access to credit at all. Comparison of the two regimes will reveal, that this is more pronounced under information sharing, and is a source of welfare improvement.

The incumbent bank will make positive profits on good-signal borrowers, and will not bid for bad-signal borrowers. Uninformed banks will make zero profits, but they will *sometimes get the good-signal borrowers*.[10]

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[10]Good borrower switching is a key property of the mixed-strategy equilibrium that stands in contrast with sequential move games, where all good borrowers are held up by the incumbent (see, for instance, Padilla and Pagano(2000)). This is in line with the recent evidence on borrower-bank relationships (see for example Ioannidou and Ongena 2008).

Proposition 2.2 *The expected gross profits for the incumbent bank when default information is shared is given by*

$$\pi_{share} = I(1 - \lambda)(2\varphi - 1)$$

The uninformed bank makes 0 profits.

Proof See Appendix.

The expected profits are similar to Hauswald and Marquez (2006).[11] The gross profits of the incumbent bank are increasing in the informativeness of the monitoring signal, as one would expect: the more intensive the monitoring, the higher the appropriated monopolistic rents.

2.3 No information is shared

We describe now the case where there is no credit bureau in the economy. At the beginning of the second period, both default and monitoring information are known only to the incumbent bank. The second period timing is:

$T = 2$

- Banks ***do not*** share hard information.
- Simultaneously the informed and the uninformed banks offer second period interest rates. Each bank has ***three*** types of borrower group from first period lending, and one group of borrowers that switch from the competitor bank.
- The firm chooses an offer and invests I. If indifferent, the firm chooses randomly.
- Profits are realized based on soft information *and* default information.

Similar to the case with information sharing, there is no pure strategy equilibrium, but there is a mixed-strategy one.

Let $F_u(r)$ denote the bidding strategy of the uninformed bank. Given the first-period monitoring φ, the profit functions for the incumbent bank can be written as follows:

$$\pi_i^N(r) = N_N(p_N r - I)(1 - F_u(r))$$
$$\pi_i^{GD}(r) = N_{BN}(p_{BN} r - I)(1 - F_u(r))$$
$$\pi_i^{BD}(r) = N_{BD}(p_{BD} r - I)(1 - F_u(r))$$

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[11] It is the same as their location dependent expected profits for a borrower at a given distance.

The uninformed bank only has *one* bidding function since it cannot distinguish between any of the types since it has no information.

The profit function for the uninformed bank is given as follows:

$$\pi_u(r) = N_N(p_N r - I)(1 - F_i^N(r)) + N_{GD}(p_{GD} r - I)(1 - F_i^{GD}(r)) + N_{BD}(p_{BD} r - I)(1 - F_i^{BD}(r))$$

The proportions of the types and their success probabilities are expressed in the same way as in the previous case. Before characterizing the equilibrium, we remind the definition of $\overline{r_D}$, the break-even interest rate for the *two least qualified* groups, the defaulting borrowers GD and BD (both good- and bad-signal).

Proposition 2.3 **Equilibrium Strategy** *The competition between the informed and the uninformed bank has a mixed-strategy equilibrium for defaulters. In this equilibrium,*

1. when $\varphi > \bar{\varphi}$, the informed bank

- *bids only for non-defaulting borrowers in $[\bar{r}, \bar{r}_D]$;*

$$F_i^N = 1 - \frac{N_{BD}(I - p_{BD}r) + N_{GD}(I - p_{GD}r)}{N_N(p_N r - I)} = \frac{\lambda p r - I}{\lambda p(pr - I)}$$

- *bids only for good signal borrowers that have defaulted in $[\bar{r}_D, R]$;*

$$F_i^{GD} = 1 - \frac{N_{BD}(I - p_{BD}r)}{N_{GD}(p_{GD}r - I)}$$

with a point mass at R.

- *refrain from bidding for the bad-signal, defaulting group.*
  The uninformed bank bids

$$F_u(r) = 1 - \frac{p_N \bar{r} - I}{p_N r - I} = \frac{\lambda p r - I}{\lambda(pr - I)} = p F_i^N,$$

on $[\bar{r}, \bar{r}_D]$,

$$F_u(r) = 1 - (1 - p)\frac{p_{GD}\bar{r}_D - I}{p_{GD}r - I} = p + (1 - p)\varphi F_i^{GD},$$

on $[\overline{r_D}; R)$. It does not bid with probability $1 - F_u(R) = (1 - p)\frac{p_{GD}\bar{r}_D - I}{p_{GD}R - I}$

2. when $\varphi \leq \bar{\varphi}$, all banks bid for all borrowers

Proof See Appendix.

The rates are depicted in figure **??**. To save space, details on the case $\varphi \leq \bar{\varphi}$ are provided in the appendix. As under information sharing, the uninformed bank faces adverse selection. In this case, however, it faces adverse selection from hard information as well, and it bids weakly higher. While success probability p did not matter under information sharing, it does matter under no information sharing. Once again, better types receive better interest rates.

The term $1 - p = \frac{p_N \bar{r} - I}{p_N \bar{r}_D - I}$ comes from the *pooling* of better population – the non-defaulters. Indeed, at $\bar{r}_D$, the uninformed bank already bids rather aggressively for the defaulting borrowers (with probability $p = 1 - \frac{p_N \bar{r} - I}{p_N \bar{r}_D - I} = F_u(r_D)$ it bids lower than that) compared to the information sharing case. Because, contrary to the case with information sharing, the uninformed bank confuses *best* types with defaulting borrowers, it is willingly more aggressive with them. Finally, as under information sharing regime, the uninformed bank may sometimes deny credit when informativeness of the monitoring is high enough. From equilibria under both regimes (propositions 2.3 and 2.1), we will see that uninformed bank makes fewer type II mistakes under information sharing. We will come back to this point under welfare discussion.

2.4 Information Rents and Optimal Monitoring

Proposition 2.4 *Informational rents are given by:*

For the informed bank under information sharing

$$\pi_{share} = I(1 - \lambda)(2\varphi - 1)$$

For the informed bank, under no sharing

$$\pi_{noshare} = Ip(1 - \lambda) + I(1 - p)(1 - \lambda)(2\varphi - 1)$$

Under both regimes, informational rents are growing in the informativeness of the monitoring. This proposition therefore provides a theoretical counterpart to the empirical findings that bank rents grow with relationship intensity (Degryse and Cayseele (2000), Ioannidou and Ongena (2010)).

We can now compare the optimal choices of monitoring with and without information sharing.

Proposition 2.5 *Marginal return to soft information is higher under hard information sharing:*

$$\frac{\partial \pi_{share}(\varphi)}{\partial \varphi} \geq \frac{\partial \pi_{noshare}(\varphi)}{\partial \varphi}$$

Optimal investment in monitoring is higher under information sharing, and is given

by:

$$\varphi_{share} = 0.5 + \frac{I}{c}(1 - \lambda)$$

$$\varphi_{noshare} = 0.5 + \frac{I}{c}(1 - \lambda)(1 - p)$$

Proof See Appendix.

Because under no information sharing the informed bank is likely to lose some of its GD borrowers to the uninformed bank, it is less motivated to invest in monitoring. The payoff to the monitoring is lower by fraction $1 - p$: the uninformed bank is rather aggressive towards defaulting borrowers when information is not shared (it bids (weakly) lower than $\bar{r}_D$ for D borrowers and wins them almost surely, and higher than –with only $1 - p$). It does so because it cannot distinguish between the defaulting and non-defaulting groups. However, the uninformed bank is less aggressive under information sharing (bids higher than $\bar{r}_D$ for D borrowers with certainty), leaving them to the incumbent more often. Using firm level data, we test and confirm that firms that operate in countries where information sharing is established, invest more in their borrowers, using several proxies of soft information investment.

The idea that information sharing may adjust competition is also present in Bouckaert and Degryse (2006), where the inside bank has free full information about types. In their model with switching costs, information sharing may increase profits by preventing the outside bank from bidding in the defaulters' market. At the same time, the successful borrowers' switching is slowed by the costs.

By contrast, information acquisition is used strategically in our model, and it changes competition between the banks. In our model information sharing may increase the inside bank's profits, since costly information acquisition provides higher marginal returns. [12]

Proposition 2.6 *(1)Optimal investment in soft information is increasing in the risk parameters $1 - \lambda$, and $1 - p$.*
(2)The increase in optimal information acquisition is higher when acquisition cost c is lower

Proof Obvious and omitted.

Consistent with the arguments that small firms are a much more opaque and risky population (see Berger et al. 2005, among others), part (1) predicts that our findings

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[12]Costly information acquisition may change the bank's regime choice. When adverse selection is low, information sharing does not keep the outside bank away, and does not increase bank's profits in Bouckaert and Degryse (2006). However, it may increase the inside bank's rents in our case via higher monitoring.

should be more pronounced for small firms. We test this hypothesis in the empirical section.

Part(2) of the proposition illustrates our message on the implication of information sharing on the banking structure. Smaller banks have an advantage in collecting and acting on soft information. This enters in our model through lower cost, implying that the increase in soft information acquisition is higher for small banks.

Proposition 2.7 *If monitoring costs are low enough ($c < 2I(1-\lambda)(2-p)$), second-period informational rents will be higher under information sharing.*

Proof Indeed, plugging in optimal values, one can see that $\pi_{share}^{optimal} = \frac{2I^2}{c}(1-\lambda)^2 > Ip(1-\lambda) + \frac{2I^2}{c}(1-\lambda)^2(1-p)^2 = \pi_{noshare}^{optimal}$ will yield the necessary condition.

Thus, second period informational rents can be higher under information sharing, unless the increased cost from higher monitoring outweighs benefits from the higher return.

2.4.1 First Period

At the beginning of first period banks compete for the whole population, under symmetric information: banks know the proportion of the good and bad borrowers and their success probabilities. The total profits across two periods are given by

$$\lambda(pR_1^{sharing} - I) + \beta\pi^{sharing}$$

and

$$\lambda(pR_1^{nosharing} - I) + \beta\pi^{nosharing}$$

under information sharing and the no sharing regimes, respectively. Banks compete in period 1 for second period captive markets, and this will drive the total profits across the two periods to 0, like in Padilla and Pagano (2000).[13]

Information sharing decision after period-1 lending. The fact that first period competition drives down banks' informational rents in period two, yielding 0 profits overall, does not render information sharing irrelevant from banks' point of view. If banks anticipate the establishment of a credit bureau after period one lending, but before monitoring, the above comparison of period-2 equilibria profits between two regimes shows that information sharing increases rents (and can arise endogenously).[14]

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[13]Padilla and Pagano (2000) extend the model to study the effect of information sharing on borrower's effort, which is not discussed in this article.

[14]A similar approach is taken in Jappelli and Pagano (1993), Padilla and Pagano (1997), and Bouckeart and Degryse(2006) where banks share information and increase rents, as they start with incumbency positions.

2.5 Interest Rates and Switching

Proposition 2.8 *$F_i(r)$ and $F_u(r)$ for all groups of borrowers, as well as the minimum of the two rates for each borrower, are non-increasing in φ under both information sharing and no information sharing regimes.*

Proof See Appendix

Proposition 2.9 *Expected interest rates paid by borrowers, are non-decreasing in informativeness φ under both regimes.*

Proof See Appendix

A similar result is also present in Hauswald and Marquez (2006).[15] As investment in soft information increases, it also raises interest rates that borrowers pay. Rather than leveling the playing field, superior knowledge about borrowers provides the incumbent with stronger safeguard from competition, due to a higher asymmetric information. Because the uninformed bank faces larger winners' curse, it bids less aggressively in equilibrium. The response by the informed bank is to bid less aggressively as well, leading to higher expected interest rates. This complements to the recent findings that utilize detailed data from U.S. (Schenone (2009)) and Bolivia (Ioannidou and Ongena (2010)).

Proposition 2.10 *Interest rates:*
(1). Bad signal borrowers get weakly higher rates than good signal borrowers under both regimes,
(2). Defaulting borrowers get weakly higher rates under information sharing,
(3). Non-defaulting borrowers get weakly lower rates under information sharing than no sharing,
(4). Overall, borrowers are on average weakly better-off.

Proof See Appendix

Thus, the intuition that information sharing will decrease average interest rates may be misleading. Previous work has shown that information sharing decreases interest rates (Brown et al. 2009, Jappeli and Pagano 2002). Due to lack of data, empirical evidence has failed to take into account how borrower default affects interest rates. However, the finding that overall borrowers are better off is consistent with existing literature and with our evidence. This is because the uninformed bank faces a higher winner's curse, due to a more precise evaluation of borrowers by the informed bank. It bids less frequently for the (worse) switching borrowers, and avoids making too many type II mistakes. This saving is a transfer to the creditworthy borrowers because banks compete any lifetime profits in period one.

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[15]In their model, for a fixed borrower the expected interest rate is calculated similarly to the case under information sharing in our model, where the incumbent has only one source of superior information. With this proposition, we show that the result holds also when the incumbent has two sources of superior information.

Proposition 2.11 *Switching probabilities are given by*

	Sharing	*No Sharing*
Group N	$\frac{1}{2}$	$\frac{1}{2}p$
Group GD	$\frac{1}{2}\varphi_{share}$	$p + \frac{1}{2}(1-p)\varphi_{noshare}$
Group BD	$\varphi > \bar{\varphi}$, 1	$\varphi > \bar{\varphi}$, 1
	$\varphi \leq \bar{\varphi}$, $\frac{1}{2}(1-\varphi_{share}) + \varphi_{share}$	$\varphi \leq \bar{\varphi}$, $p + \frac{1}{2}(1-p)(1+\varphi_{noshare})$

Thus,

(1). Bad signal borrowers switch more than good signal ones under both regimes,

(2). Defaulting borrowers may overall switch more or less,

(3). Non-defaulting borrowers switch more under information sharing,

(4). Change in overall switching across regimes is inconclusive.

Proof See Appendix

We can see that non-defaulting borrowers are more likely to switch under information sharing, when their success story becomes public. Our results show that defaulting borrowers may or may not switch more under information sharing depending on whether borrower heterogeneity is more important (p is high) or the informativeness of the signal. In the former case, because defaulting borrowers get pooled with much better borrowers, they will tend to switch more often when that heterogeneity is not yet revealed to the uninformed bank.

In the latter, however, if the good signal has high enough informativeness under information sharing (φ_{share} is large enough), borrowers may in fact switch more since informed banks try to squeeze too much, compared to the uninformed banks: remember that $F_u^D(r) = \varphi F_i^{GD}$ and optimal informativeness is higher under information sharing.[16]. As a result of these, information sharing may not necessarily facilitate switching overall, despite leveling the playing field between banks. The interest rate strategies and the resulting switching mechanics described above are not as simple as in the case of a hypothetical pure-strategy equilibrium in which borrowers never switch to less-informed banks. However, the model intuition and its implications are arguably realistic. We test that higher investment in soft information is related to more switching. Ioannidou and Ongena (2010) present compelling empirical evidence that is consistent with the idea of incumbents accumulating informational rents and borrowers occasionally switching banks as a result of excessive interest rates. Ongena and Smith (2001) and Farinha and Santos (2002) provide evidence that the likelihood a firm switches the lender increases in relationship intensity. In our proposition too,

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[16]Contrast this to the uninformed bank's less sensitive bidding under no information sharing ($F_u(r) = p + (1-p)\varphi F_i^{GD}$) and lower φ

switching increases weakly in informativeness, except in the case for *hard* borrowers, for whom relationship does not matter.[17]

2.6   Welfare Implications

We now address the important question of how socially desirable information sharing is in our model. When informativeness of the acquired information is high enough ($\varphi > \bar{\varphi}$), banks can add to the social value of the information production by rejecting credit to uncreditworthy borrowers (fewer type II mistakes). The higher informativeness under information sharing allows banks to evaluate their borrower's true types more precisely, and reject more low quality borrowers. when these borrowers switch to the uninformed bank, the latter realizes that it faces a higher winner's curse, and in turn rejects credit more often, thus making fewer type II mistakes under information sharing. Such an outcome is a transfer to the creditworthy borrowers, since banks' total lifetime profits remain unchanged. Information sharing may thus increase welfare, unless monitoring costs are too high.

Formally, welfare consists of the sum of all NPV projects, plus the savings that the uninformed bank makes by not extending credit to the uncreditworthy, less the mistakes it makes by not doing so, less costs of monitoring.

$$W = \lambda(pR - I) - (1 - \lambda)I + ((1 - \lambda)\varphi - \lambda(1 - p)(1 - \varphi))(1 - F_u(r)) - c(\varphi - 05)^2$$

When $c \leq \frac{0.5(1-\lambda)(1-p)-p\lambda}{R/I+(1-p)(1/\lambda)}$, the benefits from fewer bad loans exceed costs of higher monitoring under information sharing.[18] Thus, although information sharing induces defaulting borrowers to pay higher rates, and non-defaulting borrowers lower rates, overall creditworthy borrowers gain, since banks make fewer type II mistakes. Consistent with this, Hertzberg et al. (2009b) and Doblas-Madrid and Minetti (2009) show that information sharing reduces access to finance for risky borrowers.

2.7   Social Optimum

The socially optimal level of monitoring maximizes efficiency of credit allocation net of monitoring costs. Efficient allocation is determined by how many truly creditworthy borrowers get credit (all creditworthy borrowers less the ones who are wrongly rejected-type I error) and how many bad borrowers receive credit (type II error)

$$(1 - \lambda)\varphi - \lambda(1 - p)(1 - \varphi) - c(\varphi - 0.5)^2$$

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[17]Black (2009) analyzes the effect of increased firm transparency on borrower switching. In their model without information acquisition, overall switching decreases

[18]Alternatively, one could include the monitor as one of the agents that the social planner cares about, and monitoring costs - as a transfer to/profit for the monitor. In that case welfare increases unambiguously.

The socially optimal level of monitoring is

$$\varphi_{s.o.} = 0.5 + \frac{1 - \lambda p}{2c}$$

Comparing $\varphi_{s.o.}$ with φ_{share} and $\varphi_{noshare}$, we see there may be underinvestment in (privately optimal) monitoring under certain parameter values: when default probability is high enough $(1 - p > \frac{1-\lambda}{\lambda})$, too many high type (but unlucky) borrowers may default and stay without credit, and the socially optimal monitoring is higher. In this case, information sharing may in fact attenuate the (private) underinvestment, rendering monitoring closer to the (social) optimum.

3   Empirical Evidence

To the best of our knowledge, there has been no study on the impact of hard information sharing on soft information acquisition. This section attempts to fill this gap, and corroborate theoretical findings above. Our main hypothesis is that *soft information acquisition increases when hard information is shared.* We then test that *good soft information outcomes reduce interest rates and switching, while bad outcomes increase both.* Earlier empirical studies have instead focused on the influence of information sharing on credit market performance, or firms' access to credit. Jappelli and Pagano (2002) use aggregate data to show bank lending to the private sector is larger and default rates are lower in countries where information sharing is more solidly established and extensive, controlling for other economic and institutional determinants of bank lending, such as country size, GDP, growth rate, and variables capturing respect for the law and protection of creditor rights. Djankov et al. (2007) confirm that private sector credit relative to GDP is positively correlated with information sharing in their recent study of credit market performance and institutional arrangements in 129 countries for the period 1978 to 2003.

Throughout our analysis we study our hypotheses separately by *distinguishing large and small firms.* In our model we derive the prediction that soft information acquisition increases when hard information is shared. There are several reasons why one may expect that introducing hard information sharing may have a larger impact on small firms, than on large ones. First, credit information sharing arrangements target mainly the small business and consumer markets (unlike credit rating agencies, that usually deal with large firms). Second, since large firms already have available information, produced by their more developed internal and external reporting, sharing information via credit bureaus should have a lower impact for these firms. Part of what is available in a standard credit bureau report may already be available without a credit bureau for a large firm - e.g., information on company profile, audited financial statements, risk class of the borrower. Earlier research has shown that information can be par-

ticularly important for small firms since they are unlikely to be monitored by rating agencies, and information asymmetries are most acute in small firms (see, for example Petersen and Rajan (1994)). Thus, apart from testing that *hard information sharing increases soft information acquisition, and that the switching is changed as a result of soft information outcome, we test whether these are stronger for small firms.*

3.1 Data

We draw our data from two main sources. Country level data on information sharing is taken from the World Bank/IFC "Doing Business database. We relate this to firm-level information taken from the EBRD/World Bank Business Environment and Enterprise Performance Survey (BEEPS).

Between 1991 and 2005 information sharing institutions were established in 17 of the 26 transition countries in Eastern Europe and the former Soviet Union.[19] The main sources of these data are the "Doing Business surveys, conducted by the World Bank/IFC (World Bank, 2006).

We use the information sharing index constructed by Brown et al. (2009) as the measure of the depth of *hard information* shared in different countries. The index measures the presence and structure of public credit registries and private credit bureaus on a scale of 1 to 5. It is constructed as the maximum of two scores, one for PCRs and one for PCBs. The PCR score adds one point for fulfilling each of the following five criteria:

(i) both firms and individuals are covered,

(ii) positive and negative data is collected and distributed,

(iii) the registry distributes data which is at least two years old,

(iv) the threshold for included loans is below per capita GDP, and

(v) the registry has existed for more than 3 years.

The PCB score is computed in the same way. The index is then taken as an average over years 1996 to 1999 for the analysis of year 2002, and average over 2000-2003 for year 2005. For year 2005 *coverage* data is also used as measure of hard information shared. It is taken from IFC doing business project: for each country it shows the percentage of firms and individuals registered in a private or public register.

Detailed definitions of all variables are available in the *Appendix B*. The BEEPS 2002 provides data on 6153 firms in 26 transition countries and covers a representative sample of firms for each of these countries (survey was done in all countries where EBRD is operational except in Tajikistan), while BEEPS 2005 covers over 9655 firms. As in Brown et al. (2009), we drop all observations from Uzbekistan and Tajikistan, due to lack of institutional indicators for these countries. Together with missing dependent variables, this leaves us with a sample of 5209 firms at best from 24 countries for year 2002 and with 8599 for year 2005.

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[19]For a comprehensive coverage see Table 1 in Brown et al. 2009

3.2 Dependent Variables

We relate our information sharing index to firm-level data on our independent variables taken from the Business Environment and Enterprise Performance Survey (BEEPS)(see Table 1).

We use 1) three dependent variables to measure the investment in proprietary information, 2) a dummy showing whether the borrower switched from the main bank, and 3) cost of capital:

1. borrower switching/keeping relationship with the main bank; *switch*

2. the banks' reaction to the borrower's non-repayment during the relationship (the reaction as perceived by the borrowers); *react*

3. the days needed to approve the loan starting from the date of application; *days*

4. the use of checking account; *checking account*

5. the *cost of capital*.

Our cross-sectional analysis is based on data from BEEPS 2002 for three variables *(switch, days, react)*, BEEPS 2005 is used for *checking account* and *capital cost* is available in 2002 and 2005. The last variable allows us to build a panel regression, which is based on responses of 1333 firms who participated in both the 2002 and 2005 surveys.

3.3 Model Specifications

We start our empirical analysis with cross-sectional regressions using the BEEPS 2002. The baseline specification relates each of our five dependent variables for firm i in country j to the information sharing index in the firms country, a vector of other country characteristics, and a vector of firm characteristics.

Our dependent variables were collected during 2002, while information sharing is measured as the average value of the index prior to the survey, i.e. from 1996 to 1999 for 2002, and 2001-2003. Thus, we relate firm-level information to countrywide measures of information sharing that are predetermined with respect to credit variables and this should address the potential endogeneity of information sharing with respect to credit market performance (see also Brown et al. 2009).

We will test our theory using 5 dependent variables. Specifically, we test three hypotheses

1) whether soft information acquisition (that is, informativeness φ) has increased using three proxies of $\varphi(i_j)$ for firm i_j (dependent variables *days, react, checking account*)

$$\varphi(i_j) = \alpha + \beta \times hard.information + \gamma \times contorls_{firm(i(j))} + \delta \times controls_{country(j)}$$

2) how switching has changed *depending on the signal sign of the informativeness* φ – *good or bad*, using a measure of whether the soft information has been good or bad (variable *soft*)

$$Switching_{i_j} = \alpha + \beta \times softsignal(G/B) + \gamma \times contorls_{firm(i(j))} + \delta \times controls_{country(j)}$$

This is proposition 2.11 H(1) showing that switching and interest rates depend on the *outcome* of the signal: *good* or *bad*

3) And similarly, *cost of capital* changes depending on the soft signal following from 2.3 and 2.3.

$$Cost.firm(i_j) = \alpha + \beta \times softsignal(G/B) + \gamma \times contorls_{firm(i(j))} + \delta \times controls_{country(j)}$$

3.3.1   Country level variables

We include eight country-level variables to control for differences in the legal environment, the structure of the banking sector, and macroeconomic performance (Table 2 provides means of the variables): an index of creditor rights, banking reform, a measure of market structure/concentration, a proxy for asymmetric information and borrower risk, a measure of foreign bank presence, per capita GDP,credit to private sector/GDP and the inflation rate. The *banking concentration* measure is the share of the largest 5 banks in terms of deposits (from Barth et al 2001): higher concentration may indicate higher market power of the banks, higher informational lock in, and therefore less switching. Moreover, since larger banks are less efficient in collecting soft information (Berger et al 2005), higher concentration may have a negative impact on the information acquisition. Also, in more competitive markets, banks anticipate a shorter expected lifespan of their relationships, and they may respond by reducing their relationship-specific investments. Weaker relationships may then induce switching further. We take the share of *non performing loans* as a measure of asymmetric information. In markets with higher degree of risk, switching will be more costly: we expect a negative sign on this variable for switching. The *Creditor rights* variable is taken from Brown et al. (2009). Higher values of this index imply that secured lenders are better protected in case a borrower defaults.

The *banking reform index* is an index showing level of changes from a state owned bank with soft-budget constraints to a commercial bank with hard budget constraints in a market economy. *Foreign bank share* variable is the asset share of foreign owned banks in each country. Recent evidence suggests that foreign bank entry has improved credit market performance in transition countries (Giannetti and Ongena 2005). Also, foreign bank presence may coincide with information sharing, if these banks are familiar with the benefits of credit reports from their home markets, and therefore tend to patronize private credit bureaus also in their host countries. Alternatively, when

foreign banks are serving foreign firms in the host country, they might be able to access their information through their home bureaus, and are less interested in information sharing. We include *inflation and log of per capita GDP*, as previous evidence suggests that macroeconomic stabilization is associated with an expansion in financial intermediation in transition countries (Fries and Taci, 2002). Finally, *private credit* is the extended credit to the private sector as a share of the GDP, taken from the EBRD transition report.

3.3.2 Firm level explanatory variables

All firm level explanatory variables are detailed in the Appendix for variables. We include six firm-level explanatory variables to control for the variation in credit risk and financing requirements across firms, and we use two different measures of good/bad soft information.

Younger firms are generally considered as more risky than older firms. However, *in transition countries firm age also determines the economic regime* under which the firm emerged. Thus, while older firms may be less risky in general, they may be riskier in transition countries, because they emerged during the pre-transition or transition phase. Rather than controlling simply for firm age, we therefore distinguish firms by three categories depending on whether they were established *before 1989 (Pre-transition firm), between 1989 and 1993 (Transition firm), after 1993 (Post-transition firm)* (Brown et al. 2009, Gianetti and Ongena 2005). We further include two control variables for firm ownership. *State-owned firm* is a dummy variable that equals one if the government holds a majority stake in the firm. The effect of this variable is a priori ambiguous. On the one hand, state ownership may reduce firm risk in the eye of a bank, due to the possible government bailout in case of default. On the other, state ownership may increase default risk, owing to the political pressures on management to diverge from profit-maximizing policies (see Brown et al. 2009). Moreover, these firms may receive public funding, which reduces their reliance on credit for investment and therefore relieves a constraint on their growth.

As discussed above, we are also interested in the differential effect depending on the firm size. Moreover, it is customary to regard larger firms as less risky, other things equal. We distinguish small firms from large ones by their number of employees (Small firm = 1-49, Large firm $\geq$ 50).

From BEEPS survey 2002 and 2005, we construct the summary variable *soft signal (1)*, that measures how protected the borrower is from different *non-financial* factors. It summarizes answers to 19 questions on "non financial problems of growth". The exact question in the survey asks: *Can you tell me how problematic are these factors for the operation and growth of your business?*. The factors include skills of workers, their education, contract violations by customers and suppliers, among others. Arguably, relationship-specific investment is necessary to evaluate how problematic these factors

are for the operations and growth of the firm. We rescale the summary variable to range from [0.21to1], with lower value indicating problems (=the bank receives *bad signal*(B), when monitors on these issues. As a further measure of the sign of the soft information, we use *management quality* (*soft signal (2)*), which is considered as one of the most important soft characteristics of the firm (Grunert, Norden, Weber (2005)). In our sample it is the sum of three variables: *previous experience* of the manager within that firm, *the age of the manager*, *the manager's education*. Each of the variables takes several values in the survey. The variable ranges from 0 to 3, and higher values of the management quality would mean better signals for the lender. Finally, in all our regressions we include sector dummies, to control for different finance needs of firms.[20]

The data provides a similar sample of non-agricultural firms across all countries. The sample is dominated by small firms (67%) and private firms (86%). The sample includes firms from service and manufacturing sectors, with the majority of firms (54%) have their main activity in the service sector. All firms in the sample are at least 3 years old. The 2005 survey includes 9655 firms. The sample structure for the 2005 survey resembles by design that of the 2002 survey.

3.4   Regressions

3.4.1   Soft Information Acquisition

Our aim is to provide empirical evidence that in support of the theory: banks invest more in soft information once hard information is shared. In order to examine this hypothesis, which is also the main message of our paper, we look at several aspects:

- the *days* banks spend to approve a loan application;
- how flexibly banks *react* to late payments from their borrowers;
- the use of *checking account* as a way to accumulate information on borrowers.

Days

The days variable is taken from the BEEPS 2002 survey. The question in the survey asks, "How many days did it take to agree the loan with the bank from the date of application?" The mean is 25, with standard deviation 37. The dependent variables is the reported *days*.[21] The reported output in table 7.3 is based on robust OLS estimation. Due to the existence of some outliers in the dependent variable days, we also estimated *log of days*, not presented here for brevity. This yields identical qualitative results to those presented in column (1) of Table 5. The significance is

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[20]Although some of these variables can be regarded as pieces of hard information, we believe the general picture may have a proprietary nature for the main bank.

[21]The existence of the many outliers motivates our use of the logarithm

preserved also when Poisson estimation used. In all specifications, the standard errors of the estimated coefficients are adjusted for cluster effects at the country level. The first column is the estimate for the total sample, the second one is only for small firms, while the third one is for large firms.

Investment in soft information by screening a loan application requires time. A bank that carefully screens its borrowers will have to spend more time before making the loan decision. If the information the bank relies on is hard, then the time interval will arguably be lower, since the borrowers have to prepare in advance the standardized information needed to get a loan. Finally, if the bank does little screening of either type, then the basic standardized procedures in that case will likely take very little time, too.[22]

The first column shows that hard information sharing is related with more time to conclude the loan application. Column 2 shows that the effect is largely driven by small firms, while column 3 is for large firms, confirming our prediction from 2.6. We also use Poisson regressions, where our results are similar with a 1% significance on hard information variable. The magnitude is economically quite large. The first coefficient on information index shows that moving from lowest to highest value of information sharing (from 0 to 4.6) may increase days for application processing as much as 16 days, rather large for the sample average of 25.

Importantly, a bank may also spend more time before making the loan simply because its procedures are inefficient. This is a reasonable worry in our case, since banking systems have been undergoing radical changes during the last two decades, and their efficiency has been transformed. Therefore the days variable can differ largely owing to the strength of legal and institutional reforms. We control for this through the variables *Banking reform index, collateral law development, and creditor rights*. Higher values of these indices reflect reforms that encourage financial discipline and governance and enforce the law. The negative coefficients on these controls point to the less time needed when financial discipline is stronger.

Concentration has a negative impact, since higher concentration means larger banks may use more hard information and standardized procedures, giving small role to screening and approving loans faster. As expected, stronger creditor protection allows to approve loans faster, since creditors worry less about defaults. For post transition younger firms banks may be using more impersonal and modern communication, in line with earlier findings that older firms are closer to their banks and are less likely to have impersonal communication. Indeed, apart from age, this is even more plausible for a pre-transition vs. post-transition borrowers. There may also be a role for the *vintage* effect (Berger et al 2005); older borrowers started their careers with their bankers face-to-face and have not changed their ways of communicating with their banks.

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[22]It should be reminded here that we solve our model for ex-ante screening of borrowers by banks. Our theoretical results are reminiscent to the monitoring case analyzed in the paper. In particular, investment in screening efforts is higher under information sharing.

Banks' reaction

The reaction variable is taken from the BEEPS 2002 survey. The question in the survey asks: "Now I would like to ask you a hypothetical question. If your firm were to fall behind in its bank repayments, which of the following would best describe how you would expect the bank to react?" Higher values indicate lenient reaction by the bank, with possible answers; 1. Extend the term of the loan without changing the conditions (=3), 2. Extend the term of the loan but increase the interest rate (=2), or 3. Begin legal proceedings to take possession of some assets of the firm (=1).

Arguably, if the bank reacts more flexibly in case of late payments (higher values of the variable), it must be that the bank has a good knowledge and is optimistic of the firm. In that case the bank relates late payments to bad luck, rather than to gloomy prospects. In contrast, a bank that does not invest in monitoring or screening its borrowers will simply take late payments as a pure negative signal about the firm's potential and will be more likely to cease the banking relationship.[23] 2000 firms reply to this question. The output in table 7.3 is ordered probit, although robust OLS estimates have similar economic magnitude, and are statistically significant at 5%. In all specifications, the standard errors of the estimated coefficients are adjusted for cluster effects at the country level.

The table shows have high significance for the hard information sharing index, both for the whole and the small firm samples. Calculation of marginal effects shows that moving from smallest to highest information index can change reaction of the bank by 0.45 (mean 2.26). Our conjecture on the firm size effect explains the no-significance of the large firm subsample.

Intuitively, bank reform index has a negative sign: banks with binding hard-budget constraints will be stricter to their borrowers. The regression shows that younger, post transition firms seem to enjoy less leniency from their banks when they fall behind payments: again, we explain this by the fact information acquisition via monitoring may take a long-standing relationship.

Checking account

The checking account variable is taken from the BEEPS 2005 survey. The question in the survey asks:"Does your establishment have a checking or savings account?" It has been documented that the use of checking account gives the bank advantageous information on the borrower, works as a monitoring tool for the lender and is used in the borrower's "internal rating" (Puri et al. (2009), Degryse and van Cayseele (2000), Norden and Weber (2008), Nakamura (1991)). Moreover, evidence suggests that there is a positive impact of the checking account existence on the probability of personal

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[23]Similar questions have been used as proxies of soft information on earlier studies, that utilize companies' grading of their main banks in terms of satisfaction (Ogura and Uchida (2006), Uchida, Udell and Yamori (2008)).

communication between the bank and the borrower (Berger et al. 2005). Table 7.3 shows that checking account is used more in countries with information sharing, supporting our hypothesis on more investment in monitoring in these countries.

The hard information index used is the percentage coverage of the individuals and firms registered in a private or public credit bureau. The variable is taken from IFC/Worldbank Doing business survey and is available only from year 2005. The coefficients show that there is higher likelihood a firm has a checking account, if it operates under information sharing: that is, 44% when moving from smallest to the highest value of hard information. The coefficients are not statistically stronger for small firms, which we attribute to the fact that small borrowers are less likely to have checking accounts for many other reasons.[24] In all three cases information sharing makes the use of checking accounts more likely. Concentration has a significant negative impact, in line with earlier arguments.

Using the information sharing index from Brown et al., shows less robust results. Coefficients are significant at 1% when standard errors are not adjusted for cluster effects at the country level, but the significance drops when they are.

3.4.2   Switching or Staying with the Main Bank?

The switching variable is taken from the BEEPS 2002 survey. The question in the survey asks, *Has your firm changed its main bank (the single bank with which your firm has the closest relationship) since 1998?'*. Possible answers include "yes", "no", "no main bank". 8 % of the firms report that they have no main bank, and we exclude those firms. This leaves us with a sample of 5209 firms). 26% of the firms report that they have switched their main bank. We also use the average information sharing index for year 1996-1998, to estimate switching *after* establishing information sharing. We would like to test whether (signal from) soft information is important for switching (proposition 2.11, H(1)).

Table 7.3 is based on probit estimations and standard errors are adjusted for cluster effects at the country level. Explanatory variable soft signal (1) is a summary measure that proxies the sign of soft information acquired for the firm and shows how protected the firm is from each of the 19 non-financial problems discussed: range $[0.21; 1]$. *Soft signal 2* is a proxy of management quality (1-3). Column 1, 2, 3 are run for overall, small and large firms, respectively. Columns 4, 5, 6 repeat the analysis adding soft signal (2). The first and second line strongly support 2.11, H(1). Calculating marginal effects, we find that this may generate up to 16% difference in switching, which is rather large given the 26% sample average. Furthermore, the insignificant hard information

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[24]Indeed many small firms may find it costly to open checking accounts in transition economies, or may borrow simply on personal accounts. See also Hogarth, Anguelov and Jinkook (2004), who document that households are generally less likely to have checking accounts, which is related to income, planning horizon, education and credit history.

coefficients are justified by proposition 2.11, H(4) – no expected difference in overall switching across regimes. We are not able to test the rest of hypotheses generated in the proposition 2.11 due to lack of data on borrower default.

3.4.3   Cost of capital

We begin analyzing the effects of information on *cost of capital*. It ranges from 1 to 4, with higher values indicating a higher cost of financing. It equals 4, if cost of finance is reported to be a major obstacle, 3 = moderate obstacle, 2 = minor obstacle, 1 = no obstacle. Existing evidence suggests that information sharing benefits firms, in line with 2.10, H(2) (see Love and Mylenko 2003, Brown et al. 2009). In this regression is to add to this study by looking at whether credit cost changes depending on soft information outcome, and whether this is stronger for small firms. Unlike Brown et al. (2009), we also take into account *soft information signal -good or bad*, which generates important difference from what is reported in Brown et al. (2009).

Table 7.3 is ordered probit output. Standard errors are adjusted for cluster effects at the country level. Robust OLS estimates give similar results. The table shows that higher values of soft signal (that is, *good* signals) reduce the cost of capital, a little more so for small firms. This confirms our hypothesis - cost of capital is lower for good signal borrowers under both regimes (from proposition 2.3 and 2.1). Brown et al. (2009) find that cost of capital is lower in countries with information sharing, and that this effect is larger for small firms (line 2 in the table, and 2.10, H(2).). Along with confirming this, we find that good soft signals reduce the cost of capital too, and even more so than information sharing.

Higher concentration and stronger creditor rights seem to reduce the cost of capital as well. We did not have any a priori prediction as to the sign post-transition and transition variables, since these are younger firms but, as argued before, may be less risky on the other hand, than pre-transition firms.

Table 7.3 repeats this analysis using panel estimates from 2002 and 2005. Our firm level variable do not change over time. First column is fixed effect estimation and second column is random effect estimation for the whole sample. Column 3 and 4 repeat fixed effects analysis for small and large firms, respectively.

4   Conclusions and Discussion

It might seem intuitive to think that when information is shared via credit bureaus or public credit registers banks will have lower incentives to invest in information collection, lower monitoring or screening, and ultimately, quality of lending decisions and welfare may decline.

Starting from the important distinction between hard and soft information, and the observation that only the former can be transferred through information sharing

arrangements, we show that banks will actually invest more in acquiring soft information when hard information is shared. The intuition behind the result is as follows: when hard information is shared, the uninformed bank becomes more aggressive about the good quality transactional customers with no-default in history, and less aggressive about the defaulting borrowers: borrowers in the latter group stay more with the incumbent, who therefore invests more in their type-informativeness. The reason for this is that the defaulting group is on average more risky, and information collection may help reveal many uncreditworthy borrowers and thus avoid losses. As a result, the higher information acquisition will improve the accuracy of lending decisions, increase welfare, and may be particularly useful for small firms that are differentiated along "soft" characteristics. Thus, one of the apparent victims of information sharing – borrowers that require significant investment in information – may actually benefit from the existence of credit bureaus.

Our results obviously present an important argument in favor of information sharing. But they also point to an interesting implication in terms of the structure of the banking system. In particular, information sharing will increase bank's rents from and their focus on relationship lending thus. Moreover, it may widen the gap between small banks relying on collecting soft information and large banks relying on standardized, hard information (Stein 2002, Berger et al. 2005): indeed, information sharing increases small banks' incentives to collect soft information and makes it easier for large banks to get their standardized data.

Our theory can be extended to allow for different aspects of hard information and partial sharing of hard information. While we do not model it explicitly, the mechanics will arguably go in similar lines. Intuitively, under information sharing, the uninformed bank will more clearly discern out "better" and "worse" populations based on a piece of hard information, poach worse populations less aggressively, and prompt the incumbent to more actively look for true bad types in the remaining worse pool.

The information sharing institution we are studying is not confined to credit bureaus and public registers.[25] In particular, our findings are applicable for borrower's interaction with its bank before and after an initial public offering (IPO). During the IPO, a considerable amount of information is revealed, and the firm is held accountable by the Securities Exchange Commission (SEC) for its reporting. Moreover, after the IPO the firm must comply with ongoing disclosure requirements mandated by the SEC and the stock exchange where its shares trade. Prior to the IPO, however, firms are not required to release information.Hence, our work implies that banks should deploy higher relationship intensity for IPO firms, especially if the firms are small and informationally opaque. Such implications are in line with recent finding on the informativeness of bank loan agreements for IPO borrowers. Using data on U.S. firm from Dealscan and Securities Data corporation, Sokolyk (2009) finds that IPO firms

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[25]Hauswald and Marquez (2003) analyze other implications of accessing the incumbent's information for the insurance and securities markets.

borrow 1.7 as much on average as they raise at the IPO, and bank loan agreements are associated with higher stock returns for small, opaque IPO borrowers than for large ones.

We assumed away investment in hard information in this article. While interesting from a theoretical point of view, it is less relevant from practical point of view: credit bureaus and credit registers share standardized, automated data, most usually total debt exposure or default information, that does not require investment efforts.

The findings of our paper emphasize the importance of making the distinction between the various types of information acquired by banks when assessing the welfare effects of information sharing arrangements. This is an area where further research can be helpful in understanding banks and bank competition.

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6   Appendix A

Proof of Proposition.2.1 Define the success probabilities

$$p_N = p$$

$$p_{GD} = \frac{\lambda \varphi p(1-p)}{\lambda \varphi (1-p) + (1-\lambda)(1-\varphi)};$$

$$p_{BD} = \frac{\lambda(1-\varphi)p(1-p)}{\lambda(1-\varphi)(1-p) + (1-\lambda)\varphi}$$

and the respective break-even rates $\bar{r}_K = \frac{I}{p_K}$, for $K = D, N, GD$ or BD.

The construction of the mixing strategies is done in a sequence of standard arguments outlined here, similar to Hauswald and Marquez (2006). For details, see Hauswald and Marquez (2000) or von Thadden (2004). Let $F_u^K(r)$ the uninformed bank's bidding distribution over loan-rate offers r, for defaulting ($K = D$) and non-defaulting ($K = N$) groups. $F_i^J(r)$ describes the bidding strategies for the informed bank for the good-signal defaulting ($J = GD$), bad-signal defaulting($J = BD$) and the non-defaulting ($J = N$) borrowers. Finally, let $t_i(J)$ and $r_u(K)$ denote interest-rate offers by the informed and the uninformed banks.

1. *The non-defaulting borrowers*: both banks know their repayment history, and compete a la Bertrand under symmetric information, offering marginal cost pricing $\bar{r}_N$.

2. *Defaulting borrowers* (GD, BD, D): Let $\bar{\varphi}$ denote informativeness level that solves $p_{BD}(\varphi)R = I$.

a) *Suppose first* $\varphi > \bar{\varphi}$.

The informed bank will not bid for $J = BD$, since they are not creditworthy (this is because $\frac{\partial \bar{p}_{BD}}{\partial \varphi} = \frac{(1-2\varphi)\lambda(1-\lambda)p(1-p)}{\left(\lambda(1-\varphi)(1-p)+(1-\lambda)\varphi\right)^2} \leq 0$). Thus, $F_i^{BD}(r) = 0$ for all r. Furthermore, it can be shown that $F_i(r)$ and $F_u(r)$ are continuous, strictly increasing, and atomless on some common support $[\underline{r}, \bar{R})$ (see von Thadden 2004).For $J = GD$, the informed bank gets expected profits for any r

$$\pi_{i,share}^{GD}(r) = N_{GD}(p_{GD}r - I)(1 - F_u^D(r))$$

$$\pi_{u,share}^{D}(r) = N_{GD}(p_{GD}r - I)(1 - F_i^G D(r)) + N_{BD}(p_{BD}r - I)(1 - F_i^{BD}(r))$$

Finally, it can be shown that the uninformed bank has to break even in the equilibrium, implying that $\pi_{u,share}(r) = 0$ (von Thadden 2004). To calculate the lower bound of the common support, observe that the uninformed bank wins the defaulter almost surely at that rate and gets $\underline{r}p_D - I$, implying $\underline{r} = \bar{r}_D$. For the upper note that none of the banks will clearly bid above cash flow R. Thus, in the current case with $\varphi > \bar{\varphi}$ the support is $[\bar{r}_D, R)$

b)Now suppose $\varphi < \bar{\varphi}$ (the bad signal defaulting borrowers are creditworthy). and Clearly, $r_i^{BD} \geq \bar{r}_{BD}$ because anything lower than that yields losses. Repeated undercutting arguments establish that the informed bank bids pure strategy breakeven $\bar{r}_{BD}$ for bad signal defaulting borrowers. The remainder of the proof is similar to case is similar, except that common support is now $[\bar{r}_D, \bar{r}_{BD})$. Concluding, the common support of the c.d.f.'s of the two banks is therefore $[\bar{r}_D, \bar{r}_{BD} \wedge R)$.

Since the mixing distributions are increasing, equilibrium profits for each banks must be constant over any $r \in [\bar{r}_D, \bar{r}_{BD} \wedge R)$: the bank has to be indifferent for any bid. Thus,

But then,

$$N_{GD}(p_{GD}r - I)(1 - F_u^D(r)) = \text{ constant.}$$

so that

$$N_{GD}(p_{GD}\bar{r}_D - I) = N_{GD}(p_{GD}r - I)(1 - F_u^D(r)).$$

because the uninformed bank starts bidding from $\bar{r}_D$, $1 - F_u^D(\bar{r}_D) = 1$. This gives us the expression for $F_u^D(r)$:

$$F_u^D(r) = 1 - \frac{p_{GD}\bar{r}_D - I}{p_{GD}r - I}.$$

Similarly,

$$N_{GD}(p_{GD}r - I)(1 - F_i^{GD}(r)) + N_{BD}(p_{BD}r - I) = 0$$

which yields

$$F_i^{GD}(r) = 1 - \frac{N_{BD}(I - p_{BD}r)}{N_{GN}(p_{GD}r - I)}.$$

over $r \in [\bar{r}_D, \bar{r}_{BD} \wedge R)$, where $N_{GD} = \lambda\varphi(1-p) + (1-\lambda)(1-\varphi)$, $N_{BD} = \lambda(1-\varphi)(1-p) + (1-\lambda)\varphi$. It is now easy to verify that $\varphi F_i^{GD}(r) = \frac{p_{GD}r - p_{GD}\bar{r}_D}{p_{GD}r - I} = F_u^D(r)$. Since both banks randomize over the full support of their distribution functions, they cannot profitably deviate from their mixed strategies. Therefore, the distributions above represent the unique equilibrium of the bidding game for a given borrower. Observe that $F_i^{GD}(R^-) = 1 - \frac{N_{BD}(I - p_{BD}R)}{N_{GN}(p_{GD}R - I)} < 1$, so that there is a point mass at R. Moreover, $F_u^D(R) = \varphi F_i^{GD}(R) < 1$, so that the uninformed does not bid with probability $1 - F_u^D(R)$ whenever $\varphi > \bar{\varphi}$.

Proof of proposition 2.2 Indeed, the incumbent lends to group N and GD and earns , so the incumbent bank's *total* profits can therefore be written as the sum of

two terms:

$$\pi_{share} = N_N(p_N\bar{r}_N - I) + N_{GD}(p_{GD}\bar{r}_D - I)$$

However, the first term is 0 since, hard information sharing has leveled the playing field. Gross profits are now given by

$$N_{GD}(p_{GD}\bar{r}_D - I) = \lambda\varphi p(1-p)\frac{\lambda(1-p)+1-\lambda}{\lambda p(1-p)} - (\lambda\varphi(1-p) + (1-\lambda)(1-\varphi))$$
$$= (2\varphi - 1)(1 - \lambda)$$

Thus gross profits are linearly increasing in φ. Net profits can be obtained by subtracting the cost of monitoring $c(\varphi - \frac{1}{2})^2$.

For $\varphi < \bar{\varphi}$ the analysis follows similar steps, remembering that the worst type yields 0 profits since the bank bids pure strategy break-even rate. For the proof of the uninformed bank's zero profits, see von Thadden (2004) or Hauswald and Marquez (2000).

Proof of Proposition 2.3 The construction of the common support is similar to the one in 2.1, with a change in lower bound, $[\bar{r}, \bar{r}_{BD} \wedge R)$, since the uninformed breaks even by solving $\underline{r}\lambda p - I$.

As before, the informed bank bids different rates for $J = BD, GD, D$, while the uninformed bids $F_u(r)$ for any borrower, since it does not distinguish any types. It is clear, that as in the case with information sharing, the informed bank will bid $\bar{r}_{BD}$ for bad signal defaulting borrowers whenever $\varphi < \bar{\varphi}$, and will not bid otherwise. In equilibrium, the informed bank starts bidding at $\bar{r}$ for the N. It can bid up until the average break-even rate for the two other groups, that have lower quality, the BD and GD groups. The average break-even rate for these two groups is $\bar{r}_D$. For GD it starts bidding at $\bar{r}_D$, up until $\bar{r}_{BD} \wedge R$. To see that this is an equilibrium, let's suppose it's not, and that the informed bank bids in $[\bar{r}_N, x]$, $x in [\bar{r}_N, \bar{r}_{BD} \wedge R)$, and in $[y, \bar{r}_{BD} \wedge R)$, $y in [\bar{r}_N, \bar{r}_{BD} \wedge R)$ for GD. We show first that there can be no equilibrium with $y \neq x$

When $x < y \leq \bar{r}_D$, then the informed can increase profits by increasing x, without fear of undercutting by the uninformed. If $y < x \geq \bar{r}_D$, the informed can increase profits by increasing y. If $y > x \geq \bar{r}_D$ the uninformed can just undercut below y to get all defaulting borrowers without loss. the uninformed can undercut and get positive profits. If $x > y \geq \bar{r}_D$, then the uninformed can undercut x profitably. If $x > \bar{r}_D > y$, the informed can increase profit by increasing y. If $y > \bar{r}_D > x$ the uninformed can undercut profitably.

Thus, any equilibrium has to entail $y = x$. Moreover, if $y = x > \bar{r}_D$, the uninformed will undercut, and $y = x < \bar{r}_D$, the informed can increase profits. Therefore, $y = x = \bar{r}_D$. For the informed bank, there are two sources of rents

$$\pi_{noshare}^N = N_N(p_N r - I)(1 - F_u(r))$$

which are constant across all r on $[\bar{r}, \bar{r}_D]$ and

$$\pi^{GD}_{noshare} = N_{GD}(p_{GD}r - I)(1 - F_u(r))$$

for every r on $[\bar{r}_D, \bar{r}_{BD} \wedge R)$. BD group yield 0 profits when offered break even, or do not get an offer.

From the first one, plugging in $\bar{r}$ we get

$$F_u(r) = 1 - \frac{p_N\bar{r} - I}{p_N r - I} = \frac{\lambda pr - I}{\lambda(pr - I)}$$

. From the second one

$$\pi^{GD}_{noshare}(\bar{r}_D) = N_{GD}(p_{GD}\bar{r}_D - I)(1 - F_u(\bar{r}_D)) = N_{GD}(p_{GD}\bar{r}_D - I)\frac{p_N\bar{r} - I}{p_N\bar{r}_D - I}$$

we get

$$F_u(r) = 1 - \frac{p_N\bar{r} - I}{p_N\bar{r}_D - I}\frac{p_{GD}\bar{r}_D - I}{p_{GD}r - I} = 1 - \frac{\frac{1}{\lambda} - I}{\frac{\lambda(1-p) + (1-\lambda)}{\lambda(1-p)} - I}\frac{p_{GD}\bar{r}_D - I}{p_{GD}r - I} = 1 - (1 - p)\frac{p_{GD}\bar{r}_D - I}{p_{GD}r - I},$$

$$\pi_u(\bar{r}) = 0 = N_N(p_N r - I)(1 - F_i^N(r)) + N_{GD}(p_{GD}r - I)(1 - F_i^{GD}(r)) + \\ + N_{BD}(p_{BD}r - I)(1 - F_i^{BD}(r)).$$

To get the expression for $F_i^N(r)$, note that $F_i^{GD}(r), F_i^{BD}(r)$ are equal to 0 in $[\bar{r}, \bar{r}_D]$. Thus, in equilibrium, the incumbent bank's strategy for N is characterized by the following cumulative density function:

$$F_i^{GN}(r) = 1 + \frac{N_{BD}(p_{BD}r - I) + N_{GD}(p_{GD}r - I)}{N_{GN}(p_{GN}r - I)} = \frac{\lambda pr - I}{\lambda p(pr - I)}$$

over the $[\bar{r}, \bar{r}_D]$.

Similarly, for non-defaulting borrowers we have

$$F_i^{GD}(r) = 1 + \frac{N_{BD}(p_{BD}r - I)}{N_{GD}(p_{GD}r - I)}$$

Proof of Proposition 2.4

Under information sharing

For the informed bank, GD group is the only source for informational rents

$$\pi^{GD}_{noshare} = N_{GD}(p_{GD}r - I)(1 - F_u(r)) = N_{GD}(p_{GD}\bar{r}_D - I) = I(1 - \lambda)(2\varphi - 1)$$

Under no information sharing.

For the informed bank, there are two sources of informational rents

$$\pi_{noshare} = N_N(p_N r - I)(1 - F_u(r)) = N_N(p_N \bar{r}_N - I) = Ip(1 - \lambda)$$

on $[\bar{r}, \bar{r}_D]$ and

$$\pi_{noshare}^{GD} = N_{GD}(p_{GD} r - I)(1 - F_u(r))$$

Total informational rents therefore are

$$
\begin{aligned}
\pi_{noshare}^N &= N_N(p_N \bar{r}_N - I) + N_{GD}(p_{GD}\bar{r}_D - I)(1 - F_u(\bar{r}_D)) \\
&= N_{GD}(p_{GD}\bar{r}_D - I)(1 - F_u(\bar{r}_D)) = N_{GD}(p_{GD}\bar{r}_D - I)\frac{p_N \bar{r} - I}{p_N \bar{r}_D - I} \\
&= Ip(1 - \lambda) + I(1 - p)(1 - \lambda)(2\varphi - 1)
\end{aligned}
$$

Proof of Proposition 2.5

$$\pi_{noshare}^{GD} - c(\varphi - 0.5)^2 = I(1 - \lambda)(2\varphi - 1) - c(\varphi - 0.5)^2$$

$$\varphi_{share}^* = 0.5 + \frac{I}{c}(1 - \lambda)$$

$$\pi_{noshare}^N - c(\varphi - 0.5)^2 = Ip(1 - \lambda) + I(1 - p)(1 - \lambda)(2\varphi - 1) - c(\varphi - 0.5)^2 =$$

$$\varphi_{noshare}^* = 0.5 + \frac{I}{c}(1 - \lambda)(1 - p) \le \varphi_{share}^* = 0.5 + \frac{I}{c}(1 - \lambda)$$

Proof of Proposition 2.8

Let $F^J(r)$ denote the c.d.f. of the paid rate for a borrower of $J = GD, N, BD$- the minimum of the two rates.

Under information sharing,

$$F^{GD}(r) = 1 - (1 - F_i^{GD}(r))(1 - F_u^D(r)) = F_i^{GD}(r) + F_u^D(r) - F_i^{GD}(r)F_u^D(r),$$

$$F^N(r) = \bar{r}_N = F_i^N(r) = F_u^N(r)$$

Under no information sharing,

$$F^{GD}(r) = 1 - (1 - F_i^{GD}(r))(1 - F_u(r)) = F_i^{GD}(r) + F_u(r) - F_i^{GD}(r)F_u(r),$$

$$F^N(r) = 1 - (1 - F_i^N(r))(1 - F_u(r)) = F_i^{GD}(r) + F_u^D(r) - F_i^{GD}(r)F_u(r).$$

Finally, $F^{BD}(r) = min\{\bar{r}_{BD}, F_u(r)\}$ or $F^{BD}(r) = min\{\bar{r}_{BD}, F_u^D(r)\}$ under information sharing.

Under information sharing, observe above $F_i^N(r) = F_u^N(r) = \bar{r}_N$ and thus does not depend on φ.

For the informed bank

$$F_i^{GD}(r) = 1 + \frac{N_{BD}(p_{BD}r - I)}{N_{GD}(p_{GD}r - I)} = \frac{\lambda p(1-p)r - \left(\lambda(1-p) + (1-\lambda)\right)}{\lambda\varphi p(1-p)r - \left(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\right)}$$

$$\frac{\partial F_i^{GD}(r)}{\partial \varphi} = \frac{-\left(\lambda p(1-p)r - \left(\lambda(1-p) + (1-\lambda)\right)\right)\left(\lambda p(1-p)r - \left(\lambda(1-p) - (1-\lambda)\right)\right)}{\left(\lambda\varphi p(1-p)r - \left(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\right)\right)^2}$$

So,

$$\frac{\partial F_i^{GD}(r)}{\partial \varphi} = \frac{-\left(\lambda^2(1-p)^2(pr-1)^2 - (1-\lambda)^2\right)}{\left(\lambda\varphi p(1-p)r - \left(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\right)\right)^2} \leq 0$$

which is true because $r \in [\bar{r}_D, R \wedge \bar{BD}$, so that $r > \bar{r}_D$, which implies $pr > \frac{1-\lambda+\lambda(1-p)}{\lambda(1-p)}$, which in turn implies $(pr-1)^2 > \frac{(1-\lambda)^2}{\lambda^2(1-p)^2}$.

For the uninformed bank

$$F_u^D(r) = \varphi F_i^{GD}(r)$$

From the above

$$\frac{\partial F_i^{GD}(r)}{\partial \varphi} = \frac{-\left(\lambda p(1-p)r - \left(\lambda(1-p) + (1-\lambda)\right)\right)\left(\lambda p(1-p)r - \left(\lambda(1-p) - (1-\lambda)\right)\right)}{\left(\lambda\varphi p(1-p)r - \left(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\right)\right)^2} =$$

$$- F_i^{GD}(r)\frac{\left(\lambda p(1-p)r - \left(\lambda(1-p) - (1-\lambda)\right)\right)}{\lambda\varphi p(1-p)r - \left(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\right)} \leq 0$$

So

$$\frac{\partial F_u^D(r)}{\partial \varphi} = - \varphi F_i^{GD}(r)\frac{\lambda p(1-p)r - \left(\lambda(1-p) - (1-\lambda)\right)}{\lambda\varphi p(1-p)r - \left(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\right)} + F_i^{GD}(r) =$$

$$\frac{-F_i^{GD}(r)(1-\lambda)}{\lambda\varphi p(1-p)r - \left(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\right)}$$

Therefore,

$$\frac{\partial F(r)}{\partial \varphi} = \frac{\partial F_i(r)}{\partial \varphi} + \frac{\partial F_u(r)}{\partial \varphi} - \frac{\partial F_i(r)}{\partial \varphi} F_u(r) - F_i(r)\frac{\partial F_u(r)}{\partial \varphi} \leq 0$$

Finally, remember that

$$\frac{\partial \bar{r}_{BD}}{\partial \varphi} = \frac{(1 - 2\varphi)\lambda(1-\lambda)p(1-p)}{\left(\lambda(1-\varphi)p(1-p)\right)^2} \geq 0$$

Thus, minimum interest rates for the BD is non-decreasing, too.

Under no information sharing
$F_i^N(r) = \frac{\lambda pr - I}{\lambda p(pr - I)}$, and is independent of φ. $F_i^{GD}(r)$ is the same as above.

$F_u = pF_i^N$ on $[\bar{r}, \bar{r}_D]$, and so does not depend on φ.

$F_u^D(r) = p + (1-p)\varphi F_i^{GD}(r)$ on $[\bar{r}_D, \bar{r}_{BD} \wedge R]$ and so is non-increasing from the above.

Proof for group BD is analogous to information sharing case.

Proof of Proposition 2.9

$$E[r] = \int_{\bar{r}}^{R} \left(1 - F(r)\right) + \bar{r}$$

and is increasing in φ because $\left(1 - F(r)\right)$ is increasing in it too.

Proof of Proposition 2.10
1. This follows directly from proposition 2.1 and 2.3
2. For non-defaulting borrowers, trivially, both banks bid break even rates $\bar{r}_N$ under information sharing: this is lower than any other rate on the supports in the two regimes.
3. For defaulting borrowers, *The informed bank:* a)Bad signal defaulting borrowers, either do not get credit from the incumbent ($\varphi > \bar{\varphi}$), or receive rate $\bar{r}_{BD} = \frac{\lambda(1-\varphi)(1-p)+(1-\lambda)\varphi}{\lambda(1-\varphi)p(1-p)}$ ($\varphi \leq \bar{\varphi}$). In the latter case, remember that $\frac{\partial \bar{r}_{BD}}{\partial \varphi} \geq 0$
b) Good signal defaulting borrowers have the c.d.f, which, by proposition 2.8 implies (weakly) higher rates under information sharing:

$$F_i^{GD}(r, \varphi^{share}) \leq F_i^{GD}(r, \varphi^{noshare})$$

The uninformed bank bids $p + (1-p)\varphi_{noshare}F_i^{GD}(r, \varphi_{noshare}$ on $[\bar{r}_D, \bar{r}_{BD} \wedge R]$

under no information sharing. The result now follows from the fact that φF_i^{GD} is non increasing in φ so that $p+(1-p)\varphi_{noshare}F_i^{GD}(r,\varphi_{noshare}) > \varphi_{noshare}F_i^{GD}(r,\varphi_{noshare}) > \varphi_{share}F_i^{GD}(r,\varphi_{share})$.

4. Overall, from proposition 2.3 and 2.1, probabilities of not-bidding relate as follows

$$1 - F_u(R,\varphi^{share}) \geq 1 - F_u(R,\varphi^{noshare}) > (1-p)(1 - F_u(R,\varphi^{noshare}))$$

where $F_u(R) = 1 - \frac{p_{GD}\bar{r}_D - I}{p_{GD}R - I}$. Thus, while all other borrowers receive at least one offer and accept one, we still have that a bad defaulting borrower is rejected by the incumbent ($\varphi > \bar{\varphi}$), and faces lower chances of receiving any credit from the outside as well under information sharing. Given that banks' overall profits are 0, this is a transfer to the creditworthy borrowers.

Proof of Proposition 2.11

$$Pr(switch) = 1 - Pr(stay)$$

Borrowers stay with probability 1 when the uninformed bank bids strictly higher, and with probability 0.5 when rates are equal. For all mixed strategy cases with general strategy pair $F_u(r)$ and $F_i(r)$ on $[\underline{r},\bar{r}]$

$$Pr(switch) = 1 - \int_{\underline{r}}^{\bar{r}} (1 - F_u(r))dF_i(r)$$

as long as bidding equal rates has measure 0. For the case with pure strategy bidding $\bar{r}_N$ for group N under information sharing, $Pr(switch) = 0.5$. Thus,

$Pr(switch) =$	Sharing	No Sharing
Group N	Both bid equal rates $\bar{r}_N => \frac{1}{2}$	$1 - \int_{\bar{r}}^{\bar{r}_D}(1 - pF_i^N)dF_i$ $= p(|F_i^2 + \int_{\bar{r}}^{\bar{r}_D} F_i^N dF_i^N)$ $= p - \frac{1}{2}p = \frac{1}{2}p$
Group GD	$1 - \int_{\bar{r}_D}^{R}(1 - F_u^D)dF_i^{GD} = 1 - 1$ $+\varphi \int_{\bar{r}_D}^{R} F_i^{GD} dF_i^{GD} = \frac{1}{2}\varphi$	$1 - \int_{\bar{r}}^{\bar{r}_D}(1 - F_u)dF_i^{GD} = 1 -$ $\int_{\bar{r}}^{\bar{r}_D}(1-p)(1 - \varphi F_i^{GD})dF_i^{GD}$ $= p + \frac{1}{2}(1-p)\varphi$
Group BD	$\varphi > \bar{\varphi}$, the informed doesn't bid	$\varphi > \bar{\varphi}$, the informed doesn't bid.

$\varphi \leq \bar{\varphi}$, from proposition 2.1 it follows that the uninformed bank bids less than $\bar{r}_{BD}$ with probability φ_{share} under information sharing, so borrowers are switching $\frac{1}{2}(1 - \varphi_{share}) + \varphi_{share}$. Similarly, under no information sharing and from proposition 2.3, switching probability will be given by $p+(1-p)\varphi_{noshare}+\frac{1}{2}(1-p)(1-\varphi_{noshare}) = p + \frac{1}{2}(1-p)(1+\varphi)$

7 Appendix B

7.1 Dependent Variables

Source: BEEPS 2002 survey, except where other source is mentioned.

Switch. Definition: Dummy variable that takes value 1 if the firm has answered "yes" to the question in the survey, "Has your firm changed its main bank (the single bank with which your firm has the closest relationship) since 1998?" Possible answers include "yes", "no", "no main bank". 8 percent of the firms report that they have no main bank. We exclude those firms, this leaves us with a sample of 5209 firms.

React. Definition based on answer to the question: "Now I would like to ask you a hypothetical question. If your firm were to fall behind in its bank repayments, which of the following would best describe how you would expect the bank to react?" Possible answers include: 1. Extend the term of the loan without changing the conditions(=3) 2. Extend the term of the loan but increase the interest rate (=2) 3. Begin legal proceedings to take possession of some assets of the firm(=1).

Days. Definition:"How many days did it take to agree the loan with the bank from the date of application?" The mean is 25 while standard deviation is 37. The output is the robust OLS measure (we also do Poisson regressions, where we have high significance in all columns).

Checking Account. Definition: Dummy variable that takes value 1 if the firm has answered "yes" to the question in the survey,"Does your establishment have a checking or saving account".(source BEEPS 2005)

Ccost. Definition: Ccost is cost of finance; higher values indicate higher cost of financing. It equals 4, if cost of finance is reported to be of no obstacle, 3=moderate obstacle, 2= Minor obstacle, 1=No obstacle.

7.2 Firm Level

Source: BEEPS 2002 survey.

Soft signal (1). *Soft Signal (1)* measures how protected the borrower is from different *non-financial* factors. It summarizes answers to 19 questions on non financial problems of growth. The exact question in the survey asks: *Can you tell me how problematic are these factors for the operation and growth of your business?*. The factors include skills of workers, their education, contract violations by customers and suppliers, among others. Each of the questions is answered on a scale from 1-to 4, where higher values

stand for less obstacles (4=no obstacle, 1=major obstacle). We take the sum of the 19 questions, and divide by 4*19. Thus, the variable ranges from 0.25 to 1, where a value of 1 indicates that the received soft signals about the quality of the borrower, have all been good/favorable (19 answers "no obstacle"). We then take 1 - the value of the variable, so that higher values mean less problems.

Soft Signal (2). *Soft Signal 2* is a proxy of the management quality. It adds: 1 point if the manager has prior experience in the company, 1 point if the manager is older than 40, 1 point if the manager has higher education.

Small firm. Definition: Dummy Variable that takes value 1 if total number of full-time employees is less then 50. Source: s4a2.

Large firm. Definition: Sample of firms that are not small. Source: s4a2.

Transition firm. Definition: Firm was established in the years 19891993. Source: s1a.

Post-transition firm. Definition: Firm was established after 1993. Source: s1a.

State-owned firm. Definition: State controlled firm (yes/no). Source: s2b.

Sector. Definition: Mining, Construction, Manufacturing transport and communication, Wholesale, retail and repairs, Real estate, renting and business service, Hotels and restaurants, Others. Source: q2.

7.3 Country Level

Source: Brown et al. (2009).

Hard Information. For each year between 1996 and 1999 the index is computed for private credit bureaus and one for public credit registers (Brown et al. 2009): 1 point if it exists for more than 3 years; 1 point if individuals and firms are covered; 1 point if positive and negative data are collected; 1 point if PCR/PCB distributes data which is at least 2 years old; 1 point if threshold loan is below per capita GDP. We then take the maximum of the index for credit bureaus and public credit registers. We use 19961999 values for the 2002 BEEPS.

The private credit bureau coverage indicator is used for year 2005 (only available at 2005, source IFC). It reports the percentage of individuals and firms listed by a private credit bureau with information on repayment history, unpaid debts or credit

outstanding from the past 5 years. The number is expressed as a percentage of the adult population (the population aged 15 and above in 2009 according to the World Banks World Development Indicators).

Creditor rights. We take the score from brown et al. (2009). A score of one is assigned when each of the following rights of secured lenders are defined in laws and regulations. First, there are restrictions, such as creditor consent or minimum dividends, for a debtor to file for reorganization. Second, secured creditors are able to seize their collateral after the reorganization petition is approved. Third, secured creditors are paid first out of the proceeds of liquidating a bankrupt firm. Fourth, if management does not retain administration of its property pending the resolution of the reorganization. We use 19962000 values for the 2002 BEEPS, and 20012003 value for the 2005 BEEPS.

Time to enforce payment. Definition: The time taken to resolve a dispute in which a debtor defaults on a payment equal to 50% of a countrys per capita GDP. The indicator measures the (log of the) number of days from the moment the plaintiff files the lawsuit in court until the moment of actual payment. We use 2005 value for both surveys, because earlier values are not available.

Foreign bank assets. Definition: The share of banking sector assets controlled by banks with a majority (at least 50%) foreign ownership. We use 19962000 values for the 2002 BEEPS, and 20012003 value for the 2005 BEEPS.

Av. GDP. Definition: Log of per capita GDP in thousands of US dollars. We use 19962000 values for the 2002 BEEPS, and 20012003 value for the 2005 BEEPS.

Inflation. Definition: average annual growth rate of consumer price index (CPI). We use 19962000 values for the 2002 BEEPS, and 20012003 value for the 2005 BEEPS.

Bank concentration. The fraction of deposits held by the five largest banks: Source Barth et al 2001.

NPL. Share of non-performing loans in total loans: Source, EBRD transition Report.

Bank reform index. A score of 1 represents little change from a socialist banking system apart from the separation of the central bank and commercial banks, while a score of 2 means that a country has established internal currency convertibility and has liberalized significantly both interest rates and credit allocation. A score of 3 means that a country has achieved substantial progress in developing the capacity for effective prudential regulation and supervision, including procedures for the resolution of bank

insolvencies, and in establishing hardened budget constraints on banks by eliminating preferential access to concessionary refinancing from the central bank. A score of 4+ represents a level of reform that approximates the institutional standards and norms of an industrialized market economy. Source, EBRD transition Report.

Private credit. Credit to the private sector as a share of the GDP, taken from the EBRD transition report.

Table 1: Means of key variables by country.

Detailed explanations of variables are given in the Variables Section of the Appendix. *No Switching* is a binary indicator of not having changed the main bank since 1998. *Days* is number of days the bank needed to approve the last loan of the borrower. *React* is an ordinal score, higher values indicate more lenient reaction by the bank to a sudden non-payment by the borrower. *Ccost* is capital cost, checking is an indicator for having a checking account. *Soft signal* is a score indicating soft information about non-financial problems of growth.

| country | Mean | | | | | |
	No Switching	Days	React	Ccost	Checking	Soft Signal
Albania	0.74	53.94	3.02	2.59	0.96	8.29
Armenia	0.78	24.91	2.90	2.52	0.79	11.29
Azerbaijan	0.74	21.66	2.17	2.20	0.82	12.90
Belarus	0.74	18.91	2.92	2.78	0.84	9.75
Bosnia	0.72	36.75	3.00	2.79	0.07	10.01
Bulgaria	0.70	43.69	2.97	2.88	0.93	10.17
Croatia	0.71	38.39	2.70	2.27	0.21	11.16
Czech Rep	0.88	43.22	3.03	2.53	0.99	10.68
Estonia	0.93	12.63	2.27	2.01	0.97	11.05
Georgia	0.64	23.88	2.90	2.53	0.66	9.57
Hungary	0.80	27.96	2.87	2.31	0.99	11.76
Kazakhstan	0.77	21.18	2.64	2.16	0.88	11.99
Kyrgyzstan	0.58	13.78	2.67	2.40	0.82	11.15
Latvia	0.80	17.95	2.45	2.01	0.97	10.86
Lithuania	0.77	23.63	2.54	1.99	0.99	10.61
Macedonia	0.77	33.21	2.53	2.38	0.10	10.77
Moldova	0.87	13.16	2.71	2.95	0.65	9.15
Poland	0.76	24.46	2.56	3.17	0.93	9.02
Romania	0.74	21.36	3.04	2.80	0.98	9.63
Russia	0.68	14.94	2.55	2.24	0.92	10.59
Serbia	0.56	14.30	2.67	2.78	0.09	10.43
Slovak Rep	0.75	63.22	2.95	2.58	0.99	10.04
Slovenia	0.66	24.85	2.77	2.20	1.00	12.22
Ukraine	0.69	14.79	2.77	2.62	0.94	10.08
Total	0.74	25.61	2.31	2.53	0.82	10.46

Source: BEEPS 2002, except variable checking which is BEEPS 2005.

Table 2: Means of Macro-level variables by country

Hard Information is an information sharing index (Brown et al. 2009), 1996-2000: the index adds 1 point if PCR/PB exists for more than 3 years; 1 point if individuals and firms are covered; 1 point if positive and negative data are collected; 1 point if PCR/PCB distributes data which is at least 2 years old; 1 point if threshold loan is below per capita GDP. *Foreign Bank* is the share of banking sector assets controlled by banks with a majority foreign ownership, taken over 1996-2000 (Brown et al. 2009), *Av. GDP* is the average per capita GDP during 1996-2000, *Creditor rights* is the creditor rights index based on Brown et al. (2009), *CR* is the banking concentration ratio taken from -asset share of the largest five banks, and *NPL* is the share of non-performing loans in total loans.

country	Mean						
	Hard Information	Foreign Bank	Av. GDP	Inflation	Creditor Rights	CR	NPL
Albania	0.00	27.10	1.20	0.10	3.00	86.70	3.75
Armenia	0.00	44.90	0.60	-0.80	2.00	54.60	1.97
Azerbaijan	0.00	4.40	0.60	1.80	3.00	71.90	2.67
Belarus	0.00	3.60	0.80	168.60	2.00	81.10	2.72
Bosnia	0.00	12.70	1.20	1.90	3.00	56.00	2.63
Bulgaria	0.80	59.10	1.60	10.30	1.50	56.50	2.39
Croatia	0.00	62.20	4.20	5.30	3.00	66.50	2.99
Czech Rep	0.00	51.90	5.50	3.90	3.00	69.00	3.68
Estonia	4.00	93.60	4.00	4.00	3.00	98.90	0.26
Georgia	0.00	16.80	0.70	4.10	2.00	57.30	1.97
Hungary	3.80	64.50	4.50	9.80	1.00	62.50	1.13
Kazakhstan	3.60	19.80	1.20	18.70	3.00	70.20	0.74
Kyrgyzstan	0.00	20.60	0.30	13.20	3.00	51.40	2.79
Latvia	0.00	74.20	3.20	2.70	3.00	66.20	1.61
Lithuania	4.60	45.90	3.30	1.00	2.00	87.90	2.38
Macedonia	2.00	32.50	1.80	6.60	3.00	72.10	3.84
Moldova	0.00	37.10	0.30	31.30	2.00	71.00	3.03
Poland	0.00	61.00	4.50	10.10	1.00	57.40	2.82
Romania	0.60	45.20	1.40	45.70	2.00	65.20	1.34
Russia	0.00	10.10	1.80	20.80	1.00	42.80	2.78
Serbia	0.00	0.50	1.00	8.80	3.00	42.40	3.33
Slovak Rep	1.20	33.40	3.70	60.40	2.00	66.50	3.27
Slovenia	2.80	10.10	9.50	12.00	2.00	69.00	2.23
Ukraine	0.00	10.80	0.60	28.20	2.00	37.00	3.48
Total	0.85	33.95	2.42	21.05	2.14	61.83	2.55

Source: BEEPS 2002.

Table 3: Cross-section estimation results: *Days*.

Dependent variable is the *days* from time of loan application until it is approved. *Hard information* is an information sharing index showing whether and how intensely information sharing has been established in a country (Brown et al. 2009). The first row is the total sample, the second and third rows are the sample for *small* and *large* firms, respectively. Standard errors are adjusted for cluster effects at the country level. Sector dummies not reported. Stars *, **, ***, indicate significance at 10, 5, 1 % respectively.

variable	(1) All	(2) Small	(3) Large
hard information	3.523**	4.065***	1.689
	(1.489)	(1.280)	(3.079)
post transition firm	-2.223	-1.350	-4.737
	(1.654)	(2.690)	(3.573)
transition firm	0.785	2.774	-5.983
	(2.384)	(3.284)	(4.680)
state owned firm	-0.003	0.015	-0.028
	(0.040)	(0.043)	(0.068)
concentration	-0.215	-0.217	-0.200
	(0.153)	(0.131)	(0.300)
non performing loan	0.271*	0.238*	0.387
	(0.142)	(0.134)	(0.230)
creditor rights	-6.405**	-8.881***	4.420
	(2.886)	(2.631)	(5.595)
bank reform index	-1.426	-0.368	-10.334
	(5.685)	(5.539)	(8.958)
foreign bank share	0.381***	0.366***	0.498*
	(0.131)	(0.112)	(0.240)
private credit	0.359	0.434*	0.172
	(0.291)	(0.217)	(0.567)
collateral law	-9.769***	-10.919***	-4.040
	(2.143)	(1.930)	(4.199)
GDP per capita	-4.791	-6.887*	3.723
	(3.355)	(3.512)	(5.209)
inflation	-7.093	-8.524*	-1.817
	(4.967)	(4.130)	(10.479)
constant	58.278***	69.129***	46.353
	(11.695)	(11.282)	(27.195)
R-squared	0.12	0.10	0.22
Number of obs.	2064	1638	426

Table 4: Cross-section estimation results: *React.*

React shows banks' reaction as perceived by borrowers. It is based on the hypothetical question, "If your firm were to fall behind in its bank repayments, which of the following would best describe how you would expect the bank to react?" Possible answers include: a) Extend the term of the loan without changing the conditions(=3) b) Extend the term of the loan but increase the interest rate (=2) c) Begin legal proceedings to take possession of some assets of the firm(=1). Regressions are ordered probit. *Hard information* is an information sharing index showing whether and how intensely hard information sharing has been established in a country (Brown et al. 2009). The first row is the total sample, the second row is the sample for small firms, the third one is the sample for large firms. Standard errors are adjusted for cluster effects at the country level. Sector dummies not reported. Stars *, **, ***, indicate significance at 10, 5, 1 % respectively.

variable	(1) All	(2) Small	(3) Large
hard information	0.102***	0.120***	0.030
	(0.039)	(0.044)	(0.056)
post transition firm	-0.167*	-0.217**	0.092
	(0.089)	(0.105)	(0.141)
transition firm	-0.106	-0.111	-0.169
	(0.091)	(0.107)	(0.173)
state owned firm	0.000	-0.001	0.002
	(0.001)	(0.001)	(0.002)
concentration	-0.003	-0.004	0.002
	(0.004)	(0.005)	(0.005)
non performing loan	-0.003	-0.002	-0.009
	(0.005)	(0.005)	(0.006)
creditor rights	-0.056	-0.082	0.036
	(0.067)	(0.074)	(0.081)
bank reform index	-0.692***	-0.629***	-0.896***
	(0.175)	(0.194)	(0.231)
foreign bank share	0.013***	0.013***	0.009
	(0.003)	(0.003)	(0.005)
private credit	0.013	0.011	0.022*
	(0.010)	(0.011)	(0.013)
GDP per capita	0.067	0.040	0.175
	(0.089)	(0.113)	(0.166)
inflation	-0.481***	-0.348**	-1.022***
	(0.160)	(0.173)	(0.225)
constant	-2.433***	-2.444***	-3.023***
	(0.262)	(0.283)	(0.789)
constant	-1.334***	-1.365***	-1.787**
	(0.282)	(0.286)	(0.791)
constant	0.075	-0.000	-0.179
	0.075	-0.000	-0.179
Pseudo R-Squared	0.04	0.03	0.08
Number of obs.	1937	1511	426

Table 5: Cross-section estimation results: *Checking account.*

Checking account indicates the existence of checking account for the borrower. *Hard information* shows the percentage of individuals and firms covered by information sharing institutions taken from IFC Doing business data. The first row is the total sample, the second row is the sample for small firms, the third one is the sample for large firms. All columns are based on probit estimation. Standard errors are adjusted for cluster effects at the country level. Sector dummies not reported. Stars *, **, ***, indicate significance at 10, 5, 1 %, respectively.

variable	(1)	(2)	(3)
	All	Small	Large
hard information	1.106***	1.121***	1.068***
	(0.231)	(0.257)	(0.245)
post transition firm	-0.068	0.001	-0.015
	(0.056)	(0.067)	(0.103)
transition firm	0.103	0.145	0.156
	(0.078)	(0.100)	(0.097)
state owned firm	0.001	0.000	-0.002
	(0.001)	(0.002)	(0.002)
concentration	-0.003	-0.002	-0.008
	(0.010)	(0.010)	(0.009)
non performing loan	-0.111***	-0.108***	-0.122***
	(0.019)	(0.020)	(0.021)
creditor rights	-0.228	-0.222	-0.143
	(0.207)	(0.213)	(0.245)
bank reform index	2.403***	2.211***	3.219***
	(0.525)	(0.570)	(0.453)
foreign bank share	-0.042***	-0.038***	-0.057***
	(0.008)	(0.008)	(0.008)
private credit	-0.059***	-0.054***	-0.087***
	(0.017)	(0.017)	(0.022)
GDP per capita	0.356	0.326	0.576***
	(0.230)	(0.248)	(0.209)
inflation	0.034	0.031	0.038
	(0.028)	(0.028)	(0.033)
constant	-1.222	-1.420	-1.907
	(1.109)	(1.134)	(1.220)
Pseudo Rsquared	0.36	0.33	0.49
Number of obs.	6917	4904	2013

Table 6: Cross-section estimation results: *Switching* from the main bank.

Switching is the dependent variable. It equals 1 if the firm replies "yes" to the following question: *Has your firm changed its main bank (the single bank with which your firm has the closest relationship)?*. Information is an index of shared information (Brown et al. 2009)- it is 0 for countries with no sharing. *Soft signal 1* is a summary measure that proxies the sign of soft information acquired for the firm and shows how protected the firm is from each of the 19 non-financial problems discussed: range [0.21; 1]. *Soft signal 2* is a proxy of management quality (1-3). *Hard information* is an information sharing index showing whether and how intensely information sharing has been established in a country (Brown et al. 2009). Higher values of *soft signal* indicate *good* soft signal. All columns are based on probit estimation. Sector dummies not reported. Standard errors are adjusted for cluster effects at the country level. Stars *, **, ***, indicate significance at 10, 5, 1 %, respectively.

variable	(1) All	(2) Small	(3) Large	(4) All	(5) Small	(6) Large
soft signal (1)	-0.239*	-0.274**	-0.008	-0.249**	-0.289**	0.017
	(0.123)	(0.132)	(0.345)	(0.123)	(0.133)	(0.347)
soft signal (2)				-0.074***	-0.069***	-0.092
				(0.026)	(0.021)	(0.069)
hard information	-0.011	-0.013	-0.010	-0.008	-0.009	-0.015
	(0.025)	(0.028)	(0.067)	(0.026)	(0.028)	(0.067)
hard inform*soft	-0.007	-0.008	-0.002	-0.007	-0.007	-0.004
	(0.006)	(0.006)	(0.016)	(0.006)	(0.006)	(0.016)
post transition firm	-0.161**	-0.165**	-0.076	-0.185***	-0.186**	-0.090
	(0.067)	(0.081)	(0.146)	(0.068)	(0.082)	(0.147)
transition firm	-0.078	-0.097	0.047	-0.081	-0.100	0.071
	(0.075)	(0.088)	(0.170)	(0.075)	(0.089)	(0.172)
state owned firm	-0.001	-0.001	-0.003	-0.001	-0.001	-0.003
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
concentration	-0.008***	-0.009***	-0.007	-0.008***	-0.009***	-0.008
	(0.002)	(0.003)	(0.006)	(0.002)	(0.003)	(0.006)
non performing loan	-0.004	-0.003	-0.005	-0.004	-0.003	-0.004
	(0.002)	(0.003)	(0.007)	(0.002)	(0.003)	(0.007)
creditor rights	-0.011	0.015	-0.145	-0.008	0.018	-0.146
	(0.038)	(0.041)	(0.098)	(0.038)	(0.041)	(0.099)
bank reform index	0.256**	0.258**	0.208	0.242**	0.240*	0.241
	(0.119)	(0.130)	(0.313)	(0.119)	(0.131)	(0.314)
foreign bank share	-0.010***	-0.010***	-0.006	-0.010***	-0.010***	-0.006
	(0.002)	(0.002)	(0.007)	(0.002)	(0.002)	(0.007)
private credit	-0.019***	-0.017***	-0.038***	-0.019***	-0.017***	-0.039***
	(0.005)	(0.006)	(0.014)	(0.005)	(0.006)	(0.014)
GDP per capita	0.143**	0.137**	0.226	0.144**	0.138**	0.230
	(0.062)	(0.067)	(0.167)	(0.062)	(0.067)	(0.167)
inflation	0.079	0.126	-0.143	0.063	0.106	-0.134
	(0.105)	(0.115)	(0.273)	(0.105)	(0.115)	(0.273)
constant	0.061	0.364	1.031	0.729**	0.624	0.323
	(0.284)	(0.419)	(0.785)	(0.359)	(0.432)	(0.937)
Pseudo R2	0.03	0.03	0.06	0.03	0.03	0.07
Number of obs.	3531	2984	547	3490	2945	545

Table 7: Cross-section estimation results: *Cost of capital.*

Soft signal 1 and 2 are summary measures that proxy the sign of soft information. *Hard information* is an information sharing index showing whether and how intensely information sharing has been established in a country (Brown et al. 2009). The first and forth columns are ordered probit regression of the total sample, the second and fifth are for *small* firms, and third and sixth -for *large* firms. Sector dummies not reported. Standard errors are adjusted for cluster effects at the country level. Stars *, **, ***, indicate significance at 1, 5, 10 %, respectively.

variable	(1) All	(2) Small	(3) Large	(4) All	(5) Small	(6) Large
soft signal (1)	-2.771***	-2.818***	-2.595***	-2.775***	-2.827***	-2.576***
	(0.102)	(0.110)	(0.285)	(0.103)	(0.111)	(0.285)
soft signal (2)				-0.040**	-0.040*	0.003
				(0.020)	(0.022)	(0.055)
hard information	-0.107***	-0.104***	-0.097*	-0.106***	-0.102***	-0.098*
	(0.020)	(0.022)	(0.054)	(0.020)	(0.022)	(0.054)
hard inform*soft	0.002	0.002	0.000	0.001	0.001	0.000
	(0.005)	(0.005)	(0.013)	(0.005)	(0.005)	(0.013)
post transition firm	-0.027	-0.074	-0.016	-0.045	-0.093	-0.015
	(0.054)	(0.065)	(0.115)	(0.054)	(0.066)	(0.115)
transition firm	-0.015	-0.036	-0.217	-0.012	-0.033	-0.206
	(0.060)	(0.071)	(0.134)	(0.060)	(0.071)	(0.135)
state owned firm	-0.001	-0.001	-0.002	-0.001	-0.001	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
concentration	-0.007***	-0.007***	-0.010**	-0.007***	-0.007***	-0.010**
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
non performing loan	-0.002	-0.002	-0.000	-0.002	-0.002	-0.000
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
creditor rights	-0.096***	-0.087***	-0.099	-0.092***	-0.082**	-0.102
	(0.030)	(0.032)	(0.078)	(0.030)	(0.032)	(0.078)
bank reform index	0.679***	0.642***	0.769***	0.659***	0.616***	0.774***
	(0.092)	(0.099)	(0.250)	(0.092)	(0.100)	(0.250)
foreign bank share	-0.005***	-0.004**	-0.005	-0.005***	-0.004**	-0.005
	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)
private credit	-0.002	0.000	-0.017	-0.002	0.000	-0.017
	(0.004)	(0.004)	(0.011)	(0.004)	(0.004)	(0.011)
GDP per capita	-0.180***	-0.185***	-0.136	-0.175***	-0.178***	-0.137
	(0.047)	(0.050)	(0.128)	(0.047)	(0.050)	(0.128)
inflation	0.529***	0.449***	1.009***	0.511***	0.425***	1.010***
	(0.081)	(0.089)	(0.214)	(0.081)	(0.089)	(0.214)
constant	-1.912***	-1.924***	-2.030***	-2.093***	-2.170***	-2.012***
	(0.278)	(0.334)	(0.629)	(0.236)	(0.256)	(0.646)
constant	-1.226***	-1.260***	-1.195*	-1.404***	-1.502***	-1.181*
	(0.277)	(0.333)	(0.626)	(0.235)	(0.255)	(0.644)
constant	-0.362	-0.383	-0.348	-0.542**	-0.629**	-0.333
	(0.277)	(0.333)	(0.626)	(0.235)	(0.254)	(0.643)
Pseudo R-squared	0.11	0.11	0.10	0.11	011	0,10
Number of obs.	3643	3102	541	3601	3062	539

Table 8: Panel estimation results: *Cost of capital.*

Soft signal 1 and 2 are summary measures that proxy the sign of soft information. *Hard information* is an information sharing index showing whether and how intensely information sharing has been established in a country (Brown et al. 2009).The first column is the fixed effects regression of the total sample, the second column is random effects estimation. The third one takes only small firms (Fixed effects), while the forth one takes large and medium firms (fixed effects). All estimations are ordered probit. Sector dummies not reported. Standard errors are adjusted for cluster effects at the country level. Stars *, **, ***, indicate significance, at 1, 5, 10 %, respectively.

variable	(1) All(FE)	(2) All (RE)	(3) Small(FE)	(4) Large(FE)
soft signal	-2.051***	-2.573***	-2.162***	-1.999***
	(0.232)	(0.075)	(0.290)	(0.458)
hard information	-0.114*	-0.062***	-0.167**	-0.023
	(0.061)	(0.011)	(0.078)	(0.124)
bank reform index	0.359	0.038	0.141	0.495
	(0.256)	(0.045)	(0.342)	(0.461)
foreign bank share	-1.537**	0.072	-0.468	-2.601**
	(0.713)	(0.092)	(0.953)	(1.286)
private credit	-0.023**	0.005*	-0.012	-0.029*
	(0.009)	(0.003)	(0.013)	(0.017)
GDP per capita	1.373***	-0.058*	1.117*	1.035
	(0.483)	(0.032)	(0.635)	(0.960)
inflation	0.001	0.001***	0.000	0.001
	(0.001)	(0.000)	(0.001)	(0.002)
constant	3.129***	4.209***	3.434***	3.404***
	(0.556)	(0.090)	(0.752)	(0.928)
R-squared	0.153	0.134	0.163	0.148
Number of obs.	4626	4626	3082	1544