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 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. This can result in more accurate lending decisions, higher welfare, and favor informationally opaque borrowers. We test our theory using a large sample of firm-level data from 24 countries.

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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 about their potential borrowers, thus 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 bank 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 the first period, 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 among 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 outside, 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", and therefore cannot be communicated in a verifiable way. Monitoring is costly, but it can potentially provide further rents for the bank, as it increases the asymmetric information problem faced by the outside bank. For second-period lending, the incumbent bank differentiates borrowers based on two sources of information: hard information - default or success of its borrowers, and soft information - good or bad signal.

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 with the successful ones from the outside bank's point of view. This means they sometimes receive relatively low 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

[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.

soft information is higher when hard information is shared.

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 can 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 well-founded. Supporting the establishment of information sharing arrangements can be a good idea.

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 suggest that information acquisition is higher in countries that have set up information sharing arrangements.

We use two main proxies to measure banks' investment in soft information. First, we use the time that banks spend to approve a loan application. Arguably, obtaining more information about borrowers requires more time. As a second measure, we utilize banks' reaction to a borrower's failure to repay. A more lenient reaction on the banks' side shows a stronger relationship and less conditioning on hard information.

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

Our paper 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 (2010)). 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. (2011)). 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), Bouckaert 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), Petersen (2004), Berger et al. (2005), Degryse and Ongena (2005), Hertzberg et al. (2010)). Agarwal and Hauswald (2010) 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 widely used and they cater for their own distinct groups of customers (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.

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]

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

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. At the same time, if outside access to the same (hard) information improves, that will erode the inside bank's rents and its incentives to invest. In contrast, we focus on two types

[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.

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 I presents a model of banking competition and information acquisition. We first derive the equilibrium of the banking competition with and without information sharing. We then look at interest rates, switching and welfare. Section II provides empirical evidence, and section III concludes. Proofs are mostly relegated to the Appendix.

I 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 and the distribution of borrower types. During the first-period lending relationship, each bank acquires both default and relationship information about those borrowers who have previously contracted with it. Following Petersen (2004) and Stein (2002), we label the former hard and the latter soft information.[3] We

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

call the incumbent bank 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 competitive environments. Without information sharing, both types of information are unavailable to the outside, uninformed 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.

A The Setup

There are two banks and a continuum of borrowers on $[0, 2]$ who are active for two periods. In both periods, every borrower has access to a project that requires initial investment $\$I$. 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 $R > 0$. With probability $1 - p$ they produce 0.
- Low-type borrowers represent a proportion $1 - \lambda$ in the overall population and they always fail, yielding 0.

The final cash flows in both periods are observable and contractible by the current lender.

The proportions of borrowers and the success probabilities are common knowledge. Borrowers of a given type have identical (and independent) projects, are protected by limited liability and have no initial funds in both periods. We assume a project's output cannot be stored, so that it does not generate resources for operations in the second period.

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[4]. For simplicity, the discount factor between the two periods is taken to be 1.

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:

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

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 the informativeness of monitoring. Banks will have to decide how much to invest in the monitoring technology.

At the end of the first period banks have therefore two types of information about their own borrowers:

- the signal generated by monitoring, $\eta = G$ or $\eta = B$;
- the repayment history - i.e., whether borrowers have defaulted or not. Their

[4]As shown in Sharpe (1990), it makes sense to examine the case without long-run contracts, since otherwise the analysis would reduce to standard competitive pricing and miss some of the most important issues in bank relationships (see also von Thadden (2004)).

history is $h = D$ or $h = N$.

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.

There is of course information that is publicly available especially in the case of large, established firms. However, there may be little information on the significantly more numerous small or young firms for which banks are a crucial source of financing (Petersen and Rajan (1994), Petersen and Rajan (1995)). There is also information that borrowers themselves can disclose voluntarily and to some extent verifiably to potential lenders. Nonetheless, borrowers will be unlikely to disclose negative information and much of what they communicate to the bank may be difficult to verify by it.

There will therefore be for most firms a significant amount of information that banks have to spend time and money to find out. Some of it will be hard information - such as previous defaults or existing loans. That information can be shared via credit bureaus. A significant portion of the most important information about a given borrower - such as a given manager's business acumen, or the success probability of a given new product - will be nonetheless soft information difficult to fit meaningfully into a standardized database. These are the types of information that we encompass under "hard" and "soft" information respectively in our paper. We claim that they play a major role in lending decisions for most firms; however, there will obviously be variation across the universe of firms in an economy. In our empirical section we distinguish between "transparent" and "opaque" firms.

The soft and hard information will allow the incumbent bank to distinguish between

three groups among its first-period customers:

- borrowers that have defaulted and have also generated a bad signal when monitored (BD borrowers);
- borrowers that have defaulted, but have generated a good signal when monitored (GD borrowers);
- borrowers that have not defaulted (but generated either a good signal or a bad signal when monitored; we call those non-defaulting - N - borrowers).

The last group obviously consists only of high-type borrowers. The first groups include both high- and low-type borrowers, in a proportion that is influenced by the informativeness of first-period monitoring. Informed banks can discriminate between the three types in their second-period lending and interest decisions.

We assume that $p_D R > I$, where $p_D = P(h = D)$ is the success probability given the borrower has defaulted: it is efficient to grant a loan to defaulters.[5]

The timing of the game can be summarized as follows:

$T = 1$

- The information sharing regime is/ is not established.
- Banks announce one-period lending rates.
- Borrowers choose one of the banks and invest I.
- Incumbent banks invest in monitoring.
- Borrowers repay whenever they can do so.

$T = 2$

[5]Obviously, the condition also implies it is ex-ante efficient to grant a loan to an average risk.

- Banks share their past borrowers' default history, if an information sharing arrangement has been established.
- The incumbent and the outside bank offer simultaneously second-period interest rates.
- Each firm chooses an offer and invests I.
- Borrowers repay whenever they can, and banks' final payoffs are realized.

In the next two subsections we derive the Perfect Bayesian equilibrium of the game under information sharing and no information sharing, respectively. We then examine when information sharing is profitable for banks, whether borrowers win or lose, whether they switch more or less, and whether welfare increases.

B Default information is shared

We start with the case where hard information is shared. We solve the model through backward induction, starting from the second period.

B.1 Preliminary steps

The banks will use the information they have to derive borrowers' second-period success probability. The incumbent, informed bank has both soft and hard information, while the outside, uninformed bank only has hard information.

Denoting by $p_{GD} = P(\eta = G, h = D)$ 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:

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

for the three groups that the incumbent bank can distinguish. The uninformed bank cannot discriminate between good- and bad-signal borrowers, and estimates an average success probability

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

for defaulting borrowers. The average success probability for all borrowers is $\bar{p} = \lambda p$.

The break-even gross interest rate for each of the groups is equal to the investment I divided by the respective success probability, $\overline{r}_K = \frac{I}{p_K}$, for $K = D, N, GD$ or BD, while for the overall population it is equal to $\overline{r} = \frac{I}{\bar{p}} = \frac{I}{\lambda p}$. The break-even interest rates will obviously be lower for better-quality borrower groups.

We denote by N_K the proportion of group K in the borrower population. We also define $\bar{\varphi}$ such that $p_{BD}R = I$. Whenever $\varphi > \bar{\varphi}$, bad-signal defaulting borrowers are not creditworthy and the incumbent bank will not bid for them.

B.2 Lending Competition

Banks move simultaneously to offer second-period interest rates, and thus do not observe each other's rates. As showed in von Thadden (2004), there is no pure-strategy equilibrium in simultaneous-bid games where one lender knows more than the other[6]. There is however a mixed-strategy equilibrium in which banks randomize over intervals

[6]This is a result also known from the literature on auctions (Engelbrecht-Wiggans et al. (1982)).

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. Those properties will allow us to derive conclusions on optimal information acquisition, bank profits, borrower switching and expected interest rates, and overall welfare.

In the pool of defaulting borrowers, the informed bank can discriminate between good- and bad-signal borrowers, while the uninformed bank cannot. As mentioned above, this is the case in which a mixed-strategy equilibrium will obtain. Denote by $F_D^i(r)$ the cumulative distribution function of interest rates offered by the uninformed bank to defaulting borrowers, and by F_{GD}^i and F_{BD}^i the cumulative distribution function of interest rates offered by the informed bank to good- and bad-signal borrowers respectively.

In contrast, both the incumbent and the outside bank see that successful first-period borrowers are obviously high-type. The two banks will compete à la Bertrand, offering the break-even interest rate $\bar{r}_N = \frac{I}{p}$.

Proposition I.1 ***Equilibrium Strategies*** *The competition between the informed and the uninformed bank has a mixed-strategy equilibrium for defaulters. In this equilibrium,*

1. If $\varphi > \bar{\varphi}$ (monitoring is high and the worst group of borrowers is not creditworthy), the informed bank bids

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

on $[\overline{r}_D, R)$ and has an atom at R. It does not bid for the bad-signal, defaulting group, which is not creditworthy in this case.

The uninformed bank bids

$$F_D^u(r) = \varphi F_{GD}^i,$$

on $[\overline{r}_D; R)$. *It does not bid with probability* $1 - F_D^u(R) = \frac{p_{GD}\overline{r}_D - I}{p_{GD}R - I}$.

2. If $\varphi \leq \bar{\varphi}$ *(monitoring is relatively low and the worst group of borrowers is still creditworthy), both the informed and the uninformed bank always offer credit to all borrowers. The informed bank bids*

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

where F_{GD}^i *is defined on* $[\overline{r}_D, \bar{r}_{BD}]$, *and bids* $\bar{r}_{BD}$ *for the bad-signal, defaulting group.*

The uninformed bank bids

$$F_D^u(r) = \varphi F_{GD}^i,$$

on $[\overline{r}_D; \bar{r}_{BD})$ *with an atom at* $\bar{r}_{BD}$.

Both banks bid pure-strategy $\bar{r}_N$ *for the non-defaulting group.*

Proof See Appendix A.

The equilibrium bidding is similar to the one derived in Hauswald and Marquez (2006). It has an intuitive property that will hold true throughout the analysis: better borrower groups receive better loan terms from the incumbent. Indeed, non-defaulters N get as low as their break-even rate $\overline{r}_N$. At the same time, good-signal defaulters get higher rates in $[\overline{r}_D; R]$ (or $[\overline{r}_D; \overline{r}_{BD}]$), while bad-signal ones receive even higher interest rates ($\bar{r}_{BD}$) or are prevented from borrowing. Compared to the informed bank's interest rates for good-signal defaulting borrowers, the uninformed bank's bidding strategy is less aggressive ($\varphi \leq 1$).

As it may be expected, the incumbent bank gets information rents as a result of having exclusive soft information about its first-period borrowers. The information rents are given in the following proposition.

Proposition I.2 *The second-period profits (information rents) for the incumbent bank when default information is shared are given by*

$$IR_{\text{sharing}} = I(1-\lambda)(2\varphi - 1)$$

The uninformed bank makes zero profits.

Proof See Appendix A.

The incumbent bank is the one getting informational rents as a result of its exclusive soft signal. The rents are of course increasing in the informativeness of monitoring. They also increase in the proportion of low-type borrowers - an increase in that proportion increases the adverse selection problem faced by the outside bank and raises interest rates. The uninformed bank just breaks even on average, but it will sometimes lend to the good-signal borrowers. 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)). The switching of high-quality borrowers as the relationship progresses is in line the recent evidence on borrower-bank relationships (Ioannidou and Ongena (2010)). We derive our model's implications about the intensity of borrower switching below.

C No information is shared

We now describe 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. As in the case with information sharing, there is no pure-strategy equilibrium, but there is a mixed-strategy one.

Let $F^u(r)$ denote cumulative distribution function of interest rates offered by the uninformed bank. The informed bank will choose different interest rates for successful,

good- and bad-signal defaulting borrowers; let the cumulative distribution functions be denoted by F_N^i, F_{GD}^i, and F_{BD}^i respectively.

Proposition I.3 ***Equilibrium Strategies*** *The competition between the informed and the uninformed bank has a mixed-strategy equilibrium. In this equilibrium:*

1. *When $\varphi > \bar{\varphi}$ (monitoring is high), the informed bank*

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

$$F_N^i = 1 - \frac{N_{BD}(I - p_{BD}r) + N_{GD}(I - p_{GD}r)}{N_N(p_N r - I)}$$

- *bids only for good-signal borrowers that have defaulted on $[\bar{r}_D, R)$:*

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

  with an atom at R.

- *refrains from bidding for the bad-signal, defaulting group, which is not creditworthy in this case.*

  The uninformed bank bids

$$F^u(r) = 1 - \frac{p_N\overline{r} - I}{p_N r - I} = pF_i^N,$$

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

$$F^u(r) = 1 - (1-p)\frac{p_{GD}\overline{r}_D - I}{p_{GD}r - I} = p + (1-p)\varphi F_{GD}^i,$$

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

2. when $\varphi \leq \bar{\varphi}$ (monitoring is low), both banks bid for all borrowers. The informed bank

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

$$F_N^i = 1 - \frac{N_{BD}(I - p_{BD}r) + N_{GD}(I - p_{GD}r)}{N_N(p_N r - I)}$$

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

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

- *bids $\bar{r}_{BD}$ for the bad-signal, defaulting group.*

  The uninformed bank bids

$$F^u(r) = 1 - \frac{p_N\overline{r} - I}{p_N r - I} = pF_i^N,$$

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

$$F^u(r) = 1 - (1-p)\frac{p_{GD}\overline{r}_D - I}{p_{GD}r - I} = p + (1-p)\varphi F_{GD}^i,$$

  on $[\overline{r}_D; \bar{r}_{BD})$. It has an atom at $\bar{r}_{BD}$.

Proof See Appendix A.

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 interest rates. Once again, better groups receive better interest rates from the incumbent.

The term $1-p=\frac{p_N\bar{r}-I}{p_N\bar{r}_D-I}$ comes from the pooling of non-defaulting and defaulting borrowers. With probability $p=1-\frac{p_N\bar{r}-I}{p_N\bar{r}_D-I}=F_u(\bar{r}_D)$ the uninformed bank bids below $\bar{r}_D$, and defaulting borrowers get an interest rate below their break-even rate. This is because, unlike in the case of information sharing, the uninformed bank does not observe first-period repayments. From the informed bank's point of view, this raises the probability of losing the good-signal, defaulting first-period borrowers.

The information rents of the incumbent are given below.

Proposition I.4 *The expected gross profits (i.e. profits not including monitoring costs) for the incumbent bank when default information is not shared are given by*

$$IR_{\text{no sharing}}=Ip(1-\lambda)+I(1-p)(1-\lambda)(2\varphi-1)$$

The uninformed bank makes zero profits.

Proof See Appendix A.

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)). Also, as in the case of information sharing, a higher proportion of low-type borrowers $(1-\lambda)$ increases information rents for the incumbent. Unlike in that case, however, we have an additional term as a result of having two sources of rents.

D Optimal Monitoring

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

Proposition I.5 *The marginal return to soft information is higher under hard information sharing:*

$$\frac{\partial IR_{\text{sharing}}(\varphi)}{\partial \varphi} \geq \frac{\partial IR_{\text{no sharing}}(\varphi)}{\partial \varphi}$$

The optimal investment in monitoring is higher under information sharing:

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

$$\varphi_{\text{no sharing}} = 0.5 + \frac{I}{c}(1-\lambda)(1-p)$$

Proof See Appendix A.

Under no information sharing, defaulting and successful borrowers are pooled from the uninformed bank's point of view. Consequently, the good-signal, defaulting borrowers are likely (with probability p) to receive outside bids below $\bar{r}_D$ and to switch to the uninformed bank. A portion of the inside bank's potential information rents is lost in this manner. The loss does not happen under information sharing, and as a result the marginal benefit from investing in monitoring is higher under the latter regime. The optimal level of monitoring is given by the point where the marginal benefit of monitoring equals its marginal cost, which results in higher optimal monitoring under information sharing.

The fact that monitoring increases under information sharing goes against the idea that information sharing destroys banks' incentives to collect information. Good information collection by banks is important for the economy given banks' role in the allocation of capital. We show below that information sharing can lead to higher welfare.

One possible concern with our result is that the quality of hard information may deteriorate once information sharing is introduced. We think that the downside potential in this case is not likely to be large, given that by definition hard information is verifiable and its quality can be established at a relatively low cost.

The main factors that determine optimal monitoring are summarized in the proposition below.

Proposition I.6 *1. Optimal investment in soft information is increasing in the risk parameters* $1-\lambda$, *and* $1-p$.

2. The gap between optimal monitoring under the two regimes is increasing in the risk parameter $1-p$.

3. The increase in optimal information acquisition is higher when the monitoring cost c *is lower.*

Proof Obvious and omitted.

As adverse selection increases, and monitoring costs decrease, monitoring becomes more attractive. At the same time, part (2) of the proposition shows that information sharing increases monitoring to a larger extent if hard information is less informative (there are more defaulting, but high-type borrowers). Our results should therefore be stronger among firms that are riskier and more opaque. We test this hypothesis in the empirical section.

Information sharing leads to higher monitoring, and this can entail both higher informational rents and higher monitoring costs. Under certain conditions, the additional rents exceed the additional monitoring costs, resulting in higher profits for the banks. The conditions are summarized below.

Proposition I.7 *If monitoring costs are low enough* ($c < I(1-\lambda)(2-p)$), *the incumbent bank's net profits from monitoring will be higher under information sharing.*

Informational rents can also be higher under information sharing. (The condition is $c < 2I(1-\lambda)(2-p)$*.)*

Proof Indeed, plugging in optimal values, one can see that $IR^{\text{optimal}}_{\text{sharing}} = \frac{2I^2}{c}(1-\lambda)^2 > Ip(1-\lambda) + \frac{2I^2}{c}(1-\lambda)^2(1-p)^2 = IR^{\text{optimal}}_{\text{no sharing}}$ will yield the necessary condition for information rents. Subtracting the monitoring costs ($c(\varphi - \frac{1}{2})^2$) (which are higher under information sharing), we get the more stringent condition for net profits.

Profits are relatively higher under information sharing if there is more adverse selection (the share of creditworthy, high-type borrowers λ is lower). A lower success probability p means that there are more defaulting, but high-quality borrowers that make it worthwhile to invest in soft information.

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. In our model, the higher incentives to monitor under information sharing may result in higher informational rents and profits. The higher monitoring plays a key role in our model; if information about types was free for the incumbent bank, and there were no switching costs, banks would never choose to share information.

E The First Period

At the beginning of the first period banks compete for the whole population, under symmetric information about the overall proportion of the good and bad borrowers and their success probabilities. The result will be similar interest rates from both banks for all borrowers and an equal sharing of the market. The total profits across two periods are given by

$$\lambda p R_{1,\text{ sharing}} - I + \pi_{\text{sharing}}$$

and

$$\lambda p R_{1,\text{ no sharing}} - I + \pi_{\text{no sharing}}$$

for each of the two regimes. (π denotes net profits from monitoring.) 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). Given the anticipation of positive second-period profits, banks bid below-break even interest rates in the first period ($R_{1,\text{ sharing}} = \frac{I}{\lambda p} - \frac{1}{\lambda p}\frac{I^2}{c}(1-\lambda)^2$, $R_{1,\text{ no sharing}} = \frac{I}{\lambda p} - \frac{1}{\lambda p}(Ip(1-\lambda) + \frac{I^2}{c}(1-\lambda)^2(1-p)^2)$, where the break-even interest rate would obviously be $R_1 = \frac{I}{\lambda p}$).

The fact that first-period competition drives banks' profits over the two periods to zero does not render information sharing irrelevant from the banks' point of view. Once the initial loans have been made, banks can decide to share information in order to increase profits over the remaining lifetime of their borrowers, or they may support a public decision to establish information sharing. Information sharing can arise endogenously.[7]

F Interest Rates and Switching

All borrowers receive the same interest rate in the first period under both regimes. During the second period, however, hard and soft information lead to different interest rates for different borrower groups.

Proposition I.8 *1. $F^i(r)$ and $F^u(r)$ for all groups of borrowers, as well as the*

[7] A similar approach is taken in Jappelli and Pagano (1993), Padilla and Pagano (1997), and Bouckaert and Degryse(2006) where banks share information and increase rents, starting with incumbency positions.

minimum of the two rates for each borrower, are non-increasing in φ under both information sharing and no information sharing regimes. Expected interest rates paid by borrowers are non-decreasing in informativeness φ under both regimes.

2. *Non-defaulting borrowers get lower expected interest rates under information sharing.*
3. *Defaulting borrowers (both good- and bad-signal, and defaulting borrowers as a group) get higher expected interest rates under information sharing.*
4. *Defaulting borrowers get higher expected interest rates than successful borrowers under both regimes.*
5. *Bad-signal borrowers get higher expected interest rates than good-signal borrowers under both regimes.*

Under low monitoring ($\varphi \leq \bar{\varphi}$):

- *High-type borrowers get higher expected interest rates under information sharing whenever the information rents are higher under that regime.*
- *Low-type borrowers always get higher expected interest rates under information sharing.*

Proof See Appendix A.

Increased monitoring enhances the informational advantage of the incumbent bank, and usually drives up the interest rates the outside bank needs to charge in order to break even. This will also increase the interest rates charged by the incumbent, as well as the interest rates effectively paid by borrowers.

Negative information, both soft and hard, will increase the interest rates faced by borrowers under both regimes. At the same time, if one is interested in the welfare of high-type borrowers, it is important to note that they will be charged higher expected interest rates under information sharing in the case when the incumbent's information rents are higher under that regime. This is not surprising, since the high-type borrowers

are the source of those rents[8]. Low-type borrowers are charged higher interest rates under information sharing.

As it may seem natural, information sharing increases the gap between the expected interest shares for successful and defaulting borrowers. Because the uninformed bank faces a more serious case of winner's curse in the pool of defaulting borrowers (the successful first-period borrowers are missing from the pool), 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.

Our results allow us to get a more detailed view of interest rates for different borrower groups and information regimes. Thus we complement previous work that has shown that information sharing decreases overall interest rates (Brown et al. (2009), Jappelli and Pagano (2002)). We test some of our results in the empirical section.

In our model, borrowers will switch to the outside bank if offered a lower interest rate. The intensity of switching varies across borrower groups and information sharing regimes.

Proposition I.9 *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. *Defaulting borrowers switch more than successful borrowers under both regimes.*

[8]The comparison is more complicated in the case of high monitoring ($\varphi > \bar{\varphi}$), since then we have the possibility that some borrowers do not receive any bids. However, the conclusion goes in the same direction.

2. *Bad-signal borrowers switch more than good-signal ones under both regimes.*

3. *Non-defaulting borrowers switch more in the presence of information sharing. Whether defaulting borrowers switch more or less under information sharing depends on parameter values.*

4. *Under low monitoring ($\varphi \leq \bar{\varphi}$), high-type borrowers have the same switching probability ($\frac{1}{2}$) under both regimes. Low-type borrowers switch more under information sharing when information rents for the incumbent are higher under that regime.*

5. *The change in overall switching across regimes is inconclusive.*

Proof See Appendix A.

The results in the above proposition assume that when offered the same interest rates by both banks borrowers will switch to the outside bank with probability $\frac{1}{2}$.

The fact that bad-signal borrowers switch more than good-signal ones illustrates the adverse selection problem faced by the outside bank. The same applies for defaulting and non-defaulting borrowers.

Looking across regimes, successful borrowers will find it easier to switch banks when their credit history is public knowledge. Under information sharing, defaulting borrowers are pooled with higher-quality borrowers, which facilitates their switching to the outside bank. At the same time, under that regime monitoring is lower, and there also are fewer borrowers that switch as a direct result of monitoring (adverse selection generated by the soft signal). This explains the ambiguous result concerning the switching of defaulting borrowers. Finally, and not surprisingly, higher information rents for the incumbent bank are associated with higher switching of the low-type borrowers to the outside bank.

Information sharing may not necessarily facilitate the overall switching of borrowers, despite leveling the playing field between banks. For high-type borrowers, the

easier switching in case of success and the higher adverse selection faced by the outside bank as a result of higher monitoring could even exactly cancel each other out. The interest rates charged by the incumbent bank go up the point where high-type borrowers are indifferent between switching and staying in their initial relationship.

Our theoretical results are more nuanced than in the case of a hypothetical pure-strategy equilibrium in which borrowers never switch to less-informed banks. We test the main implications in our empirical section. Our work complements recent findings in the literature on relationship banking and borrower 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 switching increases in the informativeness of monitoring for two of the three borrower groups, and is unrelated to it for the third group.[9]

G Welfare Implications

Monitoring can improve lending decisions since some of the low-quality borrowers do not receive credit[10]. At the same time, it generates additional costs. It may be interesting to see what is the balance between the two, and whether information sharing can increase welfare.

In our model, if monitoring is high ($\varphi > \bar{\varphi}$), bad-signal defaulting borrowers will sometimes not receive credit. This is also the case in which those borrowers are not creditworthy on average, so the fact that they are denied loans increases welfare. For-

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

[10]Consistent with this, Hertzberg et al. (2011) and Doblas-Madrid and Minetti (2009) show that information sharing reduces access to finance for risky borrowers. Jappelli and Pagano (2002) find that information sharing is associated with lower default rates. In our sample we also find a negative correlation between information sharing and the proportion of non-performing loans.

mally, welfare consists of the sum of the value created by all potential projects, less the possible losses avoided by not lending to BD borrowers, and less the costs of monitoring:

$$\text{Welfare} = \lambda(pR - I) - (1-\lambda)I - N_{BD}(p_{BD}R - I)(1 - F_u(R)) - c(\varphi - \frac{1}{2})^2$$

Proposition I.10 *1. If monitoring costs are low enough, monitoring can enhance welfare both with and without information sharing.*

2. Welfare is higher under information sharing than under no information shared.

Proof See Appendix A.

II Empirical Evidence

To the best of our knowledge, there has been no empirical study on the impact of hard information sharing on soft information acquisition. This section attempts to fill that gap and corroborate the theoretical findings presented above. Our main hypothesis is that soft information acquisition is higher when hard information is shared. We then move on to test whether hard (default) and soft (good and bad signals) information, as well as information sharing itself matter for borrower switching and the cost of capital (propositions I.9 andI.8).

Earlier empirical studies have 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 that bank lending to the private sector is larger and default rates are lower in countries where information sharing is more solidly established. 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. Brown

et al. (2009) find that information sharing can reduce the cost of capital as perceived by borrowers. Herzberg et al. (2011) find that borrowers preemptively react to the introduction of information sharing.

Throughout our analysis we also study our hypotheses separately by distinguishing between transparent and opaque firms. Transparent firms are (mainly large) firms that have adopted IAS reporting standards. Large, transparent firms have a large amount of publicly available information, standardized reporting systems and an established track record. The need for additional information acquisition in their case is likely to be lower, and the information effects predicted by our theoretical results are likely to be weaker. At the same time, they are likely to have a lower default probability and have a lower proportion of low-quality borrowers. For all those reasons we expect (as suggested by Proposition I.6) to get stronger results for the subsample of opaque firms.

A 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.[11]

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 public credit registers (PCRs) and one for private credit bureaus (PCBs). The PCR score adds one point for fulfilling each of the following five criteria:

[11] For a comprehensive picture see Table 1 in Brown et al. (2009).

1. both firms and individuals are covered,
2. positive and negative data is collected and distributed,
3. the registry distributes data which is at least two years old,
4. the threshold for included loans is below per capita GDP, and
5. 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 the year 2002, and average over 2000-2003 for the year 2005.

Detailed definitions of all variables are available in 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 (the survey was run 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. Our main dependent variables are not available for all firms, and that also restricts the number of observations in our regressions. We are left with 1680 observations from 24 countries in our main sample for 2002. In the case of the cost of capital variable, we also have data for 2005, which allows us to run panel regressions on 1118 firms.

The data provides a similar sample of non-agricultural firms across all countries. They are mainly 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. Firms classified as "opaque" represent 59% of the sample, while those classified as "transparent" form the remaining 41%.

B Hypotheses and Model Specifications

We start our empirical analysis with cross-sectional regressions using BEEPS 2002. The baseline specification relates each of our four 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:

$$\text{Dependent variable}_{ij} = \alpha + \beta \times \text{Information sharing}_j + \gamma \times \text{Controls firm}_{ij} + \delta \times \text{Controls country}_j$$

where dependent variables are described below. Due to possible correlation between residuals for a given country we use country-level clustering.

Our dependent variables were collected during 2002 (and 2005 for the cost of capital), 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 for year 2005. 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 issues (see also Brown et al. 2009).

We test three main hypotheses:

H1. Soft information acquisition is higher in countries with established PCRs or PCBs. This is our main theoretical result. While it is true that an accurate measurement of soft information acquisition is difficult, our data provides us with two useful variables: the number of days needed until a bank approves a loan application and banks' reaction to late payments. Our argument is that if banks invest in acquiring more soft information about the borrower they may need more time, and also that they will condition less on hard information when faced with a late payment.

H2. We move on to test whether borrower switching is related to soft information (using a proxy of whether the soft signals are likely to be good or bad, based on self-reported issues and management quality), to hard information (using a measure of overdue payments), and to the information sharing regime.

H3. Finally, we test whether the cost of capital changes depends on the potential soft signal, the default measure and the information sharing regime.

C Dependent Variables

Our main explanatory variables are taken from the Business Environment and Enterprise Performance Survey (BEEPS) (see Table I for summary statistics).

[Insert Table I here]

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 dependent variables is the logarithm of the reported number of days[12].

Investment in soft information by examining 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 before submitting the application. 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[13].

[12]The existence of the some rather extreme values motivates our use of the logarithm. The sample average is 25 days, while the standard deviation is 37 days. Almost 1.5% of the firms report from 180 to 365 days before loan approval.

[13]While the days variable is more closely related to initial screening than to monitoring during the lifetime of the loan, our theoretical result (higher soft information collection under information sharing) also holds in a screening model.

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?" We code a more severe reaction from the bank as 0 and a more lenient one as 1. If banks collect additional forms of information besides basic repayment data, they will be less likely to condition on just hard information. A more flexible reaction of the incumbent bank in case of late payments (higher values of the reaction variable) arguably indicates that the bank has additional information about the borrower and relates late payments to bad luck, rather than to bad prospects. In contrast, a bank that does not have more information from monitoring or screening its borrowers will observe only the late payments, negative information about the firm's potential, and will be more likely to cease the banking relationship[14]. 2000 firms reply to this question.

The Switching variable is taken from the BEEPS 2002 survey. The question in the survey is "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"[15]. 26% of the firms report that they have switched their main bank. We use the average information sharing index for year 1996-1998, to estimate switching after the establishment of information sharing[16]. We also test whether soft and hard information (proxied by overdue payments) are important for switching (as suggested by Proposition I.9).

Finally, we also look at the effects of information on the cost of capital. Our measure for the cost of capital is taken from the survey of firms. It ranges from 1 to 4, with higher values indicating a higher cost of financing. It equals 4, if the cost of finance is reported to be a major obstacle for the firm, 3 if it is reported as a moderate obstacle,

[14]Similar questions have been used as proxies of soft information on earlier studies (Ogura and Uchida (2006), Uchida, Udell and Yamori (2008)).

[15]8 % of the firms report that they have no main bank, and we exclude those firms.

[16]Results are unchanged when we instead use previous index over 1996-2000.

2 if it is a minor obstacle, and 1 if it is no obstacle. Existing evidence suggests that information sharing can benefit borrowers (see Love and Mylenko (2003), Brown et al. (2009)). In our regression we add to existing findings by looking at whether credit cost changes depending on soft information outcome and whether defaulting borrowers get higher cost of capital under information sharing. Unlike the previous three dependent variables, which are only available in the BEEPS 2002 survey, the proxy for the cost of capital is available in both 2002 and 2005. This allows us to run panel regressions for the cost of capital.

D Country-level explanatory variables

We also use several country-level variables to control for differences in the legal environment, the structure of the banking sector, and macroeconomic performance: an index of creditor rights, a proxy for asymmetric information and borrower risk, a measure of bank concentration, a measure of foreign bank presence, per capita GDP, and the inflation rate. Table II provides an overview of the variables.

[Insert Table II here]

The Creditor rights variable is based on Brown et al. (2009). Higher values of this index imply that lenders have better protection in case a borrower defaults. This may affect the time they spend examining potential borrowers, their reaction to overdue payments, the cost of capital and even borrower switching.

In our model asymmetric information and the overall share of low-quality borrowers influence soft information acquisition, as well as switching and interest rates. We take the share of non-performing loans as a measure for these features of borrower population in each country.

Concentration is the share of the largest 5 banks in terms of deposits (from Barth et al. (2001)). Higher concentration could influence competition, borrower switching,

and the cost of capital, and therefore we control for concentration when testing our last two hypotheses.

The 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)). At the same time, it is not completely obvious whether the entry of foreign banks will increase or decrease leniency in case of default, or that will alter the intensity of borrower switching. However, since foreign bank entry has been massive in several countries in our sample, we control for the share of foreign-controlled banks.

In the regressions involving the cost of capital, we also include inflation and log of per capita GDP (denoted in short as GDP in the tables) as explanatory variables. Previous evidence suggests that macroeconomic stabilization is associated with an expansion in financial intermediation in transition countries (Fries and Taci (2002)).

E Firm-level explanatory variables

The time the bank takes to analyze a loan application, the bank's reaction to overdue payments, borrowers' switching and the burden of financing costs may all depend on obvious firm characteristics as well as the information sharing regime. We include several firm-level explanatory variables to control for the variation in credit risk and financing requirements across firms. We also employ measures of good/bad soft information and default history to get more detailed tests of propositions I.9 and I.8.

From the BEEPS survey 2002 and 2005, we construct a 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 workers' skills, their education, contract violations by customers and suppliers, and corruption 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 0.25 to 1, with lower value indicating potential problems (the bank is likely to receive a bad signal when monitoring the firm).

As a further measure of the sign of the soft signal, 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, and whether he or she has recently been fired from somewhere else[17]. Each of the variables takes several values in the survey. The variable ranges from 0 to 4, and higher values of the management quality would mean better signals for the lender. We normalize the variable so that its range is up to 1, and combine it with Soft signal (1) using equal weights in order to get our final Soft signal variable. A higher value of that variable means that the bank is more likely to have received a good signal about the firm[18]. The range of the final variable is between 0.11 and 1.

Younger firms are generally considered as riskier 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 may have undergone radical changes in the recent past. Rather than controlling simply for firm age, and following Brown et al. (2009), we 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).

Loans which are secured by collateral may carry lower interest rates and may require

[17]Although some of these variables can be regarded as pieces of hard information, the general picture is arguably proprietary for the main bank.

[18]Using either of the two soft signal variables separately gives us similar results.

less soft information (Manove et al. (2001)), therefore we also control for Collateralized loans.

We further include two control variables for firm ownership. State ownership shows share of government ownership in the firm. As Brown et al. (2009) point out, the effect of state ownership is a priori ambiguous. On the one hand, state ownership may reduce firm risk from the bank's point of view, due to the possibility of government bailouts. On the other hand, state ownership may increase default risk, owing to the political pressures on management to diverge from profit-maximizing policies.

Firms with foreign ownership are more likely to patronize foreign banks, which in our sample of transition economies are likely to be more advanced in terms of the efficiency of service (e.g., days to conclude on the loan application) and the financing opportunities available. Moreover, foreign firms are likely to be older, better known and less dependent on soft information. We therefore include a variable for the foreign ownership of firms.

We also include Asset growth and Profit margin (the margin over production cost on the main product line) as proxies for investment opportunities since these may well be related to relationship measures (Petersen and Rajan (1994)). To capture firm size effects, we use Asset size which measures the replacement value of physical assets.

Finally, in all our regressions we include sector dummies, to control for different finance needs of firms in various industries.

F Regression Results

F.1 Soft Information Acquisition

We first test whether information sharing results in more days being spent to approve a loan application and a more flexible reaction to late payments.

Days

The reported output in Table III is based on OLS estimation[19]. The first column is the estimate for the total sample, the second one is only for opaque firms, while the third one is for transparent firms.

The first column shows that hard information sharing is related with more time to decide on the loan application. Column 2 shows that the effect is largely driven by opaque firms, confirming our prediction from I.6. 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 time for application processing by as much as almost 6 days (the sample average is 25).

A bank may also spend more time before making the loan simply because of a riskier borrower population. The non-performing loans measure does indeed have a positive coefficient in all regressions, but it is not significant at a 10% level.

We also find that loans with collateral require significantly fewer days to be approved. This could be evidence supporting the negative relationship between collateral and screening outlined in Manove et al. (2001).

We also look for a vintage effect (Berger et al. (2005)) in our sample. For post-transition, younger firms banks may be using more impersonal and modern communication. At the same time, state-owned firms, especially the opaque ones, are analyzed for significantly fewer days. This can be interpreted as evidence for less careful lending to state-owned firms, perhaps as a result of government rules or pressure. It also emphasizes the importance of controlling for firm types. Finally, large firms seem to require more time (controlling for accounting transparency), perhaps as a result of their higher complexity.

[Insert Table III here]

Banks' reaction

[19]The results are similar when Poisson estimation used.

The output in Table IV is based on OLS estimation. (Probit regressions produce similar results.) Information sharing appears to be linked to weaker conditioning on hard information. The table shows the hard information sharing index is significant both for the whole and the opaque firm samples.

The table shows a negative sign for the collateral dummy. This is consistent with the idea that incentives to collect information are lower in the presence of collateral (Manove et al. (2001)). Opaque borrowers with higher profit margins get a harsher reaction from the bank in case of late payments, perhaps as a result of potential moral hazard issues. Larger firms get a more lenient reaction, perhaps as a result of their lower risk.

One possible concern is that some of the firms may have answered the question with only a vague idea about bank procedures. If we control for firms' experience with overdue payment we still get similar results, however.

[Insert Table IV here]

F.2 Switching

Table V is based on probit estimations and presents our results concerning borrower switching. As implied by Proposition I.9, we find that good-signal borrowers tend to switch less than bad-signal ones; the effect is stronger for opaque borrowers. The same is true for successful borrowers compared to those with overdue payments. At the same time, Proposition I.9 pointed to an ambiguous effect of information sharing on overall switching and on the switching of defaulting borrowers. This appears to be confirmed by our empirical results.

As it may be expected, firms using collateral and transparent foreign-owned firms find it easier to switch banks. At the same time, higher bank concentration is associated with lower switching.

[Insert Table V here]

F.3 Cost of capital

Table VI is based on OLS estimations. The table shows that higher values of Soft signal (that is, good signals) reduce the cost of capital. We also find that defaulting borrowers get a higher cost of capital, more so under information sharing in the case of opaque borrowers. These results are consistent with Proposition I.8. By looking at various borrower groups we are therefore able to complement the results on the overall cost of capital in Brown et al. (2009).

[Insert Table VI here]

A higher proportion of non-performing loans increases the cost of capital for opaque firms, while higher inflation increases the cost of capital in all samples. Higher bank concentration appears to decrease the cost of capital, and a higher share of foreign banks to increase it for opaque firms. The latter finding is consistent with Giannetti and Ongena (2005). Higher asset growth (perhaps associated with better past performance) tends to decrease the cost of capital.

Table VII repeats this analysis using firm fixed effects and the data from 2002 and 2005. Some of our firm-level variables do not change over time, and are dropped from the regression. Column 2 and 3 repeat fixed effects analysis for opaque and transparent firms, respectively. We find again that good soft signals reduce the cost of capital[20]. Information sharing also seems to reduce the cost of capital in the overall sample.

[Insert Table VII here]

III Conclusions

Our paper shows that the establishment of information sharing arrangements can lead to an increase in information acquisition. When credit bureaus make default histories or other pieces of hard information available to all lenders in the system,

[20]We do not include Soft signal (2) because of the lack of observations.

lenders' incentives to invest in acquiring additional, soft information such as firms' management quality increase.

The quality of decisions made by lending institutions plays a major role in the allocation of capital. As the recent financial crisis indicates, errors generated by inadequate information can have serious negative consequences for the overall economy. We examine the effect of establishing institutions such as credit bureaus and registries on lenders' interest in knowing more about their clients. The question is interesting because a large part of the banking literature sees bank profits as coming from information rents. Those rents are extracted by having superior knowledge of existing borrowers. They represent the motivation for the costly acquisition of information. When some of the lenders' knowledge is shared with competitors, a source of information rents disappears.

We note that it is only specific types of information, in the shape of verifiable, standardized and easy to interpret data that can be shared through credit bureaus. Lending decisions are also based on soft, difficult to communicate information, and that information will remain the privileged domain of incumbent lenders. We show that when hard information is shared, optimal investment in soft information increases, whether or not overall information rents increase. This is because the marginal benefit of investing in soft information increases when hard information is shared. The result can be an increase in the quality of lending decisions and overall welfare, suggesting information sharing can be a good policy.

We test the predictions of our theoretical model on a sample of firms from 24 countries with significant variation in terms of information sharing arrangements. We find in countries with established and wide-ranging information sharing arrangements banks tend to spend more time analyzing credit applications and are less likely to condition their lending decisions purely on hard information. The results are stronger in the subsample of more opaque borrowers. We take this as evidence of higher investment in soft information in the presence of credit bureaus and registries.

Our findings have implications beyond credit financing. They suggest that an increase in publicly available information will stimulate rather than discourage information collection. Therefore a reasonable increase in reporting requirements, improvements in accounting standards, and better data services can enhance rather than deter close relationships based on soft information. It would be interesting to examine this prediction using data from other events, financing areas and time intervals.

Soft information can be difficult to communicate within banks as well as across banks. Recent research (Stein (2002), Berger et al. (2005)) has shown that this can lead to the specialization of small banks in the use of soft information, while large banks use standardized lending based on hard data. An issue that can be examined in light of their and our results is whether the introduction of information sharing increases the gap between large and small banks. We leave this question for future research.

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V Appendix A

Proof of Proposition I.1 Define the success probabilities

$$
\begin{aligned}
p_N &= p \\
p_{GD} &= \frac{\lambda\varphi p(1-p)}{\lambda\varphi(1-p)+(1-\lambda)(1-\varphi)} \\
p_{BD} &= \frac{\lambda(1-\varphi)p(1-p)}{\lambda(1-\varphi)(1-p)+(1-\lambda)\varphi}
\end{aligned}
$$

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

Under information sharing, both the incumbent and the outside bank can distinguish between defaulting and successful borrowers. Successful borrowers are obviously high-type, and banks compete à la Bertrand under symmetric information, offering marginal-cost pricing $\bar{r}_N$.

In the case of defaulting borrowers, the incumbent bank can distinguish between good- and bad-signal borrowers, which are of different average quality in that subgroup. The outside bank does not have that information. As shown in von Thadden (2004), there is no pure-strategy in this case, but there is a mixed-strategy one. 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. $F_i^K(r)$ describes the bidding strategies for the informed bank for the good-signal defaulting ($K = GD$), bad-signal defaulting($K = BD$) and the non-defaulting ($K = N$) borrowers.

Let $\bar{\varphi}$ denote informativeness level that solves $p_{BD}(\varphi)R = I$.

a) Suppose first $\varphi > \bar{\varphi}$. This implies bad-signal, defaulting borrowers are not creditworthy. The informed bank will not bid for them and $F_{BD}^i(r) = 0$ for all r. It can be shown that $F_{GD}^i(r)$ and $F^u(r)$ are continuous, strictly increasing, and atomless

on some common support $[\underline{r}, \bar{R})$ (see Hauswlad and Marquez 2000).For $K = GD$, the informed bank gets expected profits for any r

$$\pi^i_{GD}(r) = N_{GD}(p_{GD}r - I)(1 - F^u_D(r)),$$

while the profits of the outside bank can be written as

$$\pi^u_D(r) = N_{GD}(p_{GD}r - I)(1 - F^i_{GD}(r)) + N_{BD}(p_{BD}r - I)(1 - F^i_{BD}(r)).$$

It can be shown (Engelbrecht-Wiggans et al. (1982)) that the uninformed bank has to break even in equilibrium, implying that $\pi^u_D(r) = 0$. To calculate the lower bound of the common support, observe that the uninformed bank wins the defaulter almost surely at that rate and gets $p_D\underline{r} - I$, 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 case with $\varphi > \bar{\varphi}$ the support is $[\bar{r}_D, R)$.

b) Suppose then that $\varphi < \bar{\varphi}$ (the bad-signal defaulting borrowers are creditworthy). 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 break-even $\bar{r}_{BD}$ for bad-signal defaulting borrowers. The remainder of the proof is similar to the previous case, except that the common support is now $[\bar{r}_D, \bar{r}_{BD})$.

Equilibrium profits for each bank in the mixed-strategy equilibrium must be constant for any $r \in [\bar{r}_D, \bar{r}_{BD} \wedge R)$. We have

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

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 $\bar{r}_D$, $1 - F_D^u(\bar{r}_D) = 1$. This gives us the expression for $F_D^u(r)$:

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

Similarly,

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

which yields

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

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 $\varphi F_{GD}^i(r) = \frac{p_{GD}r - p_{GD}\bar{r}_D}{p_{GD}r - I} = F_D^u(r)$. 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 $F_{GD}^i(R^-) = 1 - \frac{N_{BD}(I - p_{BD}R)}{N_{GN}(p_{GD}R - I)} < 1$, so that there is an atom at R. Moreover, $F_D^u(R) = \varphi F_{GD}^i(R) < 1$, so that the uninformed does not bid with probability $1 - F_D^u(R)$ whenever $\varphi > \bar{\varphi}$.

Proof of proposition I.2

During the second period, the incumbent bank distinguishes between three borrower groups. Under information sharing, it makes zero profits on non-defaulting borrowers, given the Bertrand competition with the outside bank for those borrowers. It either does not bid for bad-signal, defaulting borrowers or bids only the break-even interest rate for them, again resulting in zero profits. The second-period profits are positive on good-signal, defaulting borrowers, however. Expected profits are the same for any

interest rate the incumbent bank chooses on $[\bar{r}_D, r_{BD\wedge R}$ and are equal to

$$\begin{aligned}\pi^i_{share} &= N_{GD}(p_{GD}\overline{r}_D - I) \\ &= \lambda\varphi p(1-p)\frac{\lambda(1-p)+1-\lambda}{\lambda p(1-p} - \big(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\big) \\ &= (2\varphi - 1)(1-\lambda)\end{aligned}$$

Thus second-period profits are linearly increasing in φ. These are the information rents resulting from monitoring. The "net profits" from monitoring can be obtained by subtracting the cost $c(\varphi - \frac{1}{2})^2$.

As indicated in the proof of Proposition I.1, the uninformed bank makes zero profits.

Proof of Proposition I.3

The incumbent bank distinguishes again between three groups: non-defaulting (successful) borrowers N, defaulting good-signal GD and defaulting bad-signal BD borrowers. The outside bank cannot distinguish between those groups.

If the first-period monitoring is high, and the defaulting, bad-signal borrowers are not creditworthy, the incumbent bank will not bid for them. The second-period profits from bidding interest rate r for non-defaulting and defaulting, good-signal borrowers are given by:

$$\begin{aligned}\pi^i_N(r) &= N_N(p_N r - I)(1 - F^u(r)) \\ \pi^i_{GD}(r) &= N_{GD}(p_{GD} r - I)(1 - F^u(r))\end{aligned}$$

while the outside bank's profit when bidding r is given by:

$$\pi^u(r) = N_N(p_N r - I)(1 - F^u_N(r)) + N_{GD}(p_{GD} r - I)(1 - F^i_{GD}(r)) + N_{BD}(p_{BD} r - I).$$

The informed bank bids for N borrowers on $[l_N^i, u_N^i]$ and for GD borrowers on $[l_{GD}^i, u_{GD}^i]$. The uninformed bank bids on $[l^u, u^u]$.

1. $l_N^i \geq \bar{r}_N$ and $l_{GD}^i \geq \bar{r}_{GD}$, i.e. the incumbent bank does not bid below break-even rates.

2. $l^u \geq \bar{r}$. (The outside bank does not bid below $\bar{r}$, the break-even rate for all borrowers.) This is because the best the outside bank can do is to lend to all borrower groups.

3. The previous step implies that the incumbent bank's lowest interest rate for N or GD borrowers is greater or equal to $\bar{r}$.

4. $u^u \geq u_N^i$. This is because, since the bidding starts from $\bar{r}$, the informed bank makes strictly positive profits on non-defaulting borrowers. If we had $u^u < u_N^i$, then the incumbent bank would be making zero profits on non-defaulting borrowers on $(u^u, u_N^i]$.

5. There is no overlap between the intervals over which the incumbent bank bids for the two borrower groups. $[l_N^i, u_N^i]$ and $[l_{GD}^i, u_{GD}^i]$ have at most one point in common.

Suppose we have r_1 and r_2 with $r_1 < r_2$ and $r_1 \in [l_N^i, u_N^i]$, $r_2 \in [l_N^i, u_N^i]$, $r_1 \in [l_{GD}^i, u_{GD}^i]$ and $r_1 \in [l_{GD}^i, u_{GD}^i]$. The incumbent bank should make the same profits on $N(GD)$ borrowers whether bidding r_1 or r_2:

$$N_N(p_N r_1 - I)(1 - F^u(r_1)) = N_N(p_N r_2 - I)(1 - F^u(r_2))$$
$$N_{GD}(p_{GD} r_1 - I)(1 - F^u(r_1)) = N_{GD}(p_{GD} r_2 - I)(1 - F^u(r_2))$$

Dividing the first equation by the second we get:

$$\frac{p_N r_1 - I}{p_{GD} r_1 - I} = \frac{p_N r_2 - I}{p_{GD} r_2 - I},$$

equivalent to $p_N I(r_2 - r_1) = p_{GD} I(r_2 - r_1)$ or $p_N = p_{GD}$, which is not true (except

in the special case of full monitoring $\varphi = 1$).

We have therefore two intervals on which the incumbent bank bids for each of the two groups.

6. The outside bank makes zero profits (as also shown in (Engelbrecht-Wiggans et al. (1982)).

Let $F_u(r)$ be some equilibrium bidding strategy for the informed and the uninformed bank, respectively. If $F_u(r)$ has an atom at l^u, then the informed will bid above l^u when he has non-negative return $U_i = p_K l^u - I \geq 0$, where K ($K = GD, BD, GN, BN$) is a random variable observed only by the informed bank. Let E be the event that $p_K l^u - I \geq 0$. If $P(E) = 1$, then the informed will always bid above l^u, and therefore the uninformed's expected payoff when it bids $l^u + \epsilon$ will be $O(\epsilon)$. If $P(E) < 1$, then letting $\bar{E}$ denote the complement of E and $U_u = p_K l^u - I$, the uninformed bank's expected payoff conditional on winning with a bid of $l^u + \epsilon$ is

$$E[U_u|\bar{E}] \times P(\bar{E}) + (1 - P(\bar{E}))O(\epsilon) = E[E[p_K l^u - I|K]|\bar{E}] \times P(\bar{E}) + (1 - P(\bar{E}))O(\epsilon)$$

Now if $p_K l^u - I < 0$, then almost surely

$$E[U_u|K] = E[U_i|K] = p_K l^u - I < 0$$

Thus, total profits of the uninformed bank can never be positive. Similarly, if $F_u(r)$ has no atom at l^u, then the informed can never win by bidding $\underline{r}$ or less but it can have non-negative return by bidding more than l^u whenever $U_i = p_K \underline{r} - I \geq 0$. As before, when the uninformed bids $l^u + \epsilon$, either its probability of winning or its conditional expected payoff must be $O(\epsilon)$, yielding $O(\epsilon)$ expected payoff. In equilibrium, the uninformed must be indifferent among all bids. The payoff must be constant, and for bids above $l^u + \epsilon$ equal to $O(\epsilon)$. Its expected payoff is thus 0.

7. $u_N^i \leq l_{GD}^i$, i.e. the interval on which the incumbent bank bids for non-defaulting borrowers is below the interval on which it bids for good-signal, defaulting borrowers.

Suppose the incumbent bank bids lower interest rates for GD borrowers than for N borrowers.

7a. If $\bar{r} < \bar{r}_{GD}$, the incumbent bank's bidding would have to start from above $\bar{r}_{GD}$. Then the outside bank can bid $\bar{r}_{GD} - \varepsilon$, capture the whole market and make strictly positive profits. This cannot be an equilibrium. Therefore the incumbent bank's bidding for N borrowers starts at rates below $\bar{r}_{GD}$.

F_N^i is continuous on $[l_N^i, u_N^i)$. (Suppose that it is not. Then there must be $\hat{r} \in [l_N^i, u_N^i)$ such that $F_N^i(\hat{r}^-) < F_N^i(\hat{r})$. Then, since $p_N\hat{r} - I > 0$ we must have $\pi^u(\hat{r}^-) > \pi^u(\hat{r})$. By the right-continuity of F_N^i and π^u there is an $\varepsilon > 0$ such that $F^u(\hat{r}) = F^u((\hat{r}) + \varepsilon)$. Therefore F_N^i cannot have any mass on $[\hat{r}, \hat{r} + \varepsilon]$ and $F_N^i(\hat{r}^-) = F_N^i(\hat{r})$. We have a contradiction.)

It can next be shown that $u_N^i \geq l_{GD}^i$.

Suppose $u_N^i < l_{GD}^i$ (the incumbent never bids on (u_N^i, l_{GD}^i)).

Suppose first that $u_N^i < u^u$. Then the outside bank will not bid on $[u_N^i, l_{GD}^i)$ (any interest rate in that interval can be improved by bidding higher, still below l_{GD}^i). Therefore the outside bank only bids on $[l_{GD}^i, u^u]$ above u_N^i. The incumbent bank has a profitable deviation: it can switch some of the mass on below u_N^i to a point below l_{GD}^i and increase profits.

Alternatively, if $u_N^i = u^u$, the outside bank has a profitable deviation by switching some of the mass from below u^u to a point below l_{GD}^i.

Summing up, the incumbent bank bids for N borrowers on $[l_N^i, u_N^i]$ and for GD borrowers on $[u_N^i, u_{GD}^i]$. F_N^i is continuous on $[l_N^i, u_N^i)$.

7b. If $\bar{r} > \bar{r}_{GD}$, suppose again that the incumbent bank starts bidding for GD borrowers from $\bar{r}$. (A higher starting point would lead to the outside bank undercutting and profitably taking over the whole market). Then, following the same reasoning as in the previous case, it can be shown that F_{GD}^i is continuous on $[l_{GD}^i, u_{GD}^i]$ and that

$u_N^i \geq l_{GD}^i$. We have that $u_N^i = l_{GD}^i = r_x$.

On $[\bar{r}, r_x]$, the expected profits for the incumbent bank when bidding for GD borrowers have to be the same for any interest rate chosen in that interval. We have $N_{GD}(p_{GD}r - I)(1 - F^u(r)) = N_{GD}(p_{GD}\bar{r} - I)$ for $r \in [\bar{r}, r_x]$, which implies that $1 - F^u(r) = \frac{p_{GD}\bar{r} - I}{p_{GD}r - I}$.

The informed bank has a profitable deviation in this case. Suppose it bids for N borrowers lower (at $r_x - \varepsilon$ instead of r_x):

$$N_N(p_N r_x - I)\frac{p_{GD}\bar{r} - I}{p_{GD}r_x - I}$$
$$N_N(p_N(r_x - \varepsilon) - I)\frac{p_{GD}\bar{r} - I}{p_{GD}(r_x - \varepsilon) - I}$$

The deviation is profitable:

$$N_N(p_N(r_x - \epsilon) - I)\frac{p_{GD}\bar{r} - I}{p_{GD}(r_x - \epsilon) - I} > N_N(p_N r_x - I)\frac{p_{GD}\bar{r} - I}{p_{GD}r_x - I},$$

equivalent to $(p_N - p_{GD})\varepsilon > 0$, which is true.

Therefore, just like in the previous case the incumbent bank bids for N borrowers on $[l_N^i, u_N^i]$ and for GD borrowers on $[u_N^i, u_{GD}^i]$. F_N^i is continuous on $[l_N^i, u_N^i)$.

8. $l^u = \bar{r}$. At l^u the outside banks wins the entire market almost surely (the incumbent will not start bidding below l^u). Also, the outside bank's profits are zero for any interest rate it chooses. Therefore $\bar{p}l_u - I = 0$, which implies $l_u = \bar{r}$. This also implies $l_N^i = \bar{r}$.

9. $l_{GD}^i = \bar{r}_D$. We know that $u^u \geq u_N^i$. At u_N^i, the outside bank get all defaulting borrowers, and make zero profits; therefore $u_N^i = \bar{r}_D = l_{GD}^i$.

10. $u^u \geq u_{GD}^i$ and F_{GD}^i is continuous on $[l_{GD}^i, u_{GD}^i)$. The proof is similar to the proof in the case of non-defaulting borrowers.

11. $u^u = u^i_{GD} = R$. Neither of the banks will bid above the highest possible payoff, and the outside bank can never undercut the incumbent on GD borrowers.

The proof in the case of low monitoring (where BD borrowers are creditworthy) is similar. The upper limit in that case is r_{BD}, the break-even rate for the lowest-quality group of borrowers, and the the incumbent bids for BD borrowers at r_{BD}.

We can next derive the explicit expressions for the cumulative distribution functions.

For the informed bank, the rents on non-defaulting borrowers $\pi_N(r) = N_N(p_N r - I)(1 - F_u(r))$ are constant across all r on $[\bar{r}, \bar{r}_D]$. This implies that on that interval $F_u(r) = 1 - \frac{p_N \bar{r} - I}{p_N r - I} = \frac{\lambda pr - I}{\lambda(pr - I)}$.

The rents on good-signal, defaulting borrowers $\pi_{GD}(r) = N_{GD}(p_{GD} r - I)(1 - F_u(r))$ are again constant for every r on $[\bar{r}_D, \bar{r}_{BD} \wedge R)$. This implies that $\pi^{GD}(\bar{r}_D) = N_{GD}(p_{GD}\bar{r}_D - I)(1 - F_u(\bar{r}_D)) = N_{GD}(p_{GD}\bar{r}_D - I)\frac{p_N \bar{r} - I}{p_N \bar{r}_D - I}$ for any r in the interval and therefore the cumulative distribution function for the uninformed bank is $F_u(r) = 1 - \frac{p_N \bar{r} - I}{p_N \bar{r}_D - I}\frac{p_{GD}\bar{r}_D - I}{p_{GD} r - I} = 1 - \frac{\frac{1}{\lambda} - I}{\frac{\lambda(1-p)+(1-\lambda)}{\lambda(1-p)} - I}\frac{p_{GD}\bar{r}_D - I}{p_{GD} r - I} = 1 - (1-p)\frac{p_{GD}\bar{r}_D - I}{p_{GD} r - I}$.

The BD group either yields zero profits when it is creditworthy, or does not get an offer.

The outside bank makes zero profits for all interest rates it bids:

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

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 $[\overline{r}, \overline{r}_D]$.

Similarly, for non-defaulting borrowers we have

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

on $\bar{r}_D, \bar{r}_{BD}]$ and $\bar{r}_D, R)$ respectively. In the latter case (high monitoring)the incumbent's distribution function for GD bids has an atom at R.

Proof of Proposition I.4

In the absence of information sharing, the incumbent bank will make positive profits on both non-defaulting N and good-signal, defaulting GD borrowers - both groups are offered interest rates above the bank's break-even level.

On $[\overline{r}, \bar{r}_D]$, the informed bank bids for non-defaulting borrowers, and expected profits are the same at any point on the interval. Evaluating profits at $\bar{r}$ we get

$$\pi_{\text{N, no sharing}} = N_N(p_N\bar{r} - I) = Ip(1-\lambda).$$

Similarly, evaluating profits on good-signal, defaulting borrowers at $\bar{r}_D$ we get

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

Total informational rents (or second-period profits for the incumbent) are

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

Proof of Proposition I.5

Under information sharing, the incumbent bank chooses an informativeness level φ to maximize the following net profits from monitoring:

$$IR_{\text{sharing}} - c(\varphi - 0.5)^2 = I(1-\lambda)(2\varphi - 1) - c(\varphi - 0.5)^2$$

Solving the maximization problem we get

$$\varphi^*_{\text{sharing}} = 0.5 + \frac{I}{c}(1-\lambda).$$

Without information sharing, the net profits to be maximized are:

$$IR_{\text{no sharing}} - c(\varphi - 0.5)^2 = Ip(1-\lambda) + I(1-p)(1-\lambda)(2\varphi - 1) - c(\varphi - 0.5)^2,$$

resulting in optimal informativeness

$$\varphi^*_{\text{no sharing}} = 0.5 + \frac{I}{c}(1-\lambda)(1-p) \leq \varphi^*_{share} = 0.5 + \frac{I}{c}(1-\lambda).$$

Information rents (second-period profits) are increasing in φ under both regimes, but the slope (the marginal benefit from investing in soft information) is higher under information sharing:

$$\frac{\partial IR_{\text{sharing}}(\varphi)}{\partial \varphi} = 2I(1-\lambda) \qquad \frac{\partial IR_{\text{no sharing}}(\varphi)}{\partial \varphi} = 2I(1-\lambda)(1-p) < 2I(1-\lambda).$$

Proof of Proposition I.8

Let $F_K(r)$ denote the cumulative distribution function for the rate paid by a borrower in group $K = GD, N, BD$. Borrowers will obviously pay the minimum of the rates offered by the incumbent and the outside bank.

$$F_K(r) = F_K^{\min}(r) = 1 - (1 - F^u(r))(1 - F_K^i(r))$$

It can be shown that F^i, F^u and $F^{\min}$ are non-increasing in φ. For instance, for good-signal, defaulting borrowers, under information sharing the cdf of the informed bank will be:

$$F^i_{GD}(r) = 1 + \frac{N_{BD}(p_{BD}r - I)}{N_{GD}(p_{GD}r - I)} = \frac{\lambda p(1-p)r - \big(\lambda(1-p) + (1-\lambda)\big)I}{\lambda\varphi p(1-p)r - \big(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\big)I},$$

therefore

$$\frac{\partial F^i_{GD}(r)}{\partial\varphi} = \frac{-\Big(\lambda^2(1-p)^2(pr-I)^2 - (1-\lambda)^2I^2\Big)}{\Big(\lambda\varphi p(1-p)r - \big(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\big)I\Big)^2} \leq 0$$

because $r \in [\bar{r}_D, R \wedge \bar{r}_{BD}]$, so that $r > \bar{r}_D$, which implies $pr > \frac{\lambda(1-p)+1-\lambda}{\lambda(1-p)}I$.

For the uninformed bank

$$F^u_D(r) = \varphi F^i_{GD}(r)$$

From the above

$$\begin{aligned}\frac{\partial F^u_{GD}(r)}{\partial\varphi} =& F^i_{GD}(r) + \varphi\frac{\partial F^i_{GD}(r)}{\partial\varphi} \\ =& -\frac{-(1-\lambda)I(\lambda(1-p)(pr-I) + (1-\lambda)I(2\varphi-1))}{\Big(\lambda\varphi p(1-p)r - \big(\lambda\varphi(1-p) + (1-\lambda)(1-\varphi)\big)I\Big)^2} < 0.\end{aligned}$$

Therefore,

$$\frac{\partial F^{min}_{GD}(r)}{\partial\varphi} = \frac{\partial F^i(r)}{\partial\varphi}(1 - F^u(r)) + \frac{\partial F^u(r)}{\partial\varphi}(1 - F^i(r)) \leq 0$$

Similar proofs show that the cumulative distribution functions for the incumbent and outside bank, as well as for the minimal (actually paid) interest rate for all borrower groups are nonincreasing in φ. Increased monitoring increases the adverse selection faced by the outside bank, and therefore the interest rates it bids. This can result in higher interest rates charged by the incumbent, and higher paid interest rates.

We can now move on to derive the results concerning expected interest rates for various borrower groups.

Take first the case in which monitoring informativeness is relatively low ($\varphi < \bar{\varphi}$). Under information sharing, non-defaulting borrowers get the break-even interest rate $\bar{r}_N = \frac{I}{p}$ from both banks. The rate does not depend on monitoring informativeness φ. In the absence of information sharing, the expected interest rate will always be above $\bar{r} = \frac{I}{\lambda p}$ and thus obviously higher. Both the incumbent and the outside bank bid for N borrowers on $[\bar{r}, \bar{r}_D]$. The cumulative density function is given by

$$F_N^{\min}(r) = 1 - (1 - F^u(r))(1 - F_N^i(r))$$

where

$$F^u(r) = 1 - \frac{p_N \bar{r} - I}{p_N r - I}$$
$$F_N^i = 1 + \frac{N_D p_D r - I}{N_N p_N r - I}.$$

We have that

$$E(r_N) = \int_{\bar{r}}^{\bar{r}_D} \frac{N_D}{N_N}(p_N \bar{r} - I) \frac{-p_D(p_N r - I) + 2(p_N - p_D)I}{(p_N r - I)^3} \, \mathrm{d}r$$

or equivalently

$$E(r_N) = \bar{r} + \frac{1 - \lambda}{\lambda p} I \Big(1 - \frac{1 - p}{p} \ln \frac{1}{1 - p}\Big),$$

which again does not depend on φ. The expected interest rate is obviously higher in the absence of information sharing.

Using a similar procedure we get the following expected interest rates:

Expected rate	Sharing	No Sharing
Group N	$E(r_N) = \bar{r}_N = \frac{I}{p}$	$E(r_N) = \bar{r} + \frac{1-\lambda}{\lambda p} I\left(1 - \frac{1-p}{p} \ln \frac{1}{1-p}\right)$
Group GD	$\bar{r}_D + \frac{2\varphi-1}{\varphi} \frac{1-\lambda}{\lambda p(1-p)} I\left(1 - \frac{1-\varphi}{\varphi} \ln \frac{1}{1-\varphi}\right)$	$\bar{r} + \frac{1-\lambda}{\lambda p} I + \frac{2\varphi-1}{\varphi} \frac{1-\lambda}{\lambda p} I\left(1 - \frac{1-\varphi}{\varphi} \ln \frac{1}{1-\varphi}\right)$
Group BD	$\bar{r}_D + \frac{1-\lambda}{\lambda p(1-p)} \frac{2\varphi-1}{\varphi} \ln \frac{1}{1-\varphi} I$	$\bar{r} + \frac{1-\lambda}{\lambda p} \ln \frac{1}{1-p} I + \frac{1-\lambda}{\lambda p} \frac{2\varphi-1}{\varphi} \ln \frac{1}{1-\varphi} I$

It is obvious that defaulting borrowers pay higher expected interest rates than successful ones under both regimes. The same is true when comparing bad-signal to good-signal borrowers:

$$E(r_G) = P(N|G)E(r_N) + P(D|G)E(r_{GD})$$
$$E(r_B) = P(N|B)E(r_N) + P(D|B)E(r_{BD})$$

We have $E(r_{BD} > E(r_{GD}$ and $P(D|B) > P(D|G)$ (the hard and the soft signal are positively correlated.)

The expected interest rate paid by GD borrowers is higher under information sharing (since $\bar{r}_D > \bar{r} + I\frac{1-\lambda}{\lambda p} \ln \frac{1}{1-p}$ and $g(\varphi) = \frac{2\varphi-1}{\varphi}\left(1 - \frac{1-\varphi}{\varphi} \ln \frac{1}{1-\varphi}\right)$ is increasing in φ; optimal monitoring is higher under information sharing.) The same arguments show that the expected interest rate for BD borrowers is higher under information sharing.

Similarly, it can be shown that the interest rate for defaulting borrowers is higher

under information sharing.

$$
\begin{aligned}
E(r_D) &= P(GD|D)E(r_{GD}) + P(BD|D)E(r_{BD}) \\
E(r_{D,\text{no sharing}}) &= \bar{r} + I\frac{1-\lambda}{\lambda p}\ln\frac{1}{1-p} + I\frac{1-\lambda}{\lambda p}\frac{2\varphi-1}{\varphi}\frac{1}{\lambda(1-p)+1-\lambda} \\
&\quad \times \Big[\lambda(1-p)\varphi + (1-\lambda)(1-\varphi) + (1-\lambda)\frac{2\varphi-1}{\varphi}\ln\frac{1}{1-\varphi}\Big] \\
E(r_{D,\text{sharing}}) &= \bar{r}_D + I\frac{1-\lambda}{\lambda}\frac{1}{p(1-p)}\frac{2\varphi-1}{\varphi}\Big[\lambda(1-p)\varphi + (1-\lambda)(1-\varphi) \\
&\quad + \frac{2\varphi-1}{\varphi}(1-\lambda)\ln\frac{1}{1-\varphi}\Big].
\end{aligned}
$$

We have again $\bar{r}_D > \bar{r} + I\frac{1-\lambda}{\lambda p}\ln\frac{1}{1-p}$ and $h(\varphi) = \lambda(1-p)\varphi + (1-\lambda)(1-\varphi) + \frac{2\varphi-1}{\varphi}(1-\lambda)\ln\frac{1}{1-\varphi}$ is increasing in φ.

We can now compare interest rates for high-type borrowers across the two regimes.

$$
\begin{aligned}
E(r_H) &= P(N|H)E(r_N) + P(GD|H)E(r_{GD}) + P(BD|H)E(r_{BD}) \\
E(r_H) &= pE(r_N) + (1-p)\varphi E(r_{GD}) + (1-p)(1-\varphi)E(r_{BD})
\end{aligned}
$$

$$
\begin{aligned}
E(r_{H,\text{no sharing}}) &= \bar{r} + \frac{1-\lambda}{\lambda}I + \frac{1-p}{p}\frac{1-\lambda}{\lambda}(2\varphi^{NS}-1)I \\
E(r_{H,\text{sharing}}) &= \bar{r} + \frac{1-\lambda}{\lambda p}(2\varphi^{IS}-1)I
\end{aligned}
$$

Putting in the equilibrium φ we get:

$$
\begin{aligned}
E(r_{H,\text{no sharing}}) &= \bar{r} + \frac{1-\lambda}{\lambda p}I\Big(p + 2\frac{I}{c}(1-\lambda)(1-p)^2\Big) \\
E(r_{H,\text{sharing}}) &= \bar{r} + \frac{1-\lambda}{\lambda p}2\frac{I}{c}(1-\lambda)
\end{aligned}
$$

High-type borrowers get higher interest rates under information sharing if $\frac{I}{c}(1-\lambda)(2-p)<1$. Not surprisingly, this is the same condition as the one for higher total information rents for the incumbent under information sharing. Bank profits come from informational rents extracted from high-type borrowers.

Interest rates for low-type borrowers are always higher under information sharing:

$$
\begin{aligned}
E(r_L) &= P(GD|L)E(r_{GD}) + P(BD|L)E(r_{BD}) \\
E(r_L) &= \varphi E(r_{GD}) + (1-\varphi)E(r_{BD}) \\
E(r_{L,\text{no sharing}}) &= \bar{r} + I\frac{1-\lambda}{\lambda p}\ln\frac{1}{1-p} + I\frac{2\varphi-1}{\varphi}\frac{1-\lambda}{\lambda p}\Big[1-\varphi+\frac{2\varphi-1}{\varphi}\ln\frac{1}{1-\varphi}\Big] \\
E(r_{L,\text{sharing}}) &= \bar{r}_D + I\frac{2\varphi-1}{\varphi}\frac{1-\lambda}{\lambda p(1-p)}\Big[1-\varphi+\frac{2\varphi-1}{\varphi}\ln\frac{1}{1-\varphi}\Big].
\end{aligned}
$$

When monitoring is high and bad-signal, defaulting borrowers are not creditworthy ($\varphi > \bar{\varphi}$), we can look at the cumulative distribution functions to compare expected interest rates paid under the two regimes. For instance, for good-signal, defaulting borrowers we have $F^{min}_{\text{sharing}}(r) \leq F^{min}_{\text{no sharing}}(r)$ on $[\bar{r}_D, R]$:

$$
\begin{aligned}
F^{\min}_{\text{sharing}}(r) &= 1 + \frac{N_{BD}}{N_{GD}}(p_{GD}\bar{r}_D - I)\frac{p_{BD}r - I}{(p_{GD}r - I)^2} \\
F^{\min}_{\text{no sharing}}(r) &= 1 + (1-p)\frac{N_{BD}}{N_{GD}}(p_{GD}\bar{r}_D - I)\frac{p_{BD}r - I}{(p_{GD}r - I)^2}
\end{aligned}
$$

For the same φ, values are obviously higher under no information sharing. Moreover,

$N_{BD}(p_{BD}r - I)N_{GD}(p_{GD}r - I)\frac{p_{GD}\bar{r}_D - I}{p_{GD}r - I}$ is increasing in φ.

On $[\bar{r}, \bar{r}_D]$, $F^{\min}_{\text{no sharing}}(r) \geq 0 = F^{\min}_{\text{sharing}}(r)$. By first-order stochastic dominance, the expected paid interest rate is higher under information sharing. Similar proofs show

that expected interest rates are higher for bad-signal, defaulting borrowers, and for defaulting borrowers as a whole. The result is also valid in the special case in which BD borrowers are creditworthy in the absence of information sharing, but not under information sharing.

Proof of Proposition I.9

Borrowers switch with probability 1 when the uninformed bank bids a strictly lower interest rate, 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 $[r_{low}, r_{high}]$ we have

$$Pr(\text{Switching}) = 1 - \int_{r_{low}}^{r_{high}} (1 - F^u(r))dF_i(r)$$

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, $Pr(\text{Switching}) = 0.5$. We therefore have the following switching probabilities for the three borrower groups:

Pr(Switching)	Sharing	No Sharing
Group N	Both bid equal rates $\bar{r}_N \Rightarrow \frac{1}{2}$	$1 - \int_{\bar{r}}^{\bar{r}_D}(1 - pF_N^i)dF^i$ $= p - \frac{1}{2}p = \frac{1}{2}p$
Group GD	$1 - \int_{\bar{r}_D}^{R}(1 - F_D^u)dF_{GD}^i = 1$ $-1 + \varphi \int_{\bar{r}_D}^{R} F_{GD}^i dF_{GD}^i = \frac{1}{2}\varphi_{sharing}$	$1 - \int_{\bar{r}}^{\bar{r}_D}(1 - F^u)dF_{GD}^i = 1-$ $\int_{\bar{r}}^{\bar{r}_D}(1-p)(1-\varphi F_{GD}^i)dF_{GD}^i$ $= p + \frac{1}{2}(1-p)\varphi_{nosharing}$
Group BD	$\varphi > \bar{\varphi}$, the informed doesn't bid $\varphi \leq \bar{\varphi}$, $\frac{1}{2}(1 - \varphi_{sharing}) + \varphi_{sharing}$	$\varphi > \bar{\varphi}$, the informed doesn't bid. $\varphi \leq \bar{\varphi}$, $p + \frac{1}{2}(1-p)(1 + \varphi_{nosharing})$

For $\varphi \leq \bar{\varphi}$, from proposition I.1 it follows that the uninformed bank bids less than $\bar{r}_{BD}$ with probability φ under information sharing, so BD borrowers are switching

with probability $\frac{1}{2}(1-\varphi)+\varphi$. Similarly, under no information sharing and from proposition I.3, switching probability will be given by $p+(1-p)\varphi+\frac{1}{2}(1-p)(1-\varphi) = p+\frac{1}{2}(1-p)(1+\varphi)$.

It is obvious from the table above that $P(\text{Switching}_{BD}) \geq P(\text{Switching}_{GD})$ under each of the two regimes. This in turn implies that bad-signal borrowers switch more than good-signal borrowers:

$$P(\text{Switching}_G) = P(\text{Switching}_N)P(N|G) + P(\text{Switching}_{GD})P(D|G)$$
$$P(\text{Switching}_B) = P(\text{Switching}_N)P(N|B) + P(\text{Switching}_{BD})P(D|B)$$
$$P(\text{Switching}_G) \leq P(\text{Switching}_B),$$

since $P(D|B) \geq P(D|G)$.

Defaulting borrowers also switch more than non-defaulting ones under each of the two regimes. For instance, if $\varphi \leq \bar{\varphi}$, under information sharing we have:

$$P(\text{Switching}_D) = \frac{\lambda(1-p)\varphi + (1-\lambda)(1-\varphi)}{\lambda(1-p)+1-\lambda}\frac{1}{2}\varphi + \frac{\lambda(1-p)(1-\varphi)+(1-\lambda)\varphi}{\lambda(1-p)+1-\lambda}\frac{1}{2}(1+\varphi)$$
$$P(\text{Switching}_N) = \frac{1}{2}$$

We have higher switching for defaulting borrowers if

$$\frac{1}{2}\varphi + \frac{\lambda(1-p)(1-\varphi)+(1-\lambda)\varphi}{\lambda(1-p)+1-\lambda}\frac{1}{2} > \frac{1}{2} \Leftrightarrow \varphi > \frac{1}{2},$$

which is obviously true.

Under no information sharing,

$$P(\text{Switching}_D) = \frac{\lambda(1-p)\varphi + (1-\lambda)(1-\varphi)}{\lambda(1-p)+1-\lambda}(p + \frac{1}{2}(1-p)\varphi) + \\ + \frac{\lambda(1-p)(1-\varphi) + (1-\lambda)\varphi}{\lambda(1-p)+1-\lambda}(p + \frac{1}{2}(1-p)(1+\varphi))$$

$$P(\text{Switching}_N) = \frac{1}{2}p$$

We have higher switching for defaulters if

$$\frac{1}{2} + \frac{\lambda(1-p)\varphi + (1-\lambda)(1-\varphi)}{\lambda(1-p)+1-\lambda}\frac{1}{2}(1-p)\varphi + \frac{\lambda(1-p)(1-\varphi) + (1-\lambda)\varphi}{\lambda(1-p)+1-\lambda}\frac{1}{2}(1-p)(1+\varphi) > 0$$

which is obviously true.

The inequalities are even stronger under high monitoring.

Looking across regimes, non-defaulting borrowers will find it easier to switch under information sharing, when we have Bertrand competition. The intensity of defaulting borrower switching will generally depend on parameter values. For instance, under low monitoring, defaulting borrowers will switch more under information sharing if there are many low-type borrowers (the actual condition is $\frac{I}{c}(1-\lambda)(2-p) > \frac{1}{2}\left(1 + \frac{\lambda(1-p)}{1-\lambda}\right)$).

The switching of high-type borrowers is given by

$$P(\text{Switching}_H) = P(N|H)P(\text{Switching}_N) + P(GD|H)P(Switch|GD) + P(BD|H)P(\text{Switching}_{BD})$$

Under information sharing and low monitoring we get

$$\begin{aligned} P(\text{Switching}_H) &= \frac{p}{2} + \frac{1}{2}(1-p)\varphi^2 + \frac{1}{2}(1-p)(1-\varphi)(1+\varphi) \\ &= \frac{1}{2}, \end{aligned}$$

while without information sharing we get:

$$\begin{aligned} P(\text{Switching}_H) &= \frac{p^2}{2} + (1-p)\varphi(p + \frac{1}{2}(1-p)\varphi) + (1-p)(1-\varphi)(p + \frac{1}{2}(1-p)(1+\varphi)) \\ &= \frac{1}{2} \end{aligned}$$

The switching probability is the same in both cases.

For low-type borrowers we have

$$P(\text{Switching}_L) = P(N|L)P(\text{Switching}_N) + P(GD|L)P(Switch|GD) + P(BD|L)P(\text{Switching}_{BD})$$

Under information sharing this becomes

$$P(\text{Switching}_L) = \frac{1}{2}(1-\varphi)\varphi + \frac{1}{2}\varphi(1+\varphi) = \varphi$$

while without information sharing we have

$$P(\text{Switching}_L) = (1-\varphi)(p + \frac{1}{2}(1-p)\varphi) + \varphi(p + \frac{1}{2}(1-p)(1+\varphi)) = p + (1-p)\varphi.$$

Low-type borrowers switch more under information sharing if

$$\frac{I}{c}(1-\lambda)(2-p) > \frac{1}{2}$$

This is the same condition as the one for higher information rents under information sharing.

Proof of Proposition I.10

When monitoring is high (BD borrowers are not creditworthy), welfare could increase as a result of monitoring, if the losses avoided when BD borrowers do not get a loan exceed monitoring costs.

$$\text{Welfare} = \lambda(pR-I) - (1-\lambda)I - N_{BD}(p_{BD}R-I)(1-F_u(R)) - c(\varphi - \frac{1}{2})^2$$

Under information sharing, we have that

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

Monitoring is welfare-enhancing if $c < \frac{2}{3}I(1-\lambda)\frac{\lambda(1-p)(pR-I)+(1-\lambda)I}{\lambda(1-p)(pR-I)-(1-\lambda)I}$.

Without information sharing we have:

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

Monitoring increases welfare if $c < \frac{2}{3}I(1-\lambda)(1-p)\frac{\lambda(1-p)(pR-I)+(1-\lambda)I}{\lambda(1-p)(pR-I)-(1-\lambda)I}$. (We have

a stricter condition compared to the information sharing regime).

Welfare is higher under information sharing.

$$\frac{\lambda(1-p)(\varphi^{IS}-1)(pR-I)+(1-\lambda)\varphi^{IS}I}{\lambda(1-p)\varphi^{IS}(pR-I)+(1-\lambda)(1-\varphi^{IS})I}I(1-\lambda)(2\varphi^{IS}-1)-c(\varphi^{IS}-\frac{1}{2})^2>$$
$$>\frac{\lambda(1-p)(\varphi^{NS}-1)(pR-I)+(1-\lambda)\varphi^{NS}I}{\lambda(1-p)\varphi^{NS}(pR-I)+(1-\lambda)(1-\varphi^{NS})I}I(1-\lambda)(1-p)(2\varphi^{NS}-1)-c(\varphi^{NS}-\frac{1}{2})^2$$
$$2\frac{\lambda(1-p)(\varphi^{IS}-1)(pR-I)+(1-\lambda)\varphi^{IS}I}{\lambda(1-p)\varphi^{IS}(pR-I)+(1-\lambda)(1-\varphi^{IS})I}-1>\Big(\frac{\lambda(1-p)(\varphi^{NS}-1)(pR-I)+(1-\lambda)\varphi^{NS}I}{\lambda(1-p)\varphi^{NS}(pR-I)+(1-\lambda)(1-\varphi^{NS})I}-1\Big)(1-p)^2$$

This is true since $\frac{\lambda(1-p)(\varphi-1)(pR-I)+(1-\lambda)\varphi I}{\lambda(1-p)\varphi(pR-I)+(1-\lambda)(1-\varphi)I}$ is increasing in φ.

VI Appendix B

A Dependent variables

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

Switching. Dummy variable that takes value 1 if the firm has answered "yes" to the following question: "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. We exclude those firms. q70a.

Reaction. Dummy variable based on the 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: 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)." We classify the first as a lenient reaction, and the remaining as a tough reaction. q65h.

Days. Based on the answer to the question: "How many days did it take to agree the loan with the bank from the date of application?" We use the log of the number of days in our regressions. q65f.

Cost of capital. Variable based on the answer to the following question: How problematic is cost of financing (e.g. interest rates and charges) for the operation and growth of your business?" (1 = major obstacle, 2 = moderate obstacle, 3 = minor obstacle, 4 = no obstacle). Source: q80b. We use data from both BEEPS 2002 and

BEEPS 2005.

B Firm-level variables

Source: BEEPS 2002 survey.

Soft signal (1). A variable that measures how protected the borrower is from various *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 workers' skills, their education, contract violations by customers and suppliers, corruption, among others. Each of the answers ranges from 1 to 4, where higher values stand for less obstacles (4=no obstacle, 3=minor obstacle, 2=moderate obstacle, 1=major obstacle). We take the sum of the 19 questions, and divide by 4*19. q80c to q80u.

Soft signal (2). A measure of 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, 1 point if the manager has not been fired from the previous job. We divide the sum by 4. q10 - q13.

Soft signal. The average between Soft signal (1) and Soft signal (2). Range between 0.11 and 1.

Overdue. Indicates whether the firm has overdue (more than 90 days) payments to suppliers (adds 1), employees(adds 1), utilities (adds 1), tax authorities (adds 1).

Transition firm. Dummy variable equal to 1 if the firm was established in the

years 19891993. Source: s1a.

Post-transition firm. Dummy variable equal to 1 if the firm was established after 1993. Source: s1a.

Collateralized. Based on the answer to the question whether the firm's most recent financing required collateral. Source: q65a.

State ownership. The percentage of firm owned by the state. Source: s4c1.

Foreign ownership. Percentage of firm owned by foreign company/organisation. Source: s4c3.

Asset growth. Real asset (e.g., land, buildings, machinery and equipment) percentage growth during the last three years. Source:q81b3.

Profit margin. The margin of the price over costs for the main product line. Source: q23.

Asset size. Replacement value of physical assets, categorized (e.g., up to $10.000, 10.000-19.000, 20.000-49.000, ..., 50 million or more). Source: q82bcat.

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

C Country-level variables

Source: Brown et al. (2009), based on EBRD data, except where stated otherwise.

Information Sharing. An index for the depth of information sharing. For each year between 1996 and 2000 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 the PCR/PCB distributes data which is at least 2 years old; 1 point if the threshold loan is below per capita GDP. We then take the maximum of the index for credit bureaus and public credit registers. We use 19962000 values for the 2002 BEEPS.

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.

Non-performing loans (NPL). Share of non-performing loans in total loans. Source, EBRD Transition Report.

Concentration. The fraction of deposits held by the five largest banks. Source Barth et al. (2001).

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

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

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

Table I: Means of key variables by country.

Switching is a binary indicator, equal to one if the firm has changed the main bank since 1998. *Days* is number of days the bank needed to approve the last loan of the borrower. *Reaction* is a dummy variable where 1 indicates lenient reaction by the bank to a default by the firm, and 0 shows a tough reaction. *Cost of capital* is a proxy for firms' assessment of capital cost. *Soft signal* is a score summarizing management quality and non-financial problems of firm's growth. Detailed explanations of variables are given in Appendix B.

Country	Mean Switching	Days	React	Cost of capital	Soft Signal
Albania	0.26	53.94	3.02	2.59	8.29
Armenia	0.22	24.91	2.90	2.52	11.29
Azerbaijan	0.26	21.66	2.17	2.20	12.90
Belarus	0.26	18.91	2.92	2.78	9.75
Bosnia	0.28	36.75	3.00	2.79	10.01
Bulgaria	0.30	43.69	2.97	2.88	10.17
Croatia	0.29	38.39	2.70	2.27	11.16
Czech Rep	0.12	43.22	3.03	2.53	10.68
Estonia	0.07	12.63	2.27	2.01	11.05
Georgia	0.36	23.88	2.90	2.53	9.57
Hungary	0.20	27.96	2.87	2.31	11.76
Kazakhstan	0.23	21.18	2.64	2.16	11.99
Kyrgyzstan	0.42	13.78	2.67	2.40	11.15
Latvia	0.20	17.95	2.45	2.01	10.86
Lithuania	0.23	23.63	2.54	1.99	10.61
Macedonia	0.23	33.21	2.53	2.38	10.77
Moldova	0.13	13.16	2.71	2.95	9.15
Poland	0.24	24.46	2.56	3.17	9.02
Romania	0.26	21.36	3.04	2.80	9.63
Russia	0.32	14.94	2.55	2.24	10.59
Serbia	0.44	14.30	2.67	2.78	10.43
Slovak Rep	0.25	63.22	2.95	2.58	10.04
Slovenia	0.34	24.85	2.77	2.20	12.22
Ukraine	0.31	14.79	2.77	2.62	10.08
Total	0.26	25.61	2.31	2.53	10.46

Source: BEEPS 2002.

Table II: Means of macro-level variables by country

Information sharing index adds 1 point if PCR/PCB exists for more than 3 years; 1 point if individuals and firms are covered; 1 point if both 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. The index is averaged over years 1996-2000. *Foreign Bank* is the share of banking sector assets controlled by banks with a majority foreign ownership, average taken over 1996-2000, *GDP* is the average log per capita GDP in thousands of US dollars during 1996-2000, *Creditor rights* is the creditor rights index based on Brown et al. (2009), *Concentration* is the asset share of the largest five banks, and *NPL* is log of the share of non-performing loans in total loans.

Country	Mean						
	Information Sharing	Foreign Bank	GDP	Inflation	Creditor Rights	Concent.	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, Brown et al. 2009.

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

The dependent variable is the log of number of *days* between the day of loan application until the day it was approved. *Information sharing* is an information sharing index showing the depth of information sharing in a country (Brown et al. 2009). The first column is the total sample, the second and third columns are the subsample for opaque and transparent firms (using IAS), respectively. Standard errors are adjusted for cluster effects at the country level. Sector dummies are not reported. Stars *, **, ***, indicate significance at 10, 5, 1 % respectively.

Variable	(1) All	(2) Opaque	(3) Transparent
Information sharing	0.068*	0.097**	0.043
	(0.038)	(0.042)	(0.050)
Non-performing loans	0.122	0.226	0.032
	(0.124)	(0.138)	(0.134)
Creditor rights	0.137	0.199	0.057
	(0.150)	(0.153)	(0.159)
Collateralized loan	-0.635***	-0.659***	-0.609***
	(0.077)	(0.109)	(0.124)
Transition firm	0.121	0.100	0.066
	(0.125)	(0.177)	(0.202)
Post-transition firm	-0.071	-0.185	-0.016
	(0.114)	(0.166)	(0.182)
State ownership	-0.005**	-0.003**	-0.005
	(0.002)	(0.002)	(0.004)
Foreign ownership	-0.117	-0.089	-0.153
	(0.133)	(0.169)	(0.221)
Profit margin	-0.003	-0.002	-0.004
	(0.002)	(0.003)	(0.004)
Asset growth	0.016	-0.015	0.053
	(0.066)	(0.124)	(0.082)
Asset size	0.056***	0.032	0.073**
	(0.020)	(0.025)	(0.032)
Constant	3.573***	2.916***	4.041***
	(0.791)	(0.854)	(0.933)
R^2	0.12	0.14	0.12
Number of obs.	1016	548	405

Table IV: Cross-section estimation results: *Reaction*.

The dependent variable *Reaction* is a dummy that 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) Do nothing or extend the term of the loan without changing the conditions(=1) b) Extend the term of of the loan but increase the interest rate or begin legal proceedings to take possession of some assets of the firm(=0). *Information sharing* is an information sharing index showing the depth of hard information sharing in a country (Brown et al. 2009). The first column is the total sample, the second and third columns are the subsample for opaque and transparent firms (using IAS), respectively. Standard errors are adjusted for cluster effects at the country level. Sector dummies are not reported. Stars *, **, ***, indicate significance at 10, 5, 1 % respectively.

variable	(1) All	(2) Opaque	(3) Transparent
Information sharing	0.027*	0.054***	0.005
	(0.014)	(0.013)	(0.021)
Non-performing loans	-0.005	0.023	-0.036
	(0.035)	(0.040)	(0.040)
Creditor rights	-0.012	-0.059	0.003
	(0.032)	(0.041)	(0.044)
Collateralized loan	0.154***	0.060	0.230***
	(0.029)	(0.058)	(0.051)
Transition firm	-0.013	0.006	-0.004
	(0.071)	(0.064)	(0.117)
Post-transition firm	-0.045	0.008	-0.093
	(0.058)	(0.061)	(0.084)
State ownership	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
Foreign ownership	-0.036	-0.026	-0.095
	(0.053)	(0.067)	(0.076)
Profit margin	-0.003**	-0.004***	-0.002
	(0.001)	(0.001)	(0.002)
Asset growth	0.045	0.041	0.046
	(0.034)	(0.041)	(0.049)
Asset size	0.010*	0.017**	0.002
	(0.005)	(0.007)	(0.009)
Constant	-0.071	0.304	0.019
	(0.148)	(0.311)	(0.416)
R^2	0.06	0.06	0.09
Number of obs.	977	513	402

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

The dependent variable *Switching* equals 1 if the firm replies "yes" to the question: Has your firm changed its main bank (the single bank with which your firm has the closest relationship)?. *Soft signal* is a proxy for the good or bad soft signal about the firm and summarizes management quality and non-financial problems. It has values on $[0; 1]$. Higher values of *Soft signal* indicate a likely good signal. *Information sharing* is an information sharing index showing the depth of information sharing in a country (Brown et al. 2009). 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)	(2)	(3)
	All	Opaque	Transparent
Soft signal	-0.640***	-0.888**	-0.413
	(0.242)	(0.357)	(0.401)
Information sharing	0.057	0.059*	0.038
	(0.044)	(0.032)	(0.081)
Information sharing×Overdue	0.017	0.013	0.018
	(0.040)	(0.043)	(0.061)
Overdue payments	0.140***	0.146**	0.147**
	(0.040)	(0.062)	(0.071)
Non performing loans	0.017	0.024	0.015
	(0.059)	(0.066)	(0.089)
Creditor rights	-0.091*	0.041	-0.295***
	(0.051)	(0.048)	(0.105)
Concentration	-0.012***	-0.009***	-0.011*
	(0.004)	(0.003)	(0.006)
Foreign bank share	-0.262	-0.161	-0.484
	(0.217)	(0.253)	(0.347)
Collateralized	0.150***	0.146*	0.153*
	(0.049)	(0.077)	(0.087)
Post transition firm	-0.184*	-0.152	-0.206
	(0.103)	(0.137)	(0.156)
Transition firm	-0.069	-0.019	-0.058
	(0.112)	(0.179)	(0.212)
State ownership	-0.151	-0.082	-0.131
	(0.127)	(0.193)	(0.175)
Foreign ownership	0.281**	0.236	0.340***
	(0.130)	(0.287)	(0.132)
Profit margin	-0.001	-0.003	0.005
	(0.003)	(0.003)	(0.004)
Asset growth	0.023	0.156*	-0.044
	(0.047)	(0.086)	(0.060)
Asset size	0.002	-0.002	0.006
	(0.017)	(0.021)	(0.021)
Constant	0.584	0.136	1.038
	(0.437)	(0.517)	(0.708)
Pseudo R^2	0.04	0.04	0.08
Number of obs.	1604	849	671

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

Soft signal is a proxy for the good or bad soft signal about the firm and summarizes management quality and non-financial problems. It has values on $[0; 1]$. Higher values of *Soft signal* indicate a likely good signal. *Information sharing* is an information sharing index showing the depth of information sharing in a country (Brown et al. 2009). Regressions are based on OLS estimation. Sector dummies are 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) Opaque	(3) Transparent
Soft signal	-1.824***	-1.571***	-1.991***
	(0.151)	(0.193)	(0.183)
Information sharing	-0.013	0.018	-0.059
	(0.038)	(0.038)	(0.046)
Information sharing×Overdue	0.034	0.060*	-0.053
	(0.026)	(0.035)	(0.038)
Overdue payments	0.139***	0.124	0.160***
	(0.039)	(0.077)	(0.040)
Non performing loan	0.073	0.108**	0.022
	(0.043)	(0.048)	(0.046)
Creditor rights	0.028	-0.070	0.135*
	(0.069)	(0.075)	(0.070)
Concentration	-0.012***	-0.016***	-0.006*
	(0.003)	(0.004)	(0.003)
Foreign bank share	0.677***	0.948***	0.268
	(0.173)	(0.209)	(0.234)
GDP	-0.052	-0.069	-0.100*
	(0.055)	(0.062)	(0.052)
Inflation	0.003***	0.004***	0.003*
	(0.001)	(0.001)	(0.001)
Collateralized	-0.049*	-0.015	-0.054
	(0.026)	(0.038)	(0.056)
Post-transition firm	-0.049	0.019	-0.073
	(0.082)	(0.127)	(0.096)
Transition firm	0.023	0.004	0.048
	(0.110)	(0.152)	(0.128)
State ownership	-0.152	-0.051	-0.236
	(0.141)	(0.162)	(0.203)
Foreign ownership	-0.114	-0.061	-0.086
	(0.094)	(0.149)	(0.132)
Profit margin	0.001	0.003	-0.004
	(0.003)	(0.003)	(0.003)
Asset growth	-0.147**	-0.173**	-0.155**
	(0.054)	(0.073)	(0.067)
Asset size	0.007	-0.011	0.032
	(0.016)	(0.022)	(0.021)
Constant	4.012***	4.071***	3.860***
	(0.466)	(0.503)	(0.522)
Pseudo R^2	0.15	0.13	0.21
Number of obs.	1680	913	679

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

Soft signal is a proxy for the good or bad soft signal about the firm and summarizes non-financial problems. It has values on $[0; 1]$. Higher values of *Soft signal* indicate a likely good signal. *Information sharing* is an information sharing index showing the depth of information sharing in a country (Brown et al. 2009). Results are based on data from BEEPS 2002 and 2005 and use firm fixed effects. 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) Opaque	(3) Transparent
Soft signal (1)	-2.970***	-2.971***	-3.150***
	(0.257)	(0.419)	(0.585)
Information sharing	-0.157*	-0.125	0.259
	(0.085)	(0.115)	(0.262)
Information sharing × Overdue	-0.004	-0.006	-0.060
	(0.044)	(0.122)	(0.091)
Overdue payments	0.105	-0.018	0.174
	(0.097)	(0.158)	(0.199)
Non-performing loans	-0.094	0.002	-0.291
	(0.084)	(0.107)	(0.275)
Creditor rights	-0.014	-0.586	-0.133
	(0.175)	(0.410)	(0.747)
Foreign bank share	0.427	0.525	-3.469
	(0.595)	(1.575)	(2.200)
GDP	0.608	0.908	-1.461
	(0.465)	(0.628)	(1.274)
Inflation	0.004	0.001	-0.022
	(0.002)	(0.005)	(0.016)
Const.	3.638***	4.429***	7.299**
	(0.738)	(1.551)	(2.876)
R-squared	0.145	0.162	0.197
Number of obs.	1941	1172	629