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Information sharing and credit: Firm-level evidence from transition countries

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ABSTRACT

We investigate whether information sharing among banks has affected credit market performance in the transition countries of Eastern Europe and the former Soviet Union, using a large sample of firm-level data. Our estimates show that information sharing is associated with improved availability and lower cost of credit to firms. This correlation is stronger for opaque firms than transparent ones and stronger in countries with weak legal environments than in those with strong legal environments. In cross-sectional estimates, we control for variation in country-level aggregate variables that may affect credit, by examining the differential impact of information sharing across firm types. In panel estimates, we also control for the presence of unobserved heterogeneity at the firm level, as well as for changes in macroeconomic variables and the legal environment.

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1. Introduction

When a bank evaluates a request for credit, it can either collect information on the applicant first-hand or source this information from other lenders who already dealt with the applicant. Information exchange between lenders can occur voluntarily via “private credit bureaus” or be enforced by regulation via “public credit registries,” and is arguably an important determinant of credit market performance. Theory suggests that information sharing may overcome adverse selection in the

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credit market (Pagano and Jappelli, 1993) and reduce moral hazard, by raising borrowers' effort to repay loans (Padilla and Pagano, 2000) or by avoiding excessive lending when each borrower may patronize several banks (Bennardo et al., 2007). While information sharing should improve credit allocation, this does not necessarily imply that aggregate credit volume will rise or default ratios will fall. Information sharing may change the composition of households and firms which receive loans, so that its predicted impact on aggregate credit and credit risk is ambiguous. A proper empirical test of the impact of credit bureaus or credit registries should therefore rely on information regarding borrower-level credit access.

Information sharing should be particularly relevant for credit market performance in countries with weak company law and creditor rights. Lack of transparency in corporate reporting, due to weak company law, increases information asymmetries in the borrower-lender relationship, reducing incentives for banks to lend. Moreover, weak creditor rights make banks more reluctant to lend to risky firms, as contract enforcement is costly or impossible. The screening and incentive effects of information sharing can mitigate both of these problems. Indeed, recent cross-country data suggests that information sharing may be a substitute for better creditor protection in fostering credit market expansion (Djankov et al., 2007). In this paper we attempt to shed light on the role of information sharing in countries with weak company law and creditor rights. We analyze the impact of private credit bureaus and public credit registries on the availability and cost of credit to firms in 24 transition countries of Eastern Europe and the former Soviet Union.¹ Pistor et al. (2000) document that in these countries the legal environment is particularly unfavorable for lending. Moreover, transition countries are an interesting sample to study because some of them have recently experienced both strong credit market development and considerable institutional change, including the introduction of information sharing systems. Private sector credit has climbed from just 15% of GDP in 1999 to 25% at the end of 2004.² The quality of lending has also strongly improved, with the ratio of non-performing loans in banks' portfolios falling from more than 20% in 1999 to just 10% at the end of 2004. Over the same period, seven public registries and seven private credit bureaus have emerged in these countries.

To measure credit market performance, we use firm-level data on credit access and cost of credit, drawn from the EBRD/World Bank "Business Environment and Enterprise Performance Survey" (BEEPS), a representative and large sample of firms. We relate this firm-level credit data to country-level indicators of information sharing, compiled from the "Doing Business" database of the World Bank/IFC (World Bank, 2006).

There are two main benefits from investigating the impact of information sharing using our data set. First, firm-level data allow us to identify the firms that benefit more from information sharing arrangements. For instance, firms that are opaque and costly to screen may gain greater access to credit after the introduction of a credit registry or bureau. We can thus overcome the limitations of aggregate data, which confound the effect of information sharing on individual firms with that arising from compositional changes in the set of firms who obtain credit. The second reason for using the BEEPS data is methodological: it allows us to control for unobserved heterogeneity at the firm level, changes in macroeconomic variables and changes in the legal environment, using panel data constructed from the 2002 and 2005 surveys. As far as we are aware, this is the first study to use firm-level panel data to investigate the relation between information sharing and credit availability. Previous analyses are either based on country-level data (Jappelli and Pagano, 2002; Djankov et al., 2007) or on cross-sectional firm-level data (Galindo and Miller, 2001; Love and Mylenko, 2003).

Both our cross-sectional estimates and our panel estimates show that on average information sharing is associated with more abundant and cheaper credit. In particular, the cross-sectional correlation between credit availability and information sharing is stronger for opaque firms than transparent ones, where transparency is defined as the reliance on external auditors and the adoption of international

¹ We examine data from 24 transition countries, which we classify into three groups according to their status in 2005: European Union (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, Slovenia); Commonwealth of Independent States (Armenia, Azerbaijan, Belarus Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Ukraine); Other European Countries (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Romania, Serbia and Montenegro). We exclude the CIS countries Tajikistan, Turkmenistan and Uzbekistan due to lack of data.

² The statistics in this paragraph are unweighted country averages, drawn from the *EBRD Transition Report* (EBRD, 2003, 2005).

accounting standards. Moreover, our panel estimates suggest that in countries with worse protection of creditor rights information sharing improves both credit access and loan contract terms, whereas it does not in countries with good creditor protection. Taken together, these two results are consistent with the view that information sharing is particularly valuable in settings where the contracting environment is unfavorable to lending activity, either because low accounting transparency increase the cost of screening potential borrowers or because poor legal protection makes loan contracts hard to enforce.

The rest of the paper is organized as follows. Section 2 provides a literature review and presents the hypotheses to be tested. Section 3 describes the data and the specification to be estimated. Sections 4 and 5 present the results obtained with cross-sectional and panel data, respectively. Section 6 summarizes our findings.

2. Effects of information sharing

In this section we review the models proposed in the literature to capture the effects of information sharing on credit market performance, using them to draw testable predictions for our empirical analysis. We also set our work against the existing empirical evidence in this area, to highlight our contribution to the literature.

2.1. Theory

By exchanging information about their customers, banks can improve their knowledge of applicants' characteristics, past behavior and current debt exposure. In principle, this reduction of informational asymmetries can reduce adverse selection problems in lending, as well as change borrowers' incentives to repay, both directly and by changing the competitiveness of the credit market. It can also reduce each bank's uncertainty about the total exposure of the borrower, in the context of multiple-bank lending. The implied effects on lending, interest rates and default rates have been modeled in several ways.³

Pagano and Jappelli (1993) show that information sharing reduces adverse selection by improving bank's information on credit applicants. In their model, each bank has private information about local credit applicants, but no information about non-local applicants. If banks exchange information about their client's credit worthiness, they can assess also the quality of non-local credit seekers, and lend to them as safely as they do with local clients. The impact of information sharing on aggregate lending in this model is ambiguous. When banks exchange information about borrowers' types, the increase in lending to safe borrowers may fail to compensate for an eventual reduction in lending to risky types.

Information sharing can also create incentives for borrowers to perform in line with banks' interests. Klein (1992) shows that information sharing can motivate borrowers to repay loans, when the legal environment makes it difficult for banks to enforce credit contracts. In this model borrowers repay their loans because they know that defaulters will be blacklisted, reducing external finance in future. Vercammen (1995) and Padilla and Pagano (2000) show that if banks exchange information on defaults, borrowers are motivated to exert more effort in their projects. In both models, default is a signal of bad quality for outside banks and carries the penalty of higher interest rates, or no future access to credit.

Information sharing may also mitigate hold-up problems in lending relationships, which arise when banks have or generate private information about firms (Sharpe, 1990; von Thadden, 2004). Credit reports improve the information available to "outside banks," and thus reduce the informational rents that "inside banks" can extract. Padilla and Pagano (1997) show that by reducing bank's bargaining power in credit relationships, information sharing can elicit higher effort to repay by borrowers,

³ See Jappelli and Pagano (2006) for a comprehensive overview of theory and evidence on information sharing.

which in turn makes banks willing to lower lending rates and extend more credit.⁴ However, the increase in competition between banks due to information sharing may also reduce credit availability, especially for new businesses. Petersen and Rajan (1995) argue that banks with market power are in a better position to conduct intertemporal cross-subsidization in lending relationships, and are thus more likely to lend to risky young firms. The available empirical evidence on the impact of credit market competition on credit access for young and small businesses is ambiguous (see e.g. Petersen and Rajan, 1995; Zarutskie, 2006), suggesting that an increase in competition due to information sharing may cut either way.

Finally, when a customer can borrow from several banks, he may have both the incentive and the opportunity to take so much credit as to end up in default: banks may be ready to extend additional credit to already indebted people, by charging them high interest rates and expecting to recover their money at the expense of other lenders in case of default. Bennardo et al. (2007) show that this negative contractual externality in the provision of credit can induce banks to ration credit, for fear that the customer's total exposure may become so large as to induce default. However, when banks share information about their seniority or/and about their loan sizes, lending becomes safer, and the occurrence of credit rationing is reduced. Since credit rationing equilibria arise if creditor rights protection is weak and borrowers' future wealth is risky, these are also the circumstances where information sharing should be particularly valuable in reducing credit rationing and defaults.

Given the variety of the informational problems considered in these models, it is not surprising that the predicted effects of information sharing on the volume of lending are not identical across models. For instance, in the adverse selection model of Pagano and Jappelli (1993) the effect on lending is ambiguous, while it is positive in the hold-up model of Padilla and Pagano (1997) and in the multiple-bank lending model of Bennardo et al. (2007). The effect on lending also depends on the type of information being shared: in the model by Padilla and Pagano (2000), sharing only default information increases lending above the level reached when banks also share their data about borrowers' characteristics. Therefore, whether information sharing is associated with increased lending is left to the empirical evidence.

In contrast, these models offer qualitatively similar predictions about the effect of information sharing on the probability of default and interest rates: they all predict that, in one form or another, communication among banks tends to reduce defaults and thereby equilibrium interest rates. But this prediction is unambiguous only if referred to the probability of default of an individual borrower. When one considers the average default rate, composition effects may overturn the prediction. Suppose that information sharing gives lower-grade borrowers access to credit. Even if each borrower's probability of default is reduced, the aggregate default rate may increase because the relative weight of lower-grade borrowers increases in the total pool. This biases the estimates against the models' prediction that information sharing reduces defaults and interest rates. Thus, here is an instance where borrower-level data may have an edge over aggregate measures in empirical research. Being free of these composition effects, microeconomic data allow a sharper test of this prediction.

Which firms should benefit more from information sharing between lenders? The stylized models discussed so far offer no predictions about how information sharing affects credit availability and interest rates depending on borrowers' characteristics, such as firm size or accounting transparency. But such predictions can be generated by considering how these characteristics affect the banks' incentive to rely on information sharing rather than on direct screening. If direct screening has fixed costs for banks, one may expect that small firms will benefit more from information sharing. Without information sharing, banks would only lend to large firms, for whom direct screening is warranted; but with information sharing, banks can also offer credit to small firms. A firm's transparency—as measured for instance by reliance on international accounting standards or external auditors—plays a similar role: direct screening is more cost-effective when applied to firms with more transparent accounts, so that without information sharing these firms are more likely to get credit than opaque ones. The

⁴ Bouckaert and Degryse (2004) and Gehrig and Stenbacka (2007) show that if banks compete ex ante for clients and customers face switching costs, future informational rents foster banking competition. Since information sharing reduces these rents, in these models it reduces competition, in contrast to Padilla and Pagano (1997).

introduction of information sharing will enable banks to lend more easily also to opaque firms, by relying on non-accounting information from previous creditors.

The models discussed above also suggest that the impact of information sharing on firm credit depends on a country's legal system. Specifically, its impact should be stronger where laws do not require accurate financial reporting and auditing (thereby increasing adverse selection problems), and creditors rights are poorly protected (thus encouraging borrowers' opportunistic behavior). Indeed many empirical studies confirm that these characteristics of the legal system are associated with reduced access to credit (La Porta et al., 1997; Levine, 1998; Jappelli et al., 2005) and more expensive credit (Demirguc-Kunt et al., 2004; Laeven and Majnoni, 2005).

This discussion suggests that, besides investigating the effect of information sharing on the availability and cost of credit for a typical firm, our empirical analysis should also examine whether and how this effect differs depending on firms' size, their transparency, and the legal environment in which a firm operates.

2.2. Empirical evidence

A growing body of empirical evidence supports the hypothesis that information sharing enhances credit market performance. Analyses of credit bureau data confirm that credit reporting reduces the selection costs of lenders by allowing them to more accurately predict individual loan defaults (Barron and Staten, 2003; Kallberg and Udell, 2003; Powell et al., 2004; Luoto et al., 2007). Experimental evidence by Brown and Zehnder (2007) shows that a public credit registry can motivate borrowers to repay loans, when they would otherwise default.

The impact of information sharing on aggregate credit market performance has been tested by two cross-country studies. Based on their own survey of credit reporting in 43 countries, Jappelli and Pagano (2002) show that bank lending to the private sector is larger and default rates are lower in countries where information sharing is more solidly established and extensive. These cross-sectional relations persist also controlling for other economic and institutional determinants of bank lending, such as country size, GDP, growth rate, and variables capturing respect for the law and protection of creditor rights. Djankov et al. (2007) confirm that private sector credit relative to GDP is positively correlated with information sharing in their recent study of credit market performance and institutional arrangements in 129 countries for the period 1978–2003.

Firm-level data suggest that information sharing may indeed have a differential impact on credit availability for different firm types. Love and Mylenko (2003) combine cross-sectional firm-level data from the 1999 World Business Environment Survey with aggregate data on private and public registries collected in Miller (2003). They find that private credit bureaus are associated with lower perceived financing constraints and a higher share of bank financing (while public credit registries are not), and that these correlations are particularly strong for small and young firms.⁵ Our cross sectional analysis provides additional evidence on the differential impact of information sharing by firm type. In particular we show that, in line with the above discussion, information sharing benefits opaque firms more than transparent ones. But our main contribution is to investigate whether these cross-sectional findings are confirmed when the estimation is carried out on firm-level panel-data. Cross-sectional estimates, such as those by Love and Mylenko (2003), cannot disentangle the effect of information sharing from that of unobserved firm-level characteristics and of other country-level institutional factors. By also relying on panel data, our paper provides the first test that controls both for unobserved firm-level heterogeneity and for changes in other relevant country-level variables. Controlling for the latter is especially important in the context of the rapid institutional and economic changes experienced by transition economies.

⁵ Galindo and Miller (2001) also provide evidence that information sharing reduces credit constraints at firm level. Examining balance sheet data of large companies in 23 countries they find a positive relation between credit access and an index of information sharing.

3. 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 on credit availability taken from the EBRD/World Bank Business Environment and Enterprise Performance Survey (BEEPS).

3.1. Information sharing

Between 1991 and 2005 information sharing institutions were established in 17 of the 27 transition countries in Eastern Europe and the former Soviet Union. Table 1 provides an overview of public credit registries (Panel A) and private credit bureaus (Panel B) in 24 transition countries at the end of 2005. The main sources of this data are the “Doing Business” surveys, conducted by the World Bank/IFC (World Bank, 2006). We complement this data with information from our own research.⁶ Table 1 shows that public registries (PCRs) and private bureaus (PCBs) are much more frequent in EU transition countries than in CIS countries.⁷ Indeed today all of the eight EU transition countries have an active PCR, PCB, or both. In contrast, only three of the nine covered CIS countries have an operating PCR or PCB. The situation is intermediate in other non-EU countries, where in 2004 five out of eight feature a PCR, a PCB or both.

In transition countries it is more common to observe either a PCR or a PCB than both of them. In Table 1, thirteen countries have either a PCR or a PCB, and only four have both. Public registries in transition countries tend to cover larger loans than private bureaus.⁸ Panel A shows that seven of the twelve public credit registries only cover loans which exceed per capita GDP in their country. Further, while all public credit registries cover loans to firms, three do not cover loans to private individuals. In contrast, PCBs tend to focus on credit to private individuals and cover even smallest loans. Panel B shows that all nine private credit bureaus cover loans to private individuals, while four of them do not cover loans to firms.

Based on Table 1, we construct an information sharing index for each country and year between 1996 and 2004. The index measures the presence and structure of public credit registries and private credit bureaus on a scale of 1 to 5. It is constructed as the maximum of two scores, one for PCRs and one for PCBs.⁹ The PCR score adds one point for fulfilling each of the following five criteria:

- (i) both firms and individuals are covered,
- (ii) positive and negative data is collected and distributed,
- (iii) the registry distributed data which is at least two years old,
- (iv) the threshold for included loans is below per capita GDP, and
- (v) the registry has existed for more than 3 years.¹⁰

The PCB score is computed in a similar way.

Fig. 1 plots the average information index from 1996 to 2004, as well as the PCR and PCB scores. The figure highlights that the early years of transition were marked by slow emergence of information sharing institutions, driven by the creation of public registries: prior to 2000 only six PCR were set up, while only two private credit bureaus emerged.¹¹ Information sharing activity accelerated after 2001,

⁶ The characteristics of the public credit registry in Kazakhstan were provided to us via questionnaire by the National Bank of Kazakhstan and the Agency of the Republic of Kazakhstan on regulation and supervision of financial markets and organizations.

⁷ See footnote 1 for the CIS countries included in our sample.

⁸ This confirms the findings of Miller (2003) for a predominantly Latin American sample.

⁹ Computing the information sharing index as the sum of the two scores (instead of the maximum) does not change the qualitative results of the estimation.

¹⁰ Our information sharing index is similar to the “Credit Information Index” reported in the “Doing Business” data of the World Bank / IFC, although differently from that index we do not consider the right of borrowers to access their credit record.

¹¹ In 1996 Belarus also introduced a public credit registry. However, the main purpose of this registry is to support bank supervision. We therefore do not list it as a public credit registry in our data.

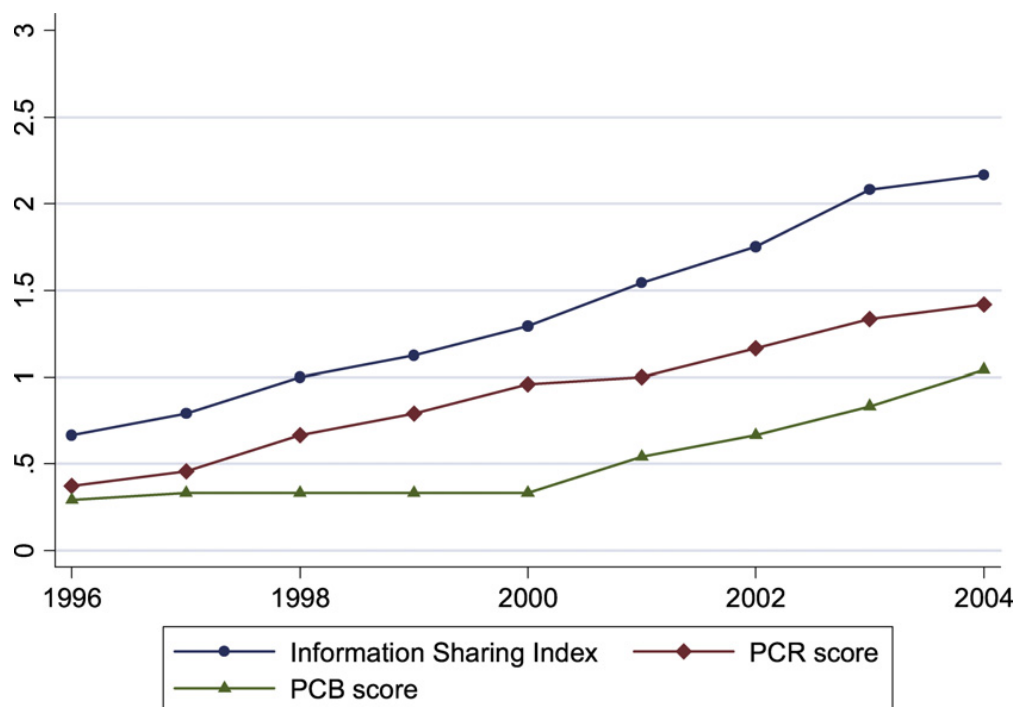
Table 1

	Start of operations	Individuals covered	Firms covered	Negative information	Positive information	Threshold	History
Panel A. Public Credit Registries in Transition Countries							
Albania							
Armenia	2003	x	x	x	x	240	
Azerbaijan	2005	x	x	x	x	107	x
Belarus							
Bosnia							
Bulgaria	1999	x	x	x	x	208	
Croatia							
Czech Rep.	2002		x	x	x	0	x
Estonia							
Georgia							
Hungary							
Kazakhstan	1996	x	x	x	x	140	x
Kyrgyz Rep.							
Latvia	2003	x	x	x		0	x
Lithuania	1995	x	x	x	x	86	x
Macedonia	1998	x	x	x	x	118	x
Moldova							
Poland							
Romania	2000	x	x	x	x	187	x
Russia							
Serbia	2002	x	x		x	2995	
Slovak Rep.	1997		x	x	x	0	
Slovenia	1994		x	x	x	0	x
Ukraine							
Panel B. Private Credit Bureaus in Transition Countries							
Albania							
Armenia	**						
Azerbaijan							
Belarus							
Bosnia	2001	x	x	x	x	0	x
Bulgaria	**						
Croatia	**						
Czech Rep.	2002	x	x	x	x	0	x
Estonia	1993	x	x	x		1	x
Georgia							
Hungary	1995	x	x	x	x	0	x
Kazakhstan	**						
Kyrgyz Rep.	2003	x		x	x	0	x
Latvia							
Lithuania	2004	x	x	x		0	
Macedonia							
Moldova							
Poland	2001	x		x	x	0	x
Romania	2004	x		x		0	x
Russia	**						
Serbia	**						
Slovak Rep.	2004	x		x	x	0	x
Slovenia							
Ukraine							

Start of operations is the year in which the public credit registry (PCR) started distributing credit records. *Individuals covered* is marked x if the PCR covers private individuals, and blank otherwise. *Firms covered* is marked x if the PCR covers firms, and blank otherwise. *Negative information* is marked x if the PCR collects and distributes negative information, and blank otherwise. *Positive information* is marked x if the PCR collects and distributes positive information, and blank otherwise. *Threshold* is the minimum loan size covered by the PCR as percentage of GDP per capita. *History* is marked x if credit reports provide information for more than the most recent 2 years, and blank otherwise.

Source: *Doing Business in 2006* (World Bank, 2006); National Bank of Kazakhstan.

** Private credit bureau is under construction.



Values reported in the figure are unweighted averages of the Information Sharing index and the PCR (public credit registry) and PCB (private credit bureau) scores for the 24 transition countries listed in Table 1. In each country/year, the information sharing index is the maximum of the corresponding PCB and PCR scores.

Fig. 1. Information sharing in transition countries over time.

and also private arrangements started to appear: five public credit registries and seven private credit bureaus were established. This fast development appears set to continue in the coming years, with private credit bureaus currently under construction in at least seven more countries.¹² Due to the limited number of private credit bureaus in our sample, especially prior to 2000, we do not attempt to compare the relative impact of public registries and private bureaus in this paper.

3.2. Credit access

We relate our information sharing index to firm-level data on credit access taken from the Business Environment and Enterprise Performance Survey (BEEPS). The EBRD and the World Bank conducted this survey jointly in 1999, 2002 and 2005. Our cross-sectional analysis is based on data from BEEPS 2002, as this survey version contains the most detailed information about firm's access to credit, and relevant characteristics of firms' governance and management.¹³ The BEEPS 2002 provides data on 6153 firms in 26 transition countries and covers a representative sample of firms for each of these countries.¹⁴ We drop all observations from Uzbekistan and Tajikistan, due to lack of institutional indicators for these countries. This leaves us with a sample of 5717 firms from 24 countries for our cross-sectional analysis. Our panel analysis is based on responses of 1333 firms who participated in both the 2002 and 2005 surveys. In the following we provide a discussion of the data used in our cross-sectional analysis. Information on the panel sample is provided in Section 5.

¹² In, Armenia, Bulgaria, Croatia, Kazakhstan, Russia, and Serbia projects to establish private credit bureaus have been initiated, but these were not operating by the end of 2005.

¹³ The 2002 survey contains information about a firm's debt-asset ratio as well as the experience of its manager. This information is not available from the more recent 2005 survey version.

¹⁴ The survey covers all countries in which the EBRD is operational, with the exception of Turkmenistan. See Fries et al. (2003) for a detailed description of the BEEPS 2002 survey.

Table 2

Access to finance, cost of finance and firm debt. Sample means

Country	Access to finance	Cost of finance	Firm debt	Observations
Albania	1.93	1.41	19.84	170
Armenia	1.66	1.48	4.23	171
Azerbaijan	1.84	1.80	3.45	170
Belarus	1.53	1.22	7.94	250
Bosnia	1.48	1.21	12.95	182
Bulgaria	1.20	1.12	12.87	250
Croatia	1.82	1.73	14.75	187
Czech Rep.	1.55	1.47	8.37	268
Estonia	2.06	1.99	14.77	170
Georgia	1.79	1.47	6.76	174
Hungary	1.78	1.69	9.82	250
Kazakhstan	2.00	1.84	7.64	250
Kyrgyz Rep.	1.76	1.60	12.26	173
Latvia	2.15	1.99	10.33	176
Lithuania	2.38	2.01	13.60	200
Macedonia	1.92	1.62	6.45	170
Moldova	1.51	1.05	6.84	174
Poland	1.35	0.83	7.76	500
Romania	1.45	1.20	10.86	255
Russia	1.69	1.76	5.03	506
Serbia	1.57	1.22	10.59	250
Slovak Rep.	1.50	1.42	15.35	170
Slovenia	2.18	1.80	12.95	188
Ukraine	1.56	1.38	4.53	463
Total	1.69	1.47	9.31	5717

Access to finance is the answer to the question: “How problematic is access to finance for the operation and growth of your business?” (1 = major obstacle, 2 = moderate obstacle, 3 = minor obstacle, 4 = no obstacle). *Cost of finance* is the answer to the question: “How problematic is the cost of finance (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). *Firm debt* is debt as a percentage of total assets in 2001.

Source: BEEPS 2002.

For our cross-sectional analysis we use three indicators of firms’ credit access available from the BEEPS 2002 survey. Two indicators capture the extent to which access to loans and the cost of credit constrain firm growth, while a third indicator captures firms’ actual use of external finance. In two separate questions, firms were asked how problematic the access to financing (as determined by collateral requirements and credit availability) and the costs of financing (interest rates and charges) are for the operation and growth of their business. We code answers to these questions on a scale from 1 to 4 (1 = major obstacle, 2 = moderate obstacle, 3 = minor obstacles, 4 = no obstacles) and form our dependent variables *Access to finance* and *Cost of finance*.¹⁵ Therefore, higher values of these two variables indicate an improvement in the terms at which credit is available: easier access and lower cost. Besides looking at how financing conditions affect firm performance, we also analyze firms’ actual reliance on external finance. To this purpose, we rely on the variable *Firm debt*, which measures a firm’s total debt as a percentage of its total assets. Table 2 provides summary statistics for the three dependent variables in our cross-sectional analysis by country. Definitions and sources of all dependent variables are provided in Appendix A.

3.3. Regression specification

We start our empirical analysis with cross-sectional regressions using the BEEPS 2002 survey data. The baseline specification relates each of our three dependent variables for firm *i* in country *j* to the

¹⁵ Our coding is opposite to that used in the original BEEPS questionnaire, where 4 = major obstacle, 3 = moderate obstacle, 2 = minor obstacles, 1 = no obstacles. This obviously affects only the sign of our coefficient estimates, not their absolute magnitude or precision.

information sharing index in the firm's country, a vector of other country characteristics, and a vector of firm characteristics that may affect credit access. Our dependent variables were collected during 2002, while information sharing is measured as the average value of the index prior to the survey, i.e. 1996–2000. The fact that we relate firm-level credit indicators to countrywide measures of *Information sharing* and that information sharing is predetermined with respect to credit variables should address the potential endogeneity of information sharing with respect to credit market performance.

We include five 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, an indicator of the ease of contract enforcement, a measure of foreign bank presence, per capita GDP, and the inflation rate. Including these variables is particularly important in transition countries, where structural and macroeconomic reforms have coincided with the emergence of information sharing, and may also have affected credit market performance. The *Creditor rights* variable is an aggregate measure of creditor legal protection built with the methodology proposed by La Porta et al. (1998). Higher values of this index imply that secured lenders are better protected in case a borrower defaults.¹⁶ Evidence by Pistor et al. (2000) suggests that transition countries with better creditor protection feature higher credit market performance. However, they also emphasize that not only the law on the books matters for credit market development, but also its actual enforcement. As a measure of actual creditor protection, we also include the variable *Time to enforce payment*, which measures the (log of the) number of days it takes for a creditor to secure an outstanding payment through the courts if a debtor defaults. This variable is taken from the World Bank/IFC “Doing Business” database.¹⁷ The *Foreign bank assets* variable is the share of assets controlled by foreign owned banks in each country. Recent evidence suggests that foreign bank entry has improved credit market performance in transition countries, reducing intermediation spreads (Bonin et al., 2005) and facilitating credit access (Giannetti and Ongena, in press), although the benefits from foreign bank presence appear to depend strongly on firm size (Detragiache et al., in press). Moreover, foreign bank presence may coincide with information sharing, if these banks are familiar with the benefits of credit reports from their home markets, and therefore tend to patronize private credit bureaus also in their host countries. Finally, we include two controls for country-specific macroeconomic performance (log *Per capita GDP* and *Inflation*), as previous evidence suggests that macroeconomic stabilization is associated with an expansion in financial intermediation in transition countries (Fries and Taci, 2002).¹⁸

Table 3 provides summary statistics for our country-level explanatory variables, including the information sharing index. Definitions and sources of all control variables are provided in Appendix A. The table documents strong variation in institutional and macroeconomic indicators. For example, the creditor rights index ranges from 1 for Hungary and Poland to 3 in Croatia and the Czech Republic. Payment enforcement requires roughly 150 days in Lithuania and Estonia, while it takes over 900 days in Poland and Slovenia. Macroeconomic conditions also range from low inflation (below 2% in Albania, Armenia, Azerbaijan, Bosnia, and Lithuania) to hyperinflation (above 100% in Belarus). Most countries with developed information sharing systems (e.g. Czech Republic and Estonia) also display relatively high levels of institutional reform and macroeconomic stability. This confirms the importance of controlling for these country-level variables, in order to identify the specific role of information sharing.

We include seven firm-level explanatory variables to control for the variation in credit risk and financing requirements across firms. It is customary to regard larger firms as less risky, other things equal. We distinguish small firms from large ones by their number of employees (*Small firm* = 1 – 49, *Large firm* ≥ 50). It is also customary to regard younger firms as more risky than older firms. However, in transition countries firm age also determines the economic regime under which the firm emerged. Thus, while older firms may be less risky in general, they may be riskier in transition countries,

¹⁶ We draw yearly measures of this creditor rights index for our sample for the years 1996–2003 from Djankov et al. (2007). In the cross-sectional estimation, we use the 1996–2000 average of this index. For Estonia we use the 1998 value taken from Pistor et al. (2000).

¹⁷ As the variable *Time to enforce payment* is taken from the Doing Business database it is available from 2003–2007 only, in the cross-sectional analysis we take the 2005 indicator.

¹⁸ For both macroeconomic variables we take the 2000 values to avoid using the extraordinary macroeconomic data from the 1998 and 1999 period in which the Russian crisis took place.

Table 3

Country-level explanatory variables. Sample means

Country	Information sharing (1–5)	Creditor rights (0–4)	Time to enforce payment (days)	Foreign bank assets (%)	Per capita GDP (1000 \$)	Inflation (%)
Albania	0	3	390	27.1	1.2	0.1
Armenia	0	2	185	44.9	0.6	−0.8
Azerbaijan	0	3	267	4.4	0.6	1.8
Belarus	0	2	225	3.6	0.8	168.6
Bosnia	0	3	330	12.7	1.2	1.9
Bulgaria	0.8	1.5	440	59.1	1.6	10.3
Croatia	0	3	415	62.2	4.2	5.3
Czech Rep	0	3	290	51.9	5.5	3.9
Estonia	4	3	150	93.6	4.0	4.0
Georgia	0	2	375	16.8	0.7	4.1
Hungary	3.8	1	365	64.5	4.5	9.8
Kazakhstan	3.6	3	380	19.8	1.2	18.7
Kyrgyzstan	0	3	492	20.6	0.3	13.2
Latvia	0	3	186	74.2	3.2	2.7
Lithuania	4.6	2	154	45.9	3.3	1.0
Macedonia	2	3	509	32.5	1.8	6.6
Moldova	0	2	340	37.1	0.3	31.3
Poland	0	1	980	61.0	4.5	10.1
Romania	0.6	2	335	45.2	1.4	45.7
Russia	0	1	330	10.1	1.8	20.8
Serbia	0	3	635	0.5	1.0	8.8
Slovak Rep	1.2	2	565	33.4	3.7	60.4
Slovenia	2.8	2	913	10.1	9.5	12.0
Ukraine	0	2	269	10.8	0.6	28.2
Total	0.9	2.1	418	33.9	2.42	21.0

The table reports the country-level explanatory variables used in the cross-sectional analysis. See [Appendix A](#) for a detailed description of the variables. For ease of interpretation, the variable *Time to enforce payment* shown in this table is the actual number of days rather than the log of this indicator used in our regression analysis. Likewise, we display *Per capita GDP* in thousands of US dollars, rather than the log of this figure used in the regressions.

because they emerged during the pre-transition or transition phase. Rather than controlling simply for firm age, we therefore distinguish firms by three categories depending on whether they were established before 1989 (*Pre-transition firm*), between 1989 and 1993 (*Transition firm*), after 1993 (*Post-transition firm*).¹⁹

We further include two control variables for firm ownership. *State-owned firm* is a dummy variable that equals one if the government holds a majority stake in the firm. The effect of this variable is *a priori* ambiguous. On the one hand, state ownership may reduce firm risk in the eye of a bank, due to the possible government bailout in case of default. On the other, state ownership may increase default risk, owing to the political pressures on management to diverge from profit-maximizing policies. Moreover, these firms may receive public funding, which reduces their reliance on credit for investment and therefore relieves their credit constraint to firm growth. The dummy variable *Privatized firm* equals one for private firms which emerged as the result of a privatization process, and zero for all de novo private firms. A successfully privatized firm may be less risky than a de novo firm, and therefore may have enhanced credit access. Furthermore, they may still have ties to the public sector that make them less dependent on bank finance.

Given the weak legal environment and lack of transparency in corporate governance, borrower-lender relationships in transition countries are likely to suffer from severe adverse selection and moral hazard. As a consequence banks' lending decisions might also be affected by firm characteristics that improve the transparency of their activities. We capture firm transparency by a composite indicator of

¹⁹ Including age rather than our three categorical variables does not alter our results.

Table 4

Firm-level control variables. Sample means

Country	Small firm	Transition firm	Post-transition firm	State-owned firm	Privatized firm	Transparency
Albania	0.71	0.17	0.75	0.08	0.11	1.41
Armenia	0.73	0.09	0.46	0.33	0.18	0.81
Azerbaijan	0.69	0.13	0.69	0.14	0.15	0.73
Belarus	0.69	0.30	0.52	0.05	0.18	0.68
Bosnia	0.60	0.10	0.56	0.23	0.13	1.05
Bulgaria	0.69	0.29	0.40	0.16	0.15	0.90
Croatia	0.67	0.36	0.37	0.13	0.15	1.03
Czech Rep	0.66	0.51	0.38	0.10	0.13	0.57
Estonia	0.71	0.34	0.58	0.09	0.14	1.71
Georgia	0.75	0.09	0.66	0.20	0.16	1.32
Hungary	0.67	0.42	0.33	0.18	0.05	0.90
Kazakhstan	0.70	0.24	0.62	0.18	0.15	0.86
Kyrgyzstan	0.62	0.17	0.58	0.24	0.16	0.78
Latvia	0.70	0.27	0.59	0.11	0.17	1.20
Lithuania	0.67	0.29	0.54	0.17	0.16	0.97
Macedonia	0.70	0.28	0.48	0.14	0.04	0.49
Moldova	0.68	0.16	0.68	0.20	0.16	1.26
Poland	0.66	0.32	0.33	0.09	0.14	0.72
Romania	0.60	0.40	0.46	0.13	0.15	0.66
Russia	0.67	0.23	0.59	0.15	0.13	0.53
Serbia	0.61	0.31	0.35	0.10	0.17	0.59
Slovak Rep	0.64	0.42	0.41	0.12	0.15	0.67
Slovenia	0.77	0.43	0.29	0.20	0.09	0.80
Ukraine	0.67	0.23	0.57	0.11	0.14	1.03
Total	0.67	0.28	0.50	0.14	0.14	0.86

The table reports the country averages of the firm-level control variables used in the cross-sectional analysis. See [Appendix A](#) for a detailed description of the variables.

a firm's book-keeping and auditing procedures. The variable *Transparency* takes the value 0 if a firm does not use international accounting standards or external auditors. The variable takes the value 1 if a firm has either international accounting standards or an external auditor; while it takes the value 2 if both apply. Of course, in general transparency is determined by regulatory standards as well as by firms' choices, and therefore cannot be regarded as an entirely exogenous firm characteristic. For this reason, we shall also control for the potential endogeneity of firm-level transparency using instrumental variables estimation.

In all our regressions we include sector dummies, to control for different finance needs of firms. [Table 4](#) provides summary statistics for our firm-level explanatory variables. Definitions and sources of all control variables are again provided in [Appendix A](#). The table shows that our sample is dominated by small firms (67%). Exactly half of the firms were established after 1993, and are thus categorized as post-transition firms, while a further 28% were established in the transition phase of 1989–1993. The majority of firms are privately owned, with only a minor share state-owned (14%). Of the 86% privately owned firms in the sample, 83% are de novo firms, implying that a total of 14% of our firms are privatized companies. Our sample displays a low level of transparency on average.

4. Cross-sectional estimates

[Tables 5–7](#) report cross-sectional estimation results for our three dependent variables based on the BEEPS 2002 survey. [Table 5](#) reports results for the dependent variable *Access to finance*. In all four estimated models we regress credit access on our information sharing index, controlling for firm characteristics and country-level indicators of institutional and macroeconomic reform. Column (1) presents results for our baseline model in which we estimated the average impact of information sharing across all firms. Columns (2)–(4) present models in which we examine the differential impact of information sharing across firms by including interaction effects of *Information sharing* with firm-level

Table 5

Cross-sectional estimates: access to finance

	(1)	(2)	(3)	(4)
Information sharing	0.090*** (3.68)	0.065** (2.25)	0.086*** (3.47)	0.075** (2.77)
Transition firm	0.076 (1.22)	0.079 (1.30)	0.075 (1.20)	0.076 (1.23)
Post-transition firm	0.163*** (3.22)	0.165*** (3.25)	0.162*** (3.21)	0.165*** (3.29)
Small firm	−0.155*** (4.78)	−0.152*** (4.64)	−0.145*** (4.35)	−0.155*** (4.81)
Privatized firm	0.084 (1.23)	0.083 (1.22)	0.084 (1.22)	0.084 (1.24)
State-owned firm	0.105 (1.52)	0.110 (1.63)	0.105 (1.53)	0.106 (1.54)
Transparency	0.134*** (4.86)	0.166*** (5.64)	0.134*** (4.92)	0.134*** (4.88)
Per capita GDP (Log)	0.113* (1.92)	0.117* (1.95)	0.113* (1.92)	0.106* (1.81)
Inflation	−0.165** (2.55)	−0.163** (2.46)	−0.165** (2.55)	−0.159** (2.37)
Foreign bank assets	−0.005*** (2.85)	−0.005** (2.76)	−0.005*** (2.85)	−0.005** (2.62)
Creditor rights	0.082* (1.96)	0.080* (1.92)	0.082* (1.97)	0.095* (1.86)
Time to enforce payment (Log)	−0.168** (2.17)	−0.178** (2.30)	−0.167** (2.16)	−0.160* (2.05)
Information sharing × Opaque firm		0.076*** (2.99)		
Information sharing × Small firm			0.011 (0.63)	
Information sharing × Weak creditor rights				0.026 (0.95)
Constant	2.340*** (4.81)	2.370*** (4.84)	2.333*** (4.78)	2.262*** (4.35)
Observations	5392	5392	5392	5392
R-squared	0.06	0.06	0.06	0.06

The table reports OLS estimates of regressions whose dependent variable is *Access to finance*, defined as the answer to the question: “How problematic is access to finance for the operation and growth of your business?” (1 = major obstacle, 2 = moderate obstacle, 3 = minor obstacle, 4 = no obstacle). Each regression includes sector dummies. *Opaque firm* is a dummy variable which is 1 only for those that do not have external auditors or international accounting standards. *Weak creditor rights* is a dummy variable which is 1 only for firms in countries where the value of the *Creditor right index* is less than or equal to 2. Robust *t*-statistics are reported in parentheses. Standard errors are adjusted for cluster effects at the country level.

* Estimated coefficient is significantly different from zero at the 10% level.

** Idem, 5%.

*** Idem, 1%.

and country-level characteristics. Although the dependent variable *Access to finance* is measured on an ordinal scale from 1 to 4, we present OLS estimates in Table 5. This makes it easier to compare the results to those of our panel analysis, and facilitates the interpretation of the coefficients of the interaction effects on columns (2)–(4).²⁰ However, ordered probit estimates (not reported for brevity) yield identical qualitative results to those presented in column (1) of Table 5. In all specifications, the standard errors of the estimated coefficients are adjusted for cluster effects at the country level.²¹

²⁰ For a discussion of the difficulty of interpreting interaction effects in non-linear models such as the ordered probit model, see Ai and Norton (2003).

²¹ Note that inference with cluster-robust standard errors is based on the assumption that the number of clusters is large, and that with a small number of clusters, cluster-robust standard errors are downward biased. In our analysis we have 24 clusters only, so that the standard STATA procedure to compute robust standard errors may be subject to such a bias. Therefore

The positive coefficient of *Information sharing* in all four columns of Table 5 suggests that, on average, credit access is less of a constraint on firm growth in countries where public credit registries or private credit bureaus are more developed. The relevant coefficient estimates are not only statistically significant but also economically sizeable: for instance the coefficient in column (1) suggests that raising the information sharing index from the lowest (0) to the highest observed value (4.6) raises the credit access indicator by 0.41, which is about 24% of the sample mean (1.69).

The results in Table 5 further show that larger firms perceive credit access as less of a growth constraint. The same applies to firms that were established in the post-transition phase and to more transparent firms. To give an idea of the economic impact of a change in firm-level transparency, consider that a firm with external auditors and international accounting standards has a credit access indicator that is about 10% higher than the sample mean.²² As for country-level explanatory variables, we find that perceived credit constraints are lower in countries with higher per capita GDP, lower inflation, stronger creditor protection and less foreign bank presence.

The results suggest that opaque firms benefit more from information sharing than transparent firms. In column (2) we introduce the interaction effect *Information sharing* $\times$ *Opaque firm*, whereby *Opaque firm* is a dummy variable which is only 1 for firms who do not adhere to international accounting standards and have no external auditor. The estimated coefficient of the interaction term is positive and highly significant. This finding supports our conjecture that lenders find information sharing more valuable for firms where accounting information is poorer, and therefore adverse selection and incentive problems would otherwise be more severe.

In column three of the table we introduce the interaction term *Information sharing* $\times$ *Small firm* to capture differences in the impact of information sharing across firm size. If banks have fixed costs of screening clients we expect that small firms may benefit more from information sharing than large firms. While we do find that the coefficient of this interaction term is positive, this result is not statistically significant.

One reason for the substantial impact of information sharing in transition economies may be the weak legal and institutional environment that makes it costly for banks to screen loan applicants and enforce credit contracts. In the final column of Table 5 we test this conjecture by exploiting variation in the institutional environment for countries in our sample. We introduce an interaction term *Information sharing* $\times$ *Weak creditor rights*, whereby countries are classified as featuring “weak creditor rights” if their score on the 0–4 creditor rights index does not exceed 2.²³ The positive coefficient of the interaction term suggests that the impact of information sharing on credit access may be higher in countries with weak creditor protection. However, again this coefficient is imprecisely estimated.

Table 6 reports estimation results when the *Cost of finance* indicator is the dependent variable using the same model specifications as the previous table. Again the reported estimations are based on OLS with standard errors adjusted for cluster effects at the country level. The results generally parallel those of Table 5. The positive coefficient of *Information sharing* all four columns suggests that, on average, the cost of credit is lower in countries where information sharing is more developed, which is consistent with the theoretical prediction discussed in Section 2. Also in line with our previous results, we find that more transparent firms, larger firms and post-transition firms view credit cost as a lower constraint on their operations. However, the coefficients for *Transparency* and *Post-transition firm* lack statistical significance. Economic prosperity, a more stable macroeconomic environment and

we performed robustness checks in which we bootstrapped standard errors as suggested by Cameron et al. (2007). Results for these checks show that bootstrapped errors are indeed larger, but the significance of our main results for information sharing is confirmed.

²² In the regressions reported in Table 5 we treat the degree of financial transparency as exogenous. However, it is conceivable that firms alter their accounting and auditing procedures in order to improve their access to credit. In order to control for the endogeneity of firm transparency, we estimate instrumental variable regressions. As instruments for firm transparency, we use the age and education of the firm's manager, as well as the type of major shareholder of the firm, which all have significant predictive power for transparency. The results of these IV estimates confirm the positive and highly significant impact of *Information sharing* and also yield coefficients of *Transparency* that are higher than those reported in Table 5. Similar IV regressions confirm the findings obtained in Table 6 for *Cost of finance* and in Table 7 for *Firm debt*.

²³ According to this classification the following countries have weak creditor rights: Armenia, Belarus, Bulgaria, Georgia, Hungary, Lithuania, Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, and Ukraine.

Table 6

Cross-sectional estimates: cost of finance

	(1)	(2)	(3)	(4)
Information sharing	0.079** (2.73)	0.067** (2.28)	0.079** (2.59)	0.095*** (3.19)
Transition firm	0.027 (0.45)	0.028 (0.48)	0.027 (0.45)	0.027 (0.44)
Post-transition firm	0.079 (1.67)	0.080 (1.69)	0.079 (1.67)	0.076 (1.55)
Small firm	−0.085* (1.87)	−0.084* (1.85)	−0.086 (1.68)	−0.085* (1.85)
Privatized firm	0.045 (0.75)	0.045 (0.74)	0.046 (0.74)	0.046 (0.75)
State-owned firm	0.157** (2.36)	0.160** (2.42)	0.157** (2.37)	0.156** (2.31)
Transparency	0.047 (1.67)	0.063** (2.07)	0.047 (1.69)	0.047 (1.66)
Per capita GDP (Log)	0.154** (2.09)	0.156** (2.10)	0.154** (2.09)	0.163* (2.00)
Inflation	−0.284*** (3.69)	−0.283*** (3.62)	−0.284*** (3.70)	−0.291*** (3.83)
Foreign bank assets	−0.006** (2.75)	−0.006** (2.71)	−0.006** (2.75)	−0.007** (2.67)
Creditor rights	0.054 (0.78)	0.053 (0.76)	0.054 (0.78)	0.040 (0.47)
Time to enforce payment (Log)	−0.403*** (3.71)	−0.408*** (3.71)	−0.403*** (3.71)	−0.412*** (3.64)
Information sharing × Opaque firm		0.036 (1.61)		
Information sharing × Small firm			−0.001 (0.03)	
Information sharing × Weak creditor rights				−0.029 (0.62)
Constant	3.786*** (4.74)	3.799*** (4.70)	3.786*** (4.76)	3.876*** (4.58)
Observations	5450	5450	5450	5450
R-squared	0.07	0.07	0.07	0.07

The table reports OLS estimates of regressions whose dependent variable is *Cost of finance*, defined as the answer to the 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). Each regression includes sector dummies. *Opaque firm* is a dummy variable which is 1 only for those that do not have external auditors or international accounting standards. *Weak creditor rights* is a dummy variable which is 1 only for firms in countries where the value of the *Creditor right index* is less than or equal to 2. Robust *t*-statistics are reported in parentheses. Standard errors are adjusted for cluster effects at the country level.

* Estimated coefficient is significantly different from zero at the 10% level.

** Idem, 5%.

*** Idem, 1%.

stronger creditor protection again seem to reduce firm-level credit constraints, while foreign bank presence increases constraints. As in the previous table the interaction term *Information sharing* × *Opaque firm* yields a positive coefficient. However in Table 6 it is less precisely estimated. The results for the interaction terms of information sharing with firm transparency and creditor rights are again insignificant.

Table 7 reports estimates of Tobit regressions for the dependent variable *Firm debt*. The estimated coefficients for firm-level explanatory variables in column (1) of the table confirm only some of our previous findings for *Access to finance* and *Cost of finance*. Other things equal, leverage is positively associated with financial transparency, firm size and creditor rights. In contrast to our findings for our subjective indicators of credit access and credit cost we find however that firm leverage is positively related to foreign bank presence and inflation. The coefficient of *Information sharing* is not significantly positive in any of the four specifications of Table 7. However we do find a significant and positive

Table 7

Cross-sectional estimates: firm debt

	(1)	(2)	(3)	(4)
Information sharing	1.062 (0.92)	1.071 (1.00)	0.615 (0.52)	−1.292 (1.11)
Transition firm	1.110 (0.50)	1.109 (0.51)	1.009 (0.46)	1.141 (0.53)
Post-transition firm	0.586 (0.27)	0.585 (0.27)	0.433 (0.21)	1.039 (0.48)
Small firm	−8.542*** (5.04)	−8.543*** (5.04)	−7.360*** (3.98)	−8.485*** (5.17)
Privatized firm	4.433** (2.45)	4.433** (2.45)	4.352** (2.41)	4.347** (2.53)
State-owned firm	3.881*** (2.90)	3.879*** (3.01)	3.934*** (2.95)	4.113*** (2.99)
Transparency	3.675*** (2.58)	3.662** (2.42)	3.733*** (2.61)	3.743*** (2.72)
Per capita GDP (Log)	1.586 (0.97)	1.585 (0.97)	1.604 (0.98)	0.283 (0.18)
Inflation	5.970* (1.79)	5.968* (1.80)	5.985* (1.80)	7.215** (2.18)
Foreign bank assets	0.117** (2.03)	0.117** (2.04)	0.116** (2.00)	0.160*** (2.70)
Creditor rights	5.276*** (2.86)	5.277*** (2.86)	5.306*** (2.87)	7.511*** (3.62)
Time to enforce payment (Log)	4.235 (1.31)	4.239 (1.30)	4.267 (1.32)	5.655** (2.12)
Information sharing × Opaque firm		−0.029 (0.02)		
Information sharing × Small firm			1.294* (1.72)	
Information sharing × Low creditor rights				4.317*** (3.09)
Constant	−59.712*** (2.75)	−59.716*** (2.74)	−60.551*** (2.80)	−74.515*** (3.71)
Observations	5717	5717	5717	5717

The table reports Tobit regression estimates for the ratio of total debt to total assets (expressed in percentage values). Each regression includes sector dummies. *Opaque firm* is a dummy variable which is 1 only for those that do not have external auditors or international accounting standards. *Weak creditor rights* is a dummy variable which is 1 only for firms in countries where the value of the *Creditor right index* is less than or equal to 2. Robust *t*-statistics are reported in parentheses. Standard errors are adjusted for cluster effects at the country level.

* Estimated coefficient is significantly different from zero at the 10% level.

** Idem, 5%.

*** Idem, 1%.

coefficient for the interaction terms *Information sharing* × *Small firm* and *Information sharing* × *Weak creditor rights*. These results provide first evidence for our conjectures that the benefits of information sharing should be stronger for small firms and firms in countries with weak creditor protection.

5. Panel estimates

The cross-sectional results reported so far may be biased due to omitted country-level and firm-level variables. To tackle these issues, we repeat our analysis using a panel generated from the 2002 and 2005 BEEPS. Of the total 9655 firms covered by the BEEPS 2005, 1457 were also surveyed in 2002. Due to our exclusion of Uzbekistan and Tajikistan, and the absence of firms from Bosnia in the panel, our data set shrinks to 1333 firms from 23 countries.

As the BEEPS 2005 does not contain information on firm's external debt, our panel estimates are limited to the dependent variables *Access to finance* and *Cost of finance*. For both variables we perform fixed-effect estimation, regressing the change in the reported credit constraint per firm on changes in

Table 8

Fixed effects panel estimates: access to finance

	(1)	(2)	(3)	(4)
Information sharing	0.127*** (2.72)	0.124** (2.40)	0.120* (1.89)	−0.001 (0.01)
Small firm	0.214 (1.52)	0.213 (1.51)	0.215 (1.52)	0.204 (1.45)
Transparency	0.049 (0.92)	0.048 (0.90)	0.049 (0.92)	0.052 (0.98)
Per capita GDP (Log)	−0.071 (0.22)	−0.067 (0.21)	−0.068 (0.21)	−0.059 (0.18)
Inflation	−0.002 (1.32)	−0.002 (1.32)	−0.002 (1.32)	−0.002 (1.08)
Foreign bank assets	0.001 (0.28)	0.001 (0.27)	0.001 (0.28)	0.002 (0.47)
Creditor rights	0.508*** (2.92)	0.509*** (2.92)	0.508*** (2.92)	0.441** (2.47)
Information sharing × Opaque firm		0.013 (0.16)		
Information sharing × Small firm			0.013 (0.18)	
Information sharing × Low creditor rights				0.154* (1.61)
Constant	0.029 (0.18)	0.027 (0.17)	0.027 (0.17)	0.035 (0.21)
Observations	2416	2416	2416	2416
R-squared	0.02	0.02	0.02	0.02

The table reports OLS estimates with firm-level fixed effects using the panel component of the 2002 and 2005 BEEPS. The dependent variable is *Access to finance*, defined as the answer to the question: “How problematic is access to finance for the operation and growth of your business?” (1 = major obstacle, 2 = moderate obstacle, 3 = minor obstacle, 4 = no obstacle). *Opaque firm* is a dummy variable which is 1 only for those that do not have external auditors or international accounting standards. *Weak creditor rights* is a dummy variable which is 1 only for firms in countries where the value of the *Creditor right index* is less than or equal to 2. *t*-statistics are reported in parentheses.

* Estimated coefficient is significantly different from zero at the 10% level.

** Idem, 5%.

*** Idem, 1%.

firm characteristics (*Small firm*, *Transparency*) and in time-varying country-level indicators (*Information sharing*, *Per capita GDP*, *Foreign bank assets*, *Creditor rights*) between 2002 and 2005. Time invariant variables are not included. Although our panel data set includes two dates only, there is substantial variation in the information sharing index, which varies for 14 of our 23 countries. Tables 8 and 9 report the firm-level fixed-effects estimates for *Access to finance* and *Cost of finance* respectively. The specifications reported in columns (1)–(4) are identical to those in our cross-sectional analysis.

The results displayed in Table 8 confirm our findings that an increase in information sharing is associated with improved credit access for firms. The positive and significant coefficient of *Information sharing* in columns (1)–(3) of the table confirms our cross-sectional results: on average, across all transitions countries, an increase in information sharing is associated with improved credit access for firms. It is noteworthy also that the coefficient in all three columns is similar in size to that of our cross-sectional estimates, even though the sample is much smaller and we control for firm-level effects. The results in Table 8 do not confirm our cross-sectional findings that the impact of information sharing differs by firms transparency and size. While the interaction terms *Information sharing* × *Opaque firm* and *Information sharing* × *Small firm* are both positive, they are both far from significant.

The results in column (4) of Table 8 do suggest that the impact of information on credit access depends on the level of creditor protection in a country. In this specification the interaction term *Information sharing* × *Weak creditor rights* is positive and significant, while the main estimate for *Information sharing* is insignificant. This result suggests that information sharing does enhance credit access in countries with weak creditor protection, while it has no notable effect in countries with

Table 9

Fixed effects panel estimates: cost of finance

	(1)	(2)	(3)	(4)
Information sharing	0.120*** (2.65)	0.123** (2.43)	0.099 (1.58)	−0.089 (0.99)
Small firm	0.172 (1.27)	0.172 (1.27)	0.175 (1.29)	0.154 (1.13)
Transparency	0.072 (1.39)	0.072 (1.39)	0.073 (1.40)	0.077 (1.50)
Per capita GDP (Log)	−0.196 (0.62)	−0.199 (0.62)	−0.187 (0.59)	−0.170 (0.54)
Inflation	−0.006*** (3.21)	−0.006*** (3.21)	−0.006*** (3.21)	−0.005*** (2.80)
Foreign bank assets	0.003 (0.83)	0.003 (0.83)	0.003 (0.84)	0.003 (1.08)
Creditor rights	0.223 (1.30)	0.222 (1.30)	0.224 (1.31)	0.113 (0.64)
Information sharing × Opaque firm		−0.009 (0.12)		
Information sharing × Small firm			0.035 (0.50)	
Information sharing × Low creditor rights				0.251*** (2.69)
Constant	−0.016 (0.10)	−0.015 (0.09)	−0.021 (0.13)	−0.009 (0.06)
Observations	2416	2416	2416	2416
R-squared	0.02	0.02	0.02	0.03

The table reports regression estimates with firm-level fixed effects using the panel component of the 2002 and 2005 BEEPS. The dependent variable is *Cost of finance*, defined as the answer to the 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). *Opaque firm* is a dummy variable which is 1 only for are those that do not have external auditors or international accounting standards. *Weak creditor rights* is a dummy variable which is 1 only for firms in countries where the value of the *Creditor right index* is less than or equal to 2. *t*-statistics are reported in parentheses.

** Estimated coefficient is significantly different from zero at the 5% level.

*** Idem, 1%.

strong creditor protection. This negligible impact of information sharing in countries where creditor rights are better protected corroborates the conjecture of Djankov et al. (2007) that information sharing and creditor rights are substitutes in fostering credit market development.

Table 9 repeats the panel fixed-effect estimation for the *Cost of finance*. The estimates closely resemble those in Table 8. Across all countries, we find that in countries where information sharing has been enhanced, the cost of credit has reportedly become less of a constraint for firms' operations: The coefficient of *Information sharing* is positive, significant (in columns (1) and (2)) and similar in size to our cross-sectional estimate. The positive effect of information sharing is similar for opaque and transparent firms as well as for small and large firms. The final column of Table 9 confirms that the impact of information sharing on firm credit hinges upon the surrounding legal environment: the main coefficient of *Information sharing* is again insignificant in this specification, while the coefficient of the interaction term *Information sharing* × *Weak creditor rights* is positive and highly significant.

The coefficients for other firm-level variables (*Transparency*, *Small firm*) and country-level variables (*Per capita GDP*, *Inflation*, *Foreign bank assets*) in Tables 8 and 9 are less precisely estimated than in our cross-sectional analysis (see Tables 5 and 6). This finding suggests that relevant cross-sectional variation in credit access is being absorbed by the firm-fixed effects in our panel analysis. This conjecture is supported by the results of a regression in which we replicate our respective baseline specifications of column (1), omitting firm fixed-effects. In these cross-sectional stacked regressions we yield similar results to those obtained in our cross-sectional analysis.

The panel estimates reported in Tables 8 and 9 could be biased if the characteristics of the firms covered in our panel differ from those of the full sample surveyed in the BEEPS 2002. Indeed, in 2002 the firms present in our panel report on average lower credit constraints (along both the access and

the cost dimension) and were more transparent than firms interviewed in 2002 but not included in the panel. However, while statistically significant, the differences between panel and non-panel firms from the 2002 survey are marginal in size.²⁴ The panel results reported below are therefore hardly biased by sample selection effects.

6. Conclusions

The transition countries of Eastern Europe and the former Soviet Union are a unique environment to test the effects of institutions on credit market performance, since recently they have featured wide variation in institutions both across countries and over time. In this paper we investigate the effects of the variation in one such institution, that is, the information sharing arrangement among banks between 1996 and 2004, using a large sample of firm-level data. The effects of information sharing arrangements are of particular interest in the context of transition countries because they may mitigate the effects of the weak protection afforded to creditors in most of these jurisdictions.

The use of firm-level data allows us to test theoretical predictions without the biases that composition effects might introduce in tests conducted on aggregate data and to check these predictions by splitting the sample by firm characteristics. Our reliance on firm-level data allows us to achieve also a substantial methodological improvement over previous empirical studies: we control for the presence of unobserved heterogeneity at the firm level, and purge the estimated correlation between information sharing and credit market performance from the effects of variation in firm-level characteristics and country-level institutional and macroeconomic variables.

Our cross-sectional and panel estimates show that information sharing is associated with improved availability and lower cost of credit, particularly in transition countries with weak creditor protection. Our cross-sectional estimates suggest that information sharing and firm-level accounting transparency are substitutes in enhancing credit availability: the correlation between information sharing and credit access (or the cost of credit) is stronger for opaque firms than for transparent ones. Our panel estimates suggest that information sharing also plays a substitute role in the protection of creditor rights, as suggested by Djankov et al. (2007): its impact on credit access and cost is present for firms located in countries with poor creditor protection, but not for those where creditor rights are already well protected by the law.

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Appendix A. Definition of variables

A.1. Firm-level variables (*Business Environment and Enterprise Performance Survey—BEEPS*)

Cross sectional analysis (BEEPS 2002). The cross-sectional analysis is based on responses by 5717 firms in 24 transition countries to the BEEPS 2002 questionnaire. By design this data set provides

²⁴ In our panel of 1333 firms, the mean indicator of “Access to finance” is 1.73, that of “Cost of finance” is 1.53, and that of “Transparency” is 0.96 (see Appendix A for the definitions of these variables). The corresponding average indicators for the 4384 non-panel firms in the 2002 survey are 1.68, 1.45, and 0.83 respectively. A *t*-test confirms that the difference between panel and non-panel firms is statistically significant for Access to finance at the 10% level, for Cost of finance at the 5% level and for Transparency at the 1% level.

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

Panel analysis (BEEPS 2002 & 2005). The panel analysis is based on responses by 1333 firms interviewed in both the BEEPS 2002 and 2005 surveys. This represents 14% of the 9655 firms covered by the BEEPS 2005 survey. The sample structure for the 2005 survey resembles by design that of the 2002 survey.

For all firm-level variables we denote as “source” below the question number in the BEEPS 2002 questionnaire.

Dependent variables

Access to finance. Definition: Answer to the following question: “Can you tell me how problematic is access to finance (e.g. collateral requirement) or financing not available from banks for the operation and growth of your business?” (1 = major obstacle, 2 = moderate obstacle, 3 = minor obstacle, 4 = no obstacle). *Source:* q80a.

Cost of finance. Definition: 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.

Firm debt. Definition: Ratio of total debt to total assets. *Source:* q84a1. Only available in the BEEPS 2002.

Explanatory variables

Small firm. Definition: Dummy Variable if total number of full-time employees less than 50. *Source:* s4a2.

Transition firm. Definition: Firm was established in the years 1989–1993. *Source:* s1a.

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

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

Privatized firm. Definition: privatized firm (yes/no). *Source:* q9aa.

Transparency. Based on use of international accounting standards (*Source:* q73) and of external auditor (*Source:* q74). Transparency equals 0 if the firm does not use international accounting standards or external auditors, 1 if it uses of the two, 2 if it uses both.

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

A.2. Country-level explanatory variables

Information sharing. For each year between 1996 and 2004 we compute an index for private credit bureaus and one for public credit registers: 1 point if it exists for more than 3 years; 1 point if individuals and firms are covered; 1 point if positive and negative data are collected; 1 point if PCR/PCB distributes data which is at least 2 years old; 1 point if threshold loan is below per capita GDP. We then take the maximum of the index for credit bureaus and public credit registers. We use 1996–2000 values for the 2002 BEEPS, and 2001–2003 value for the 2005 BEEPS. Our main data source is the *Doing Business in 2006* report (World Bank, 2006). Additional data on Belarus and Kazakhstan are based on the authors' own research.

Creditor rights. We use the index of creditor rights based on methodology of La Porta et al. (1998). 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 1996–2000 values for the 2002 BEEPS, and 2001–2003 value for the 2005 BEEPS. *Source:* Djankov et al. (2007). For Estonia, we rely on the figure for 1998 reported by Pistor et al. (2000).

Time to enforce payment. Definition: The time taken to resolve a dispute in which a debtor defaults on a payment equal to 50% of a country's per capita GDP. The indicator measures the (log of the) number of days from the moment the plaintiff files the lawsuit in court until the moment of actual payment. We use 2005 value for both surveys, because earlier values are not available. *Source:* World Bank (2006).

Foreign bank assets. Definition: The share of banking sector assets controlled by banks with a majority (at least 50%) foreign ownership. We use 1996–2000 values for the 2002 BEEPS, and 2001–2003 value for the 2005 BEEPS. *Source:* EBRD transition report (EBRD, 2003, 2005, 2006).

Per capita GDP. Definition: Log of per capita GDP in thousands of US dollars. We use 1996–2000 values for the 2002 BEEPS, and 2001–2003 value for the 2005 BEEPS. *Source:* IMF International Financial Statistics (IFS): line 99b, line ae, line 99z.

Inflation. Definition: average annual growth rate of consumer price index (CPI). We use 1996–2000 values for the 2002 BEEPS, and 2001–2003 value for the 2005 BEEPS. *Source:* IFS (line 64), EBRD transition report (EBRD, 2003, 2005).

References

- Ai, C.R., Norton, E.C., 2003. Interaction terms in logit and probit models. *Econ. Letters* 80, 123–129.
- Barron, J.M., Staten, M., 2003. The value of comprehensive credit reports: Lessons from the US experience. In: Miller, M.J. (Ed.), *Credit Reporting Systems and the International Economy*. MIT Press, Boston.
- Bennardo, A., Pagano, M., Piccolo, S., 2007. Multiple-bank lending, creditor rights and information sharing. Mimeo, University of Salerno.
- Bonin, J.P., Hasan, I., Wahclet, P., 2005. Bank performance, efficiency and ownership in transition countries. *J. Banking Finance* 29, 31–53.
- Bouckaert, J., Degryse, H., 2004. Softening competition by inducing switching in credit markets. *J. Ind. Econ.* 52, 27–52.
- Brown, M., Zehnder, C., 2007. Credit reporting, relationship banking, and loan repayment. *J. Money, Credit, Banking* 39, 1884–1918.
- Cameron, C., Gelbach, J.B., Miller, D.L., 2007. Bootstrap-based improvements for inference with clustered errors. *Law and Economics Paper 07/002*, Florida State University College of Law.
- Demirguc-Kunt, A., Laeven, L., Levine, R., 2004. Regulations, market structure, institutions, and the cost of financial intermediation. *J. Money, Credit, Banking* 36, 593–622.
- Detragiache, E., Tressel, T., Gupta, P., in press. Foreign banks in poor countries: theory and evidence. *J. Finance*.
- Djankov, S., McLiesh, C., Shleifer, A., 2007. Private credit in 129 countries. *J. Finan. Econ.* 84, 299–329.
- EBRD, 2003. Transition report 2003: Integration and regional cooperation.
- EBRD, 2005. Transition report 2005: Business in transition.
- EBRD, 2006. Transition report 2006: Finance in transition.
- Fries S., Taci, A., 2002. Banking reform and development in transition countries. Working paper 71, EBRD.
- Fries S., Lysenko, T., Polanec, S., 2003. The 2002 business environment and enterprise survey: Results from a survey of 6100 firms. Working paper 84, EBRD.
- Galindo, A., Miller, M.J., 2001. Can credit registries reduce credit constraints? Empirical evidence on the role of credit registries in firm investment decisions. Paper prepared for the Annual Meetings of the Inter-American Development Bank, Santiago, Chile.
- Gehrig, T., Stenbacka, R., 2007. Information sharing and lending market competition with switching costs and poaching. *Europ. Econ. Rev.* 51, 77–91.
- Giannetti M., Ongena, S., in press. Financial integration and entrepreneurial activity: Evidence from foreign bank entry in emerging markets. *Rev. Finance*.
- Jappelli, T., Pagano, M., 2002. Information sharing, lending and defaults: Cross-country evidence. *J. Banking Finance* 26, 2017–2045.
- Jappelli, T., Pagano, M., 2006. Role and effects of credit information sharing. In: Bertola, G., Disney, R., Grant, C. and (Eds.), *The Economics of Consumer Credit*. MIT Press, Cambridge, pp. 347–371.
- Jappelli, T., Pagano, M., Bianco, M., 2005. Courts and banks: Effects of judicial enforcement on credit markets. *J. Money, Credit, Banking* 37, 223–244.
- Kallberg, J.G., Udell, G.F., 2003. The value of private sector credit information. *J. Banking Finance* 27, 449–469.
- Klein, D.B., 1992. Promise keeping in the great society: A model of credit information sharing. *Econ. Politics* 4, 117–136.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R.W., 1997. Legal determinants of external finance. *J. Finance* 52, 1131–1150.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R.W., 1998. Law and finance. *J. Polit. Economy* 106, 1113–1155.
- Laeven, L., Majnoni, G., 2005. Does judicial efficiency lower the cost of credit? *J. Banking Finance* 29, 1791–1812.
- Levine, R., 1998. The legal environment, banks, and long-run economic growth. *J. Money, Credit, Banking* 30, 596–620.
- Love I., Mylenko, N., 2003. Credit reporting and financing constraints. Policy Research Working paper 3142, World Bank.
- Luoto, J., McIntosh, C., Wydick, B., 2007. Credit information systems in less-developed countries: Recent history and a test. *Econ. Devel. Cult. Change* 55, 313–334.
- Miller, M.J., 2003. Credit reporting around the globe. In: Miller, M.J. (Ed.), *Credit Reporting Systems and the International Economy*. MIT Press, Cambridge.

- Padilla, A.J., Pagano, M., 1997. Endogenous communication among lenders and entrepreneurial incentives. *Rev. Finan. Stud.* 10, 205–236.
- Padilla, A.J., Pagano, M., 2000. Sharing default information as a borrower discipline device. *Europ. Econ. Rev.* 44, 1951–1980.
- Pagano, M., Jappelli, T., 1993. Information sharing in credit markets. *J. Finance* 43, 1693–1718.
- Petersen, M.A., Rajan, R., 1995. The effect of credit market competition on lending relationships. *Quart. J. Econ.* 110, 407–443.
- Pistor, K., Raiser, M., Gelfer, S., 2000. Law and finance in transition countries. *Econ. Transition* 8, 325–368.
- Powell, A., Mylenko, N., Miller, M., Majnoni, G., 2004. Improving credit information, bank regulation and supervision: On the role and design of public credit registries. Policy Research Working paper 3443, The World Bank.
- Sharpe, S., 1990. Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationships. *J. Finance* 45, 1069–1087.
- Vercammen, J.A., 1995. Credit bureau policy and sustainable reputation effects in credit markets. *Economica* 62, 461–478.
- von Thadden, E.L., 2004. Asymmetric information, bank lending, and implicit contracts: The Winner's Curse. *Finance Res. Letters* 1, 11–23.
- World Bank, 2006. *Doing Business in 2006, Creating Jobs*. Oxford Univ. Press, Oxford.
- Zarutskie, R., 2006. Evidence on the effects of bank competition on firm borrowing and investment. *J. Finan. Econ.* 81, 503–537.