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## On the determinants of credit rationing: Firm-level evidence from transition countries

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Using survey data for firms from Eastern European transition economies we investigate the determinants of credit rationing. Our rationing definition incorporates firms whose loan application was rejected, but also 'discouraged' potential borrowers. We employ a bivariate probit with censoring, approach that accounts for the underlying selectivity since rationed firms are a subset of those without a loan. We include firm-specific attributes related to the alleviation of informational asymmetries, and therefore expected to affect credit rationing. We find that credit rationing depends on firm size, profitability, sales growth, ownership type, legal status, sectoral heterogeneity and the country-specific level of domestic credit.

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## 1. Introduction

Asymmetry of information in the loan market may be *ex ante*, generated by the lender's difficulty to distinguish between 'good' and 'bad' borrowers when deciding which loan applications should be granted, and/or *ex post* due to the lender's imperfect and costly monitoring of borrower's actions. Jaffee and Russell (1976) and Stiglitz and Weiss (1981) demonstrate that when adverse selection and moral hazard problems between borrowers and lenders remain unresolved, may lead to an equilibrium credit rationing.<sup>1</sup> Essentially, in such equilibrium there is excess demand for credit, and lenders find it optimal

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<sup>1</sup> It should be noted that there is also a literature advocating that credit rationing does not emerge as an equilibrium outcome or that it is of low empirical relevance (Bester 1985; Riley, 1987; De Meza and Webb, 2006).

to allocate credit by rationing, rather than charging a higher interest rate that would clear the market. Due to adverse selection increasing the loan rate is sub-optimal, because it leads to a deterioration of applicants' pool and thereby reduces bank's profits. Consequently, there is a demand segment for which the shadow value of obtaining an extra dollar of loan would be higher, and therefore may even be willing to pay above the prevailing interest rate but still denied access to credit. One of the most important side effects of credit rationing is that a set of investment projects, even though exhibiting a sufficiently positive Net Present Value, may not be funded on the basis of loan applicants' characteristics that are thought as signaling a 'bad' loan. The consequences of such an outcome may hinder production, employment and business fixed investment and are especially intensified when the firm is more reliant on external credit (Greenwald et al., 1984; Fazzari et al, 1988; Gertler, 1988; Hubbard, 1998; Bernanke and Gertler, 1990, 1995).

The purpose of this paper is to shed light on the firm-level determinants of credit rationing, taking into account the selective nature of the "credit approval" procedure. Essentially, one has to take into account that credit rationed firms are a non-random draw from the group of firms without a loan. Moreover, our analysis identifies credit rationed firms, as those who needed a loan but whose application was either rejected or they were discouraged from applying for a loan, although they need it. In order to empirically investigate the determinants of credit rationing we rely on firm-level data from Eastern European transition economies, which may be considered as a natural laboratory for studying credit rationing given that informational asymmetries are expected to be more acute since their capital markets are less mature (Egerer, 1995; Gros and Suhrcke, 2000; Erol, 2005).

In particular, we employed the EBRD-World Bank Business Environment and Enterprise Performance Survey III (BEEPS-III) which is a micro (firm-level) database corresponding to a questionnaire completed by approximately 9500 firms from 26 transition countries. Respondents provided detailed information regarding whether they had an outstanding loan and if not the reasons for not obtaining credit. This information allowed a direct identification of credit rationed firms that permits an explicit connection between rationing and potential borrower profile. This distinction is of special importance because from a methodological point of view the empirical investigation of credit rationing is usually constrained by the difficulty to identify potential borrowers that are indeed credit rationed. Using direct measures of credit rationing we overcome the problems associated with the utilization of indirect indicators regarding the classification of firms as being more or less likely to be credit rationing e.g., the impossibility to verify the selected indicators' actual ability to reflect rationing and the possibility that these indicators embody other, unrelated to rationing, information (Angelini et al., 1998).

For estimation purposes, we apply a bivariate probit with censoring to jointly model loan demand and the rationing mechanism. We advocate the appropriateness of a bivariate model since the sample of credit rationed firms is not based on a random draw from the underlying population. In addition, motivated by economic theory and past empirical evidence we investigate whether the probability of credit rationing is related to firm-level attributes that may signal a potential borrower's ability to repay debt and to alleviate informational asymmetries faced by banks (i.e., the investment opportunity set, age, size, gender of principal owner, use of external auditing, and the application of International Accounting Standards-IAS). Nevertheless, it should be pointed out that although the particular dataset offers relatively rich information that assists in overcoming misspecification issues due to the cross-sectional variations of firm-attributes, it does not guarantee the avoidance of spurious estimates due to unobserved heterogeneity originated from the lack of longitudinal data. This implies that we were not able to conduct an explicit causal analysis and thus our estimates are interpreted as correlations.

According to our results, the likelihood of being credit rationed is lower for firms with higher sales growth, higher profitability and size. In contrast, the probability of rationing increases when the firm's principal owner is female. We also found that firms maintaining a savings account, which proxied banking relationships, were associated with a higher likelihood of rationing. Also, firms operating in Mining witness the highest probability of being rationed while those in Real Estate and Hotels the lowest. Moreover, our results show that firm-specific credit rationing is affected by macro credit conditions, proxied by domestic credit to the private sector.

These findings suggest that the tendency of firms with specific characteristics to be out of the credit market could be more harmful in the presence of exogenous demand shocks, since our results indicate

that constrained firms exhibit sensitivity to fluctuations in profits and cash flow. In this context, it could be useful to develop and analyze a structural model for business performance and growth where credit “application” and “approval” could be determined endogenously. For example, if small firms are more likely to be out of the credit market and thus to suffer from low investment rates then their subsequent profits are expected to remain at low levels, *ceteris paribus*. Therefore, to the extent that credit rationing leads to poor subsequent economic performance, which may even imply that a policy to enhance loan approvals could have beneficial effects on growth.

Furthermore, it becomes apparent that additional research efforts are needed in order to enhance our understanding provided that data from the bank side are available. The typical study relies at best on survey data where firms report their credit history and experiences. However, there is effectively a complete lack of information from the supply side, i.e. data on the exact practices and mechanisms employed by banks in loan application assessments. This data unavailability ultimately hampers any analysis since the researcher attempts to infer bank behavior.

The remainder of the paper is organized as follows. Section 2 provides a literature review on credit rationing. Section 3 presents the dataset employed. Section 4 discusses the econometric methodology used. Section 5 presents the empirical results. Finally, Section 6 concludes the study.

## 2. Types and determinants of credit rationing

As discussed earlier, credit rationing, based on non-price mechanisms, may be observed in equilibrium as a result of informational asymmetries between lenders and borrowers. Essentially there are two types of rationing that lenders can impose: Type 1, where lenders grant smaller loan amounts than those requested, and Type 2, where a subset of borrowers are denied credit altogether. However, it is important to note that these types of rationing emerge due to the residual imperfect information. Thus, they are pertinent to potential borrowers who are actually loan applicants. Hence, considering only the subset of firms that were subject to either type of rationing, would result in a bias since one would not take into account firms that did not apply for credit, even though they need it. This group of firms corresponds to the discouraged potential borrowers (Jappelli, 1990) or the ‘preemptively rationed borrowers (Mushinski, 1999). Discouraged firms do not apply for credit because they assess that the cost of applying is in excess of the expected benefit, given their low anticipated probability of approval. Moreover, another strand of the literature has also pointed out that application costs may not necessarily be solely financial, but also could be in-kind or psychic (Kon and Storey, 2003).<sup>2</sup> In any case, if one ignored the group of discouraged firms, would effectively presume that their demand for credit is zero, which is clearly erroneous (Levenson and Willard, 2000). Additionally omitting this group may lead to biased estimates of the likelihood of firms being credit rationed since ‘self-rationing’ of applicants may induce loan providers to adopt screening rules that differ from those that would prevail if the discouraged borrowers were to apply too (Jappelli, 1990; Cox and Jappelli, 1993; Chakravarty and Scott, 1999; Crook, 2001; Piga and Atzeni, 2007).

Given that price (lending rate) is not an effective credit allocation mechanism, lenders must resort to some observed borrower characteristics in order to decide who obtains credit and how much. Along these lines, Diamond (1991) suggested that financial institutions should produce information about firms and use it in their decisions about credit. In a similar vein lenders base their decisions on non-price elements “such as past experience, reputation, collateral and other forms of borrower self-insurance” (Allen, 1987 p. 2). Hence, it becomes clear that rationing ought to be negatively linked to the supply and demand sides’ abilities to circumvent information asymmetries. In what follows we take stock of the main firm characteristics that have been used in the extant empirical literature as proxies for the severity of informational asymmetries.

One of the most important factors affecting the likelihood of rationing is the availability of collateral and/or guarantees. There are two main theoretical predictions, which relate to different timing

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<sup>2</sup> However, the empirical measurement of ‘psychic’ costs is rather elusive.

regarding the loan decision. First, in *ex ante* terms, before the loan is granted, collateral pledged by borrowers may help attenuate the problem of adverse selection faced by the bank when lending (Stiglitz and Weiss, 1981; Bester, 1985, 1987; Chan and Kanatas, 1985; Besanko and Thakor, 1987; Chan and Thakor, 1987). Essentially, lower risk borrowers are willing to pledge more collateral, and therefore collateral acts as a signal enabling the bank to mitigate the adverse selection problem. In a context of asymmetric information between the bank and the borrower, banks design loan contracts in order to sort out types of borrowers: high risk borrowers choose high interest rates and no collateral, whereas low risk ones pledge collateral and get lower interest rates. Moreover, collateral assists to alleviate moral hazard problems once the loan has been granted, because it forces an alignment of lenders and borrowers' interests by reducing the motives to switch to a riskier investment project or commit less effort in the investment project (Aghion and Bolton, 1992).

Firm age is usually viewed as an indicator of firm's quality, since longevity may contain a signal for survival ability and quality of management, as well as, the accumulation of reputational capital (Diamond, 1991; Oliner and Rudebusch, 1992). Moreover, the information gap is relatively smaller for older firms given their longer track record (Petersen and Rajan, 1994; Cressy, 1996).

Another dimension that may be related to the degree of asymmetric information is firm size. A number of explanations have been proposed for small firm disadvantages in loan markets. For instance, their higher relative probability of failure (Jensen and McGuckin, 1997), fixed costs in assessing application for finance (Symeonidis, 1996), and proportionately higher monitoring costs (Boocock and Woods, 1997). In addition, smaller firms may have lower collateral relative to their liabilities than larger ones, and unit bankruptcy costs are likely to decrease with size (Gertler and Gilchrist, 1994; Hu and Schiantarelli, 1994; Gilchrist and Himmelberg, 1995; Audretsch and Elston, 2002; Vijverberg, 2004).

Moreover, recent studies have shown that the likelihood of credit rationing are intensified for more innovative firms (Freel, 2007; Piga and Atzeni, 2007). Essentially, when the loan applicant requires funding for specific, intangible and highly innovative investment, such as those in R&D, rationing may be more likely. Potential explanations rely either on the informational advantage of the inventor over the investor, that may lead to moral hazard problems or adverse selection issues due to investors' inability to distinguish good R&D projects from bad. In addition, Carpenter and Petersen (2002) advocate that rationing could occur because in such contexts information is far from perfect and also due to an inherent need for secrecy, which causes firms not to share information with the lenders (Himmelberg and Petersen, 1994). Furthermore, because R&D relates to intangible capital, which by definition is highly irreversible and thereby associated with a low collateral value, rationing probability may be further exacerbated.

Banking relationships also seem to alleviate credit rationing because banks can more easily monitor and access information regarding borrowers' history and actions (Petersen and Rajan, 1994). In particular, they examine the potential benefits of the bank–firm relationship on credit availability among small businesses. They find that the length of relationship has little impact on loan rates, but it enhances the availability of funds. In a similar vein, Berger and Udell (1995) find that the length of relationship lowers both loan rate premiums and the probability of collateral requirements. Cole (1998) concludes that the previous use of a lender as a source of savings accounts and financial management service increases the likelihood of credit availability.

The firm's investment opportunity set may also affect the likelihood of rationing (Hubbard, 1998). We expect firms with higher investment opportunity set to face lower probability of rationing.

External auditing and international accounting standards are also thought to reduce firm opacity by increasing the transparency of financial accounts. Dharan (1993) points out that the auditor's opinion is assumed to convey the risk characteristics of the firm to the lenders without error. Given that external auditing is costly, firms that choose to do so actually send a quality signal to potential lenders. The literature has also considered the type of ownership as another potential determinant of rationing that captures governance characteristics. Consider the example of family owned firms who are residual claimants and therefore are likely to adopt more conservative investment strategies, as well as, minimize the probability of bankruptcy thereby reducing lender risk (Fama and Jensen, 1983; Jaffee and Stiglitz, 1990; Bopaiyah, 1998; Schiantarelli and Sembenelli, 2000; Claessens and Tzioumis, 2006). Moreover, the type of owner could also affect the efficiency of corporate governance (Ciaian, 2004; Heiss and Koke, 2004). A positive effect on governance is expected either through their

specialization in monitoring, such as banks, (Stiglitz, 1985) or via increased industry knowledge (strategic owners). In contrast, a negative effect is expected of the case of large corporate owners who may suffer from agency conflicts that impair their monitoring quality (von Thadden, 1990). In addition, firm's legal form may also reflect the entrepreneur's assessment of the riskiness of the projects undertaken (Cole, 1998; Harhoff et al., 1998).

Another factor that affects firm's credit market experiences and thus creating variation in the demand for loan is managerial ability (Cavalluzzo et al., 2002). Furthermore, sectoral heterogeneity affects the credit rationing mechanism in a substantial way since banks often use industry classification to assess borrower credit quality (Cole, 1998; Rajan and Zingales, 1998; Beck and Levine, 2002; Cowling and Mitchell, 2003).

The related small firm (entrepreneurship) literature has also suggested various owner characteristics as relevant for credit rationing, such as gender or race, in the spirit of Becker (1971). In credit markets, discrimination would take the form either of differential loan approval rates or different interest rates charged, across groups with otherwise equal ability to repay (Cavalluzzo et al., 2002; Blanflower et al., 2003; Mijid and Bernasek, 2008). In addition, gender or race effects could be present in different application rates due to diverse perceived probability of approval (Coleman, 2000; Cavalluzzo et al., 2002; Carrington, 2006; Treichel and Scott, 2006).

### 3. Data sources and variables

#### 3.1. Data sources

Our dataset is based on the *EBRD-World Bank Business Environment and Enterprise Performance Survey III* (BEEPS-III) which is a joint initiative of the European Bank for Reconstruction and Development and the World Bank Group.<sup>3</sup> The BEEPS-III covers approximately 9500 enterprises in 26 transition economies: 15 from Central and Eastern Europe<sup>4</sup> and 11 from the Commonwealth of Independent States.<sup>5</sup> Information is collected through face-to-face interviews<sup>6</sup> with owners, managers or finance officers and the dataset covers the whole economic activity in terms of sectoral composition.<sup>7</sup> The utilized dataset is considered representative for each country and contains a variety of firm-specific financial and non financial indicators.

#### 3.2. Definitions of credit rationing

For the purposes of the present study, firms are classified into two groups; "loan" and "no loan" based on responses to the question<sup>8</sup> "Thinking of the most recent loan you obtained from a financial institution, did the financing require collateral?". There are three possible answers to this question: (i) yes, (ii) no, and (iii) no loan. Based on that, we construct a dichotomous variable (*NL*) that separates firms ( $i = 1, \dots, N$ ) between those who had not a loan and those who had as follows:

<sup>3</sup> The dataset is publicly available at <http://www.ebrd.com/pubs/econo/beeps.htm>.

<sup>4</sup> Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, FR Yugoslavia, FYROM, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia.

<sup>5</sup> Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Ukraine and Uzbekistan.

<sup>6</sup> The following criteria have been applied in sampling: (i) Firms that operate in sectors subject to government price regulation and prudential supervision, such as banking, electric power, rail transport, and water and waste water, were excluded from the sample, (ii) at least 10% of the sample was to be in the small and 10% in the large size categories (Small = 2–49 employees, Medium = 50–249, Large = 250, 9999). Firms with only one employee or more than 10,000 employees were to be excluded, (iii) at least 10% of the firms were to have foreign control and 10% state control (More than 50% shareholding), (iv) at least 10% of the firms were to be exporters (Exports 20% or more of total sales), meaning that some significant share of their output is exported and (v) at least 10% of firms were to be in the category "small city/countryside" (Population under 50,000 inhabitants).

<sup>7</sup> Mining and Quarrying, Construction, Manufacturing, Transportation, Storage and Communications, Wholesale, Retail and Repairs, Real Estate, Business Services, Hotels and Restaurants, and Other Community, Social and Personal Activities.

<sup>8</sup> see question Q46a in the BEEPS-III questionnaire.

$$NL_i = \begin{cases} 1 & \text{if no loan} \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

Then those firms indicating that they did not have a loan were asked to state the reason through the following question<sup>9</sup> “If your firm does not currently have a loan, what was the reason?”. The reasons for not having a loan are the following: (i) did not apply, (ii) the application was turned down and (iii) the application of loan is still pending.

Firms who stated as the reason for not having a loan, was the fact that their application was turned down ( $R_i^F$ ) are defined as the “first” group of “credit rationed”

$$R_i^F = \begin{cases} 1 & \text{if } NL_i = 1 \wedge \text{application was turned down} \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

Next firms that did not apply for a loan are asked to state the reason for doing so using the following question<sup>10</sup> “If your firm did not apply for a loan, what were the main reasons?”. Respondents could choose among seven possible answers: (i) does not need a loan, (ii) application procedures for bank loans are too burdensome, (iii) collateral requirements for bank loans are too strict, (iv) interest rates are too high, (v) it is necessary to make informal payments to get bank loans, (vi) did not think it would be approved and (vii) other reasons.

Firms that report reasons for the lack of loan application, other than the fact that they do not need a loan, constitute the “second” group of “credit rationed” firms ( $R_i^S$ ), corresponding to the discouraged potential borrowers (Jappelli, 1990) or the “preemptively rationed borrowers” (Mushinski, 1999). In particular,

$$R_i^S = \begin{cases} 1 & \text{if } NL_i = 1 \wedge \text{did not apply for loan} \wedge \text{firm does need a loan} \\ 0 & \text{otherwise} \end{cases} \quad (3)$$

Therefore, credit rationed firms are identified as those satisfying either the first (2) or the second criterion (3) as follows:

$$R_i = \begin{cases} 1 & \text{if } R_i^F = 1 \vee R_i^S = 1 \\ 0 & \text{otherwise} \end{cases} \quad (4)$$

It should be noted that in the Stiglitz and Weiss (1981) setup, rationed firms may also be willing to borrow at the prevailing loan rate, or even above that, but are still denied access to credit. In order to account for that we modify our credit rationing identification mechanism by excluding from the sample of firms classified by the criterion (4), those that did not apply because they believed interest rates were too high.

There are two caveats that should be acknowledged before we conduct the econometric analysis. First, our rationing definition suffers from the caveat that some firms that have been granted a loan may in fact be rationed. It is possible that a given firm may have applied for a larger loan but was only granted a fraction of its demand. Unfortunately the current design of the questionnaire precludes identification of such firms. Hence, we proceed by assuming that firms that were granted a loan are not rationed. Alternatively, one may view rationing in relative terms, whereby firms that were either denied credit or were discouraged from applying (although in need of a loan) are definitely more rationed compared to those firms that have been granted loans. Another caveat is that the ‘loan’ question refers to the ‘most recent loan’ without specifying how recent or how far in the past this application was submitted.

Table 1 summarizes the percentages of firms without a loan and firms that are credit rationed by country. Firms without a loan, represent about 57 percent of the total sample, while rationing is quite sizeable, calculated as being approximately 20 percent or 15 percent depending on the rationing

<sup>9</sup> see question Q47a in the BEEPS-III questionnaire.

<sup>10</sup> see question Q47b in the BEEPS-III questionnaire.

**Table 1**

Sample sizes and proportion of firms not having a loan and being rationed by country.

	Number of firms	Percentage of firms without loan	Percentage of firms being rationed <sup>a</sup>	Percentage of firms being rationed <sup>b</sup>
<i>Central and Eastern Europe (CEE)</i>				
Albania	204	0.539	0.181	0.118
Bosnia and Herzegovina	200	0.395	0.202	0.088
Bulgaria	300	0.593	0.235	0.191
Czech Republic	343	0.679	0.253	0.231
Croatia	236	0.347	0.134	0.121
Estonia	219	0.534	0.153	0.128
FR Yugoslavia	300	0.552	0.247	0.114
FYROM	200	0.711	0.246	0.133
Hungary	610	0.450	0.185	0.117
Latvia	205	0.492	0.297	0.208
Lithuania	205	0.517	0.235	0.207
Poland	975	0.630	0.201	0.130
Romania	600	0.521	0.207	0.175
Slovak Republic	220	0.513	0.106	0.079
Slovenia	223	0.358	0.112	0.100
<i>Commonwealth of Independent States (CIS)</i>				
Armenia	351	0.538	0.248	0.164
Azerbaijan	350	0.902	0.370	0.338
Belarus	325	0.575	0.245	0.192
Georgia	200	0.611	0.237	0.204
Kazakhstan	585	0.557	0.202	0.138
Kyrgyz Republic	202	0.559	0.230	0.106
Moldova	350	0.497	0.132	0.086
Russia	601	0.660	0.173	0.120
Tajikistan	200	0.785	0.165	0.114
Ukraine	594	0.575	0.187	0.076
Uzbekistan	300	0.661	0.106	0.061
Total Sample	9098	0.574	0.208	0.147

Source: EBRD-World Bank Business Environment and Enterprise Performance Survey III (BEEPS-III). Turkey excluded from the analysis.

<sup>a</sup> Firms are classified as credit rationed if they need a loan but do not have one, including all discouraged potential borrowers.

<sup>b</sup> Firms are classified as credit rationed if they need a loan but do not have one, including discouraged potential borrowers, but excluding those who did not apply because interest rates were considered too high.

criterion. Comparing these measures between countries reveals considerable variation. For instance, when considering firms without a loan we observe that Azerbaijan, Tajikistan and FYROM have the highest percentage (90, 78 and 71 respectively) and Croatia, Slovenia and Bosnia-Herzegovina the lowest percentage (34, 35, and 39 respectively). The highest percentage of rationed firms appears in Azerbaijan, Latvia and Czech Republic, while the lowest in Slovak Republic, Uzbekistan and Slovenia. Thus, although the composition of firms across countries may substantially differ in terms of characteristics one should also expect country heterogeneity to play some role in explaining these observed differences. There is no doubt that transition countries differ, and in some cases dramatically so, in the time elapsed since the transition process was initiated, also in terms of the strategies and paths followed. In other words, the empirical analysis although primarily focused on firm-level, should not fail to incorporate in some way cross-country diversities.

### 3.3. Key determinants of credit rationing and control variables

The subsequent reduced-form econometric model will include a wide set of variables, with the vast majority of them being firm-specific. We adopt an informal partitioning between key and control variables, motivated by economic theory and past empirical evidence. The basic criterion for classifying a given variable as a key determinant is whether it is potentially related to the alleviation of

informational asymmetries between lenders and borrowers. Clearly there are some borderline cases where a given variable could be classified in either group, however this neither affects the estimation nor the inference process.

### 3.3.1. Key determinants of credit rationing

With regards to the key determinants we are particularly interested in exploring whether the following factors are significant: (i) firm's investment opportunity set (proxied by profitability, sales growth, and fixed assets growth), (ii) firm age, (iii) firm size, (iv) gender of principal owner, (v) use of external auditing, (vi) application of international accounting standards, (vii) maintenance of savings account (as a proxy of banking relationships). Our priors regarding the impact of those factors on the likelihood of credit rationing are given below.

The likelihood of credit rationing should be lower for: (i) firms with higher investment opportunity set, (ii) older firms, (iii) larger firms, (iv) firms using external auditing, (v) firms applying international accounting standards, (vi) male-owned firms, (vii) firms with established banking relationships. In [Table 2](#) we provide the exact definitions and the expected effect on the probability of rationing.

### 3.3.2. Control variables

In order to reduce unobserved heterogeneity in the rationing mechanism we control for as many relevant firm characteristics as possible given data availability.<sup>11</sup> In particular, we include (i) cash flow, (ii) trade credit, and (iii) the number of competitors (proxy for market structure). Cash flow and trade credit may be important since they capture alternative sources of funding. The former reflects the firm's ability to finance its investment via the income stream from its operations, while the latter shows the firm's capacity to rely on its suppliers' credit. Therefore both could in principle reduce a firm's need for bank credit, but may also reduce a firm's probability of being credit rationed. Essentially higher cash flow reflects higher liquidity that signals to creditors, *ceteris paribus*, a higher ability to meet interest payments. In addition, potential lenders may interpret higher trade credit as indicating that a firm's suppliers have confidence in its ability to repay. The intensity of competition within which the firm operates, proxied by the number of competitors, may also be important, although its net effect may be hard to assess. On the one hand less competition may lead to a more stable position in the market, while on the other hand, it is likely that less competition reduces the incentives for achieving higher efficiency levels. In any case, controlling for market structure is necessary.

We also take into account (i) the percentage of sales in the domestic market, (ii) whether the firm is a member of a business association or chamber of commerce, (iii) whether the firm regularly uses the Internet in its interactions with clients and suppliers, and (iv) we control for the education level of its workforce. These variables may embody useful information for firm unobserved structural characteristics related to managerial quality.

We also control for sectoral heterogeneity by including a set of sectoral dummies motivated by past evidence pointing to the direction that banks often use industry classification to assess borrower credit quality. Finally, we augment the set of control variables by domestic credit to the private sector as a percentage of GDP on a country level, which might be of relevance for transition countries. We advocate that this variable would be more informative compared to a standard country dummy because it also partially controls for the supply side impact on the two equations. Definitions of control variables can be found in the [Appendix](#) (Table A1). Basic descriptive statistics for the key correlates and the control variables are also provided in the [Appendix](#) (Table A2).

## 4. Econometric methodology: bivariate probit with censoring

According to our definition rationed firms are only observed if they do not have a loan. This implies that the sample does not correspond to a random draw from the population since it is

<sup>11</sup> The exact definitions of control variables are given in the [Appendix](#).



**Table 2**

Definition of main variables and their expected effect on credit rationing.

Variable	Definition	Expected effect
AGE	Number of years the firm is in operation	–
SALESINC	1 if the firm's sales have increased over the past 36 months, 0 otherwise	–
FIXEDINC	1 if the firm's fixed assets have increased over the past 36 months, 0 otherwise	–
NOPROFIT	1 if the firm had no profits, 0 otherwise	+
MEDIUM <sup>a</sup>	1 if the firm employs between 50 and 249 full time employees, 0 otherwise	–
LARGE <sup>a</sup>	1 if the firm employs more than 249 full time employees, 0 otherwise	–
AUDITOR	1 if the firm have its annual financial statement checked and certified by an external auditor, 0 otherwise	–
IAS	1 if the firm is using international accounting standards, 0 otherwise	–
FEMALE	1 if the firm's principal owner is female, zero otherwise	+
ACCOUNTS	1 if the firm has a checking account, 0 otherwise	–

Source: EBRD-World Bank Business Environment and Enterprise Performance Survey III (BEEPS-III).

Notes: (1) A firm is classified as "SMALL" if the total number of employees ranges between 1 and 49 (reference category).

conditioned on the probability of not having a loan. This observation introduces the possibility that errors from these seemingly unrelated discrete choices are correlated, which would render the direct estimation of a probit model for rationed firms as inappropriate. Indeed, if the error terms were correlated and one proceeded by simply estimating a single equation model for rationed firms (*i.e.* ignoring the selection bias) then the estimated parameters would be biased and inconsistent. Hence, the appropriate modeling approach compels the use of a bivariate probit where cross-equation correlation is allowed. The bivariate probit consists of two equations; one for loan demand and another for rationing. The bivariate probit model is flexible enough to allow cross-equation correlation, which in fact will be formally tested, and if rejected then the two separate independent probit models are nested. In a relevant research study, [Greene \(1998\)](#) states that the estimation of the probability of default in credit card loans requires a two equation model specification, which produces unbiased estimates (*i.e.*, the first equation refers to the estimation of the factors affecting the probability of default in credit card loans, and the second one refers to the determinants of a credit card's successful application). In the present study we adopt this methodology, which fits our priors as they are drawn both from the theory and empirical evidence on credit rationing as well as the structure of the utilized sample.

In order to formally estimate a model of credit rationing we assume that the degree of credit rationing the  $i$ th firm faces,  $R_i^*$  is a function of a vector of firm-specific attributes and environment-related characteristics,  $\mathbf{x}_i$  and of an exogenous shock  $e_i$ , *i.e.*,  $R_i^* = f(\mathbf{x}_i, e_i)$ . However, since we cannot observe the actual level of credit rationing  $R_i^*$  (latent mechanism), what we observe is the outcome of a process that identifies a firm as being rationed,  $R_i$ . In this framework the credit rationing equation is of the following form:

$$R_i = \begin{cases} 1 & \text{if } R_i^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (5)$$

where, 1 denotes that the  $i$ th firm is credit rationed and 0 otherwise. Nevertheless, and given the structure of rationing in a demand and supply framework,  $R_i$  is observed only if a firm does not have a loan (*i.e.*, sampling rule). Given this, the second required specification involves the modeling (at the firm-level) of the demand for loan equation,  $NL_i^*$  which is a function of a vector of firm-specific attributes and environment characteristics,  $\mathbf{z}_i$  and of an exogenous shock  $u_i$ , *i.e.*,  $NL_i^* = f(\mathbf{z}_i, u_i)$ . Again, the actual demand for loan is not observed. Instead, we observe whether or not a firm does not have a loan,  $NL_i$ . Thus, the loan equation is of the following form:

$$NL_i = \begin{cases} 1 & \text{if } NL_i^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (6)$$

where, 1 denotes whether the firm does not have a loan, and 0 otherwise. Notice that Eq. (6) refers to the whole population of firms.

Having established the two discrete model specifications and the corresponding sampling rule, the structural model (Greene, 2003) becomes

$$\begin{aligned}
 R_i^* &= \mathbf{x}_i' \beta_1 + e_i, & R_i &= 1 \text{ if } R_i^* > 0, & 0 & \text{ otherwise} \\
 NL_i^* &= \mathbf{z}_i' \beta_2 + u_i, & NL_i &= 1 \text{ if } NL_i^* > 0, & 0 & \text{ otherwise} \\
 [e_i, u_i] &\sim N[0, 0, 1, 1, \rho_{eu}] \\
 (R_i, \mathbf{x}_i') &\text{ are observed only when } NL_i = 1
 \end{aligned} \tag{7}$$

Given the structure of (7) and the discrete outcomes on no loan and rationing, the log-likelihood function of interest to be maximized is the one of rationing given no loan, which is:

$$\text{Log} - L = \prod_{R=1, NL=1} \Phi[\mathbf{x}_i' \beta_1, \mathbf{z}_i' \beta_2, \rho] \cdot \prod_{R=0, NL=1} \Phi[\mathbf{x}_i' \beta_1, \mathbf{z}_i' \beta_2, -\rho] \cdot \prod_{NL=0} \phi[\mathbf{z}_i' \beta_2] \tag{8}$$

where,  $\Phi[\cdot]$  is the bivariate normal cumulative probability,  $\phi[\cdot]$  is the normal cumulative probability for the no loan equation and  $\rho = \text{Cov}[e_i, u_i]$ . Eq. (8) is maximized with respect to parameters  $\beta_1, \beta_2$  and  $\rho$  via Full Information Maximum Likelihood (FIML) estimation techniques<sup>12</sup> (van de Ven and van Praag, 1981; Boyes et al., 1989; Greene, 1998). Since we estimate parameters by a Maximum Likelihood Estimation (MLE) approach the sets of covariates in the two equations may coincide. Indeed, there is no identification issue in the bivariate probit model, as it allows for unrestricted variable lists including identical ones (see Greene, 1998, 2002; Piga and Vivarelli, 2003, 2004).

Note that the estimated coefficients cannot be used to assess the relative importance of factors, in terms of magnitude. In order to make inter-factor comparisons one needs to resort to marginal effects that denote the change on the probability of rationing induced by a percentage change in each variable in the vector  $\mathbf{x}_i'$ . For the case of a continuous explanatory variable the estimated marginal effect quantify the magnitude of a 1 percentage change of this variable on the probability of not holding a loan and being credit rationed. For the case of dummy regressors the potential effects on the probability of firms' not holding loans and being rationed are assessed by computing their marginal effects, which were calculated as the change from zero to one.<sup>13</sup>

## 5. Empirical results

Before we embark on a detailed discussion of our core findings obtained from the bivariate probit with censoring, we initially explore whether such a model is indeed suitable. In order to do so, we estimate the two equations independently, i.e., first set the cross-equation correlation equal to zero ( $\rho = 0$ ) and then re-estimate the models allowing the cross-equation correlation to vary freely. The estimated correlation coefficient was  $-0.246$  ( $p$ -value 0.00), suggesting that the effects are statistically significant. Further evidence for the dependence of two models is provided by the significant Likelihood Ratio test ( $LR = 17.201$ ), which essentially tests the null hypothesis that  $\rho = 0$ , against the non-zero alternative. Based on these results, we proceed allowing the cross-equation correlation  $\rho$  varying freely. The significance of the correlation coefficient between the two equations leads to the rejection of no-selection effects for the estimation of credit rationing. This implies that non-systematic tendencies of not having a loan are correlated with non-systematic increases in the likelihood of being credit rationed. In other words, the subjective elements that diverge from the systematic decision rule for increasing the odds of no loan demand are related to decreases in rationing that cannot be explained by a systematic relation with the vector of covariates.

We now turn our attention to the estimation results from the bivariate probit model with censoring, employing a reduced-form specification of equations appearing in (3). Table 3 reports the full set of the estimated results (coefficients and the corresponding marginal effects) based on the first definition of

<sup>12</sup> See for details LIMDEP 8.0, Greene (2003).

<sup>13</sup> More details on deriving the marginal effects are given in Greene (1998) and Greene (2003, p.713–716).

**Table 3**

Estimation results for the bivariate probit model with censoring for being rationed and holding no loan.

	Being rationed	Holding no-loan	Being rationed	t-Value
	Estimated coefficient	Estimated coefficient	Marginal effect	
<i>Panel A. Main variables</i>				
AGE (in logs)	0.031	-0.017	0.008	0.903
SALESINC	-0.082*	-0.065*	-0.025	-1.990**
FIXEDINC	0.140	-0.397***	0.022	1.503
NOPROFIT	0.213***	0.098**	0.063	3.779***
MEDIUM	-0.101	-0.220***	-0.037	-2.016**
LARGE	-0.395**	-0.423***	-0.127	-4.123***
AUDITOR	-0.060	-0.093***	-0.020	-1.580
IAS	-0.038	-0.079*	-0.014	-0.665
FEMALE	0.105*	-0.032	0.028	1.853*
ACCOUNTS	0.173***	-0.020	0.047	3.005***
<i>Panel B. Control variables</i>				
OWN2	0.006	-0.033	0.000	0.017
OWN3	0.042	0.007	0.012	0.180
OWN4	0.033	-0.101	0.005	0.163
OWN5	-0.290**	0.212***	-0.071	-2.044**
OWN6	0.295	1.190**	0.131	0.843
OWN7	0.252	-0.415	0.052	0.303
OWN8	-0.256	-0.107	-0.075	-1.646*
OWN9	-0.106	-0.052	-0.031	-0.791
OWN10	0.204	0.103	0.061	0.744
OWN11	-0.155	0.122	-0.038	-0.368
LEGAL2	0.047	-0.081*	0.009	0.587
LEGAL3	0.211	0.007	0.059	1.449
LEGAL4	-0.134**	-0.082*	-0.040	-2.378**
LEGAL5	-0.402	-0.017	-0.112	-1.415
LEGAL6	0.162	-0.198*	0.036	0.843
LEGAL7	-0.144	0.468**	-0.020	-0.240
LEGAL8	-0.175	0.218	-0.039	-0.449
LEGAL9	-0.317	0.448*	-0.069	-0.636
MINING	0.503*	0.244	0.149	2.152**
CONSTRUC	0.088	0.105*	0.029	1.195
MANUF	0.039	0.080*	0.014	0.851
TRANSPOR	0.011	0.252***	0.014	0.500
WHOLESHALE	-0.096	0.060	-0.024	-1.312
REALEST	-0.217**	0.292***	-0.048	-1.817*
HOTELS	-0.299**	0.279***	-0.071	-2.311**
PMANAGER	0.200	0.520***	0.077	1.661*
PPROFES	0.126	0.298***	0.047	1.081
PSKILLED	0.104	0.245***	0.039	1.078
PNONPROD	0.179	0.024	0.050	1.049
PVOCATIO	0.039	0.166	0.018	0.282
PSECONDA	0.091	0.212	0.034	0.543
PTERTIAR	-0.262	0.396***	-0.056	-0.874
DCPS	-1.087***	-0.275**	-0.311	-5.794***
NC	0.008	-0.054**	0.000	-0.003
NC-squared	-0.001	0.006**	0.000	-0.061
CFWC	-0.471	1.251***	-0.078	-3.817***
TRCSUPWC	0.115	1.320***	0.087	1.407
EXPORTIN	-0.097	-0.063	-0.029	-1.048
DOMESTIC	0.027	0.099*	0.011	0.428
CHAMBER	0.073	-0.340***	0.006	0.412
WEB	0.093	-0.228***	0.016	1.175
INTERCEPT	-0.247	-0.670***	-	-
Log-Likelihood	-6958.400			
$\beta_{eu}$	-0.246***			
Total observations	8335			
Censored observations	4931			

Source: EBRD-World Bank Business Environment and Enterprise Performance Survey III (BEEPS-III).

Notes: Definition of credit rationing: firms need a loan but do not have one, including all discouraged potential borrowers. Asterisks \*\*\*, \*\* and \* denote statistical significance at the 1, 5 and 10 percent level, respectively.

credit rationing. Starting with the variables proxying the firm's investment opportunity set, we find that the likelihood of being credit rationed is lower for firms with higher sales growth and higher profitability. In particular, firms exhibiting an increase in their sales face a 2.5 percent lower probability of credit rationing. Similarly, firms without profits in the previous year (compared to firms with profits) are more likely to be credit rationed by 6.3 percentage points. These findings suggest that firms' with a higher investment opportunity set are less likely to be credit constrained.

Employment size is found to exert a significant and sizeable negative impact on the probability of being rationed. We find that large firms experience a sizeable decline in rationing probability of about 12.7 percent. This is consistent with the idea that small firms face higher information costs, and also that employment size could be a signal for firms' ability to repay the loan. We should also keep in mind that employment size not only affects negatively credit rationing but also the likelihood of having a loan, implying that size has a detrimental effect on the likelihood that a firm is credit constrained.

We uncover evidence for gender differences taking the form of a higher probability of rationing when the firm's principal owner is female, albeit the relevant coefficient is significant only at the 10 percent level. The estimated increase in credit rationing for women-owned firms, compared to their male-owned peers, is approximately 2.8 percent. However, it should be noted that gender effects are expected to be more pronounced when the owner and the manager coincide. Our sample though consists of all ownership as well as all legal types, therefore the marginal significance of gender does not come as a surprise. This finding indicates that if we conjecture the absence of discrimination against women, then another plausible explanation is that credit rationing is increasing with risk aversion (given that women exhibit higher risk aversion than men). Disentangling the two is rather difficult to the extent that there is an overlap between the owner's risk aversion and the riskiness of the firm as proxied by its legal type and its size.

As it regards to firms applying IAS or using external auditors the relevant coefficients are negative, suggesting that the likelihood of rationing is lower, albeit they are statistically insignificant. Similarly, we find that firms of different ages face equal probability of credit rationing. A finding that does not conform to our priors is that firms maintaining a savings account are associated with a higher likelihood of rationing (approximately by 4.7 percent).

Turning now our attention to the control variables we find a substantial dampening effect on the overall likelihood of rationing, of about 31 percent, exerted by domestic credit to the private sector. Although we cannot directly assess its impact on the firm-level it is clear that the macroeconomic information embodied in this variable is bound to have a non-trivial effect on credit market functioning.

Our findings support a lower likelihood of rationing for firms whose largest shareholder is a foreign company, when compared to the reference group of firms whose largest shareholder is an individual. This finding could be driven by greater credibility when the main shareholder is a foreign company. Firms owned by foreign companies, compared to all other types of ownership, witness 7.1 percent lower probability of being rationed.

Using single proprietorships as the reference group, we uncover systematic evidence of lower probability (approximately by 4 percent) of rationing for privately held corporations. This intuitive result is specifically attributed to the fact that the periodic publication of financial records is typically mandatory for corporations, which obviously results in higher transparency and increased access to the firm's financial information.

In addition, rationing exhibits significant inter-sectoral variation and according to our results the likelihood of rationing for firms operating in Mining is about 14.9 percent higher. In contrast, firms that operate in the Real Estate and Hotels sectors exhibit approximately 4.8 percent and 7.1 percent lower probability of being rationed, respectively. Moreover, a 1 percent increase in cash flow leads to a reduction in the probability of rationing by 7.8 percent.

In *Table 4* we report the results based on the modified definition of credit rationing (i.e., the sample contains those firms that need a loan but do not have one, including all discouraged potential borrowers, but excluding those who did not apply because interest rates were considered too high). Adopting the alternative definition of credit rationing leads to qualitatively similar results as it regards the variables of main interest. In particular, the rationing likelihood is lower for large firms and also for firms with higher sales growth, while it is higher for firms without profits. However, the

**Table 4**

Estimation results based on alternative rationing definition.

	Being rationed	Holding no-loan	Being rationed	
	Estimated coefficient	Estimated coefficient	Marginal effect	t-Value
<i>Panel A. Main variables</i>				
AGE (in logs)	0.005	-0.016	0.001	0.145
SALESINC	-0.094*	-0.064*	-0.020	-1.808*
FIXEDINC	0.053	-0.398***	0.011	0.894
NOPROFIT	0.225***	0.098**	0.049	3.320***
MEDIUM	-0.046	-0.220***	-0.010	-0.629
LARGE	-0.389***	-0.423***	-0.084	-3.176***
AUDITOR	-0.081	-0.094**	-0.017	-1.514
IAS	-0.106	-0.079*	-0.023	-1.237
FEMALE	0.034	-0.030	0.007	0.552
ACCOUNTS	0.243***	-0.018	0.052	3.662***
<i>Panel B. Control variables</i>				
OWN2	0.081	-0.032	0.017	0.926
OWN3	0.172	0.011	0.037	0.655
OWN4	0.115	-0.100	0.025	0.956
OWN5	-0.272*	0.213***	-0.059	-1.846*
OWN6	0.775	1.192**	0.167	1.394
OWN7	0.326	-0.411	0.070	0.506
OWN8	-0.137	-0.108	-0.030	-0.760
OWN9	-0.027	-0.053	-0.006	-0.163
OWN10	-0.506	0.107	-0.109	-1.057
OWN11	-0.396	0.127	-0.085	-0.946
LEGAL2	0.025	-0.082**	0.005	0.384
LEGAL3	0.081	0.006	0.018	0.473
LEGAL4	-0.067	-0.083**	-0.014	-0.981
LEGAL5	-0.533	-0.017	-0.115	-1.410
LEGAL6	0.326*	-0.200*	0.070	1.922*
LEGAL7	0.768	0.463**	0.166	1.590
LEGAL8	0.640	0.212	0.138	1.296
LEGAL9	0.689	0.444*	0.149	1.273
MINING	0.606**	0.246	0.131	2.297**
CONSTRUC	0.126	0.105*	0.027	1.309
MANUF	0.063	0.080*	0.014	0.921
TRANSPOR	0.095	0.252***	0.021	0.878
WHOLESHALE	-0.125*	0.061	-0.027	-1.678*
REALEST	-0.153	0.291***	-0.033	-1.434
HOTELS	-0.344**	0.279***	-0.074	-2.539**
PMANAGER	0.255	0.517***	0.055	1.388
PPROFES	0.196	0.296***	0.042	1.137
PSKILLED	0.115	0.245***	0.025	0.803
PNONPROD	0.233	0.024	0.050	1.245
PVOCATIO	0.087	0.168	0.019	0.340
PSECONDA	0.187	0.215	0.040	0.734
PTERTIAR	-0.088	0.402***	-0.019	-0.337
DCPS	-1.235***	-0.277**	-0.266	-5.652***
NC	-0.027	-0.054**	-0.006	-0.600
NC-squared	0.003	0.006**	0.001	0.682
CFWC	-0.325	1.250***	-0.070	-3.986***
TRCSUPWC	-0.003	1.329***	-0.001	-0.012
EXPORTIN	-0.074	-0.064	-0.016	-0.638
DOMESTIC	0.158	0.100*	0.034	1.346
CHAMBER	0.005	-0.340***	0.001	0.089
WEB	0.089	-0.227***	0.019	1.565
INTERCEPT	-0.932	-0.675***	-	-
Log-Likelihood	-6493.258			
$\beta_{eu}$	-0.127**			
Total observations	8335			
Censored observations	4459			

Source: EBRD-World Bank Business Environment and Enterprise Performance Survey III (BEEPS-III).

Notes: Definition of credit rationing: firms need a loan but do not have one, including all discouraged potential borrowers, but excluding those who did not apply because interest rates were considered too high. Asterisks \*\*\*, \*\* and \* denote statistical significance at the 1, 5 and 10 percent level, respectively.

gender effect becomes unimportant with female and male-owned firms facing identical rationing probabilities.

All in all, our empirical results complement the findings for transition countries (Isachenkova and Mickiewicz, 2004; Petrick, 2004a,b; Bignebat and Gouret, 2005). Moreover, we provide evidence for a larger number of transition countries as well as considering an extended set of potential rationing determinants. Finally, there are two important caveats in order concerning the conducted analysis. Firstly, given that the dataset is a cross-section of firms, it does not allow the use of dynamics or to control for firm fixed-effects. The former becomes important to the extent that some of the explanatory variables are simultaneously determined with credit rationing (for instance firm size and/or profitability), while the latter limits the representation of firm heterogeneity. Secondly, our results might be biased since the database used does not provide information on several key, to the credit rationing outcome, variables such as payment delinquency and leverage. All these caveats could be addressed in future research by the use of panel data.

## 6. Conclusion

In this paper we investigate the determinants of credit rationing faced by a sample of firms operating in transition countries. This sample is of particular interest given the relatively short operating history their banking systems have. More specifically, the existence of credit constraints at firm-level is modeled as the outcome of two interrelated mechanisms, i.e., demand for loan and credit rationing. Using a micro dataset of approximately 9500 firms from 26 countries we were able to classify firms according to whether they had an outstanding loan, and if not what were the reasons for not obtaining credit. This information allows a direct identification of credit rationed firms permitting an explicit connection between rationing and potential borrower profile. For estimation purposes, we apply a bivariate probit with censoring to model loan demand and the rationing mechanism, given that the sample of credit rationed firms is not based on a random draw from the underlying population. According to our results a strong linkage between loan demand and credit rationing was uncovered. Moreover, the likelihood of being credit rationed is lower for firms with increased sales growth, higher profitability and larger employment size. In contrast, the probability of rationing is increasing when the firm's principal owner is female, implying that credit constraints are correlated to some degree with risk aversion. We also found, in contrast to our priors, that firms maintaining a savings account, which proxies banking relationships, are associated with a higher likelihood of rationing. Using a wide range of control variables at firm, sectoral and country level the results show that firm-specific credit rationing is hampered by the domestic credit to the private sector. Also, firms operating in Mining witness the higher probability of being rationed while those in Real Estate and Hotels the lowest. It should be noted that the majority of the results remained unchanged when a more flexible modified indicator of rationing was applied.

All in all being credit constrained is a mixed outcome of both potential borrower's and lender's abilities to overcome informational asymmetries. The tendency of firms with specific characteristics to be out of the credit market could be more harmful in the presence of exogenous demand shocks since our results indicate that constrained firms exhibit excess sensitivity to fluctuations in profits and cash flow. Moreover, given that there is a sizeable group of rationed firms the effect of credit constraints could have detrimental effects on their performance and their survival. These detrimental effects, apart from affecting industry dynamics, would also produce discernible effects on the aggregate level in terms of employment and production.

There is no doubt that establishing whether credit rationing exists, and if it does, which are its determinants, is very complex. Future research could considerably enhance our understanding provided that data from the bank side where available. The typical study relies at best on survey data where firms report their credit history and experiences. However, there is effectively a complete lack of information from the supply side, i.e data on the exact practices and mechanisms employed by banks in loan application assessments. This data unavailability ultimately hampers any analysis since the researcher attempts to infer bank behavior.

## Appendix

**Table A1**

Definition of control variables.

Variable	Definition
<i>Largest shareholder of the firm (Dummies)</i>	
OWN1	Individual (reference)
OWN2	Family
OWN3	General Public
OWN4	Domestic Company
OWN5	Foreign Company
OWN6	Bank
OWN7	Investment Fund
OWN8	Manager of Firm
OWN9	Employees of Firm
OWN10	Government
OWN11	Other
<i>Legal status of the firm (Dummies)</i>	
LEGAL1	Single Proprietorship (reference)
LEGAL2	Partnership
LEGAL3	Cooperative
LEGAL4	Corporation Private
LEGAL5	Corporation Listed
LEGAL6	Private Other
LEGAL7	State Enterprise
LEGAL8	State Corporatized
LEGAL9	State Other
<i>Operating sector (Dummies)</i>	
MINING	Mining and quarrying
CONSTRUCT	Construction
MANUF	Manufacturing
TRANSPORT	Transport storage and communication
WHOLESHALE	Wholesale, retail, repairs
REALEST	Real estate, renting and business services
HOTELS	Hotels and restaurants
OTHERSEC	Other sector (reference)
<i>The highest percentage of firm's permanent full time staff corresponds to (Dummies)</i>	
PMANAGER	Managers
PPROFES	Professionals
PSKILLED	Skilled workers
PUNSKILLED	Unskilled workers (reference)
PNONPROD	Non-production workers
<i>The highest percentage of firm's workforce has educational level up to (Dummies)</i>	
PUPPRIM	Up to primary (reference)
PVOCATIO	Vocational qualification
PSECONDA	Secondary school qualification
PTERTIAR	Some university education or higher
<i>Other variables</i>	
DCPS	Percentage of domestic credit to the private sector over GDP at country level
NC	Number of competitors the firm currently faces in the national market
CFWC	The percentage of the firm's working capital financed by cash flow
TRCSUPWC	The percentage of the firm's working capital financed by trade credit (suppliers)
EXPORTINC	1 if the firm's exports have increased over the past 36 months, 0 otherwise
DOMESTIC	The percentage of firm's sales sold domestically
CHAMBER	1 if the firm is a member of a business association or chamber of commerce, 0 otherwise
WEB	1 if the firm regularly uses in its interactions with clients and suppliers e-mail and internet, 0 otherwise

Source: EBRD-World Bank Business Environment and Enterprise Performance Survey III (BEEPS-III).

**Table A2**

Descriptive statistics of main and control variables.

Variable	Total sample		No loan		With loan		Being rationed		Not rationed	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
<i>Panel A. Main variables</i>										
AGE (in logs)	2.283	0.808	2.224	0.791	2.363	0.823	2.224	0.795	2.291	0.809
SALESINC	0.544	0.498	0.491	0.500	0.614	0.487	0.447	0.497	0.557	0.497
FIXEDINC	0.378	0.485	0.286	0.452	0.501	0.500	0.281	0.450	0.391	0.488
NOPROFIT	0.134	0.341	0.143	0.350	0.123	0.328	0.179	0.384	0.128	0.334
MEDIUM	0.198	0.399	0.158	0.364	0.253	0.435	0.147	0.354	0.205	0.404
LARGE	0.096	0.295	0.063	0.243	0.142	0.349	0.038	0.190	0.104	0.306
AUDITOR	0.446	0.497	0.384	0.487	0.529	0.499	0.336	0.473	0.461	0.499
IAS	0.158	0.365	0.121	0.326	0.209	0.407	0.094	0.292	0.167	0.373
FEMALE	0.205	0.404	0.220	0.414	0.185	0.388	0.244	0.429	0.200	0.400
ACCOUNTS	0.216	0.412	0.206	0.404	0.231	0.421	0.240	0.427	0.213	0.410
<i>Panel B. Control variables</i>										
OWN2	0.083	0.277	0.077	0.267	0.092	0.289	0.082	0.275	0.084	0.277
OWN3	0.010	0.097	0.010	0.097	0.010	0.097	0.008	0.091	0.010	0.098
OWN4	0.054	0.226	0.043	0.202	0.069	0.254	0.043	0.203	0.055	0.229
OWN5	0.058	0.234	0.050	0.219	0.069	0.253	0.027	0.162	0.062	0.242
OWN6	0.001	0.028	0.001	0.028	0.001	0.028	0.001	0.031	0.001	0.028
OWN7	0.004	0.067	0.002	0.039	0.008	0.092	0.002	0.043	0.005	0.069
OWN8	0.024	0.152	0.020	0.141	0.029	0.167	0.012	0.110	0.025	0.157
OWN9	0.025	0.155	0.024	0.153	0.026	0.158	0.022	0.148	0.025	0.156
OWN10	0.089	0.285	0.103	0.304	0.071	0.257	0.110	0.313	0.086	0.281
OWN11	0.004	0.063	0.004	0.061	0.004	0.065	0.003	0.053	0.004	0.064
LEGAL2	0.249	0.432	0.227	0.419	0.279	0.449	0.220	0.414	0.253	0.435
LEGAL3	0.021	0.144	0.021	0.144	0.021	0.143	0.027	0.161	0.020	0.141
LEGAL4	0.231	0.422	0.204	0.403	0.269	0.443	0.168	0.374	0.240	0.427
LEGAL5	0.018	0.132	0.010	0.100	0.028	0.166	0.004	0.060	0.020	0.139
LEGAL6	0.020	0.139	0.019	0.136	0.021	0.143	0.021	0.144	0.019	0.138
LEGAL7	0.061	0.240	0.075	0.264	0.042	0.202	0.082	0.275	0.058	0.235
LEGAL8	0.019	0.138	0.019	0.136	0.020	0.141	0.019	0.137	0.019	0.138
LEGAL9	0.006	0.080	0.007	0.086	0.005	0.072	0.005	0.074	0.007	0.081
MINING	0.008	0.089	0.008	0.089	0.008	0.089	0.011	0.104	0.008	0.087
CONSTRUC	0.074	0.262	0.074	0.261	0.074	0.262	0.087	0.282	0.072	0.259
MANUF	0.297	0.457	0.283	0.450	0.317	0.465	0.313	0.464	0.295	0.456
TRANSPOR	0.056	0.229	0.060	0.237	0.050	0.219	0.063	0.243	0.055	0.227
WHOLESHALE	0.204	0.403	0.216	0.412	0.187	0.390	0.202	0.402	0.204	0.403
REALEST	0.074	0.262	0.092	0.290	0.049	0.217	0.067	0.250	0.075	0.264
HOTELS	0.045	0.208	0.053	0.224	0.035	0.184	0.036	0.186	0.046	0.211
PMANAGER	0.137	0.165	0.154	0.179	0.115	0.139	0.156	0.188	0.134	0.161
PPROFES	0.174	0.223	0.184	0.239	0.161	0.199	0.178	0.225	0.174	0.223
PSKILLED	0.495	0.312	0.487	0.323	0.506	0.294	0.499	0.319	0.495	0.310
PNONPROD	0.090	0.171	0.087	0.177	0.095	0.162	0.083	0.176	0.091	0.170
PSECONDA	0.359	0.315	0.355	0.326	0.365	0.298	0.375	0.334	0.357	0.312
PVOCATIO	0.319	0.308	0.312	0.320	0.328	0.291	0.324	0.328	0.318	0.306
PTERTIAR	0.282	0.293	0.301	0.311	0.257	0.265	0.272	0.292	0.284	0.294
DCPS	0.258	0.133	0.243	0.127	0.277	0.137	0.226	0.134	0.262	0.132
NC	1.309	2.833	1.255	2.854	1.384	2.802	1.267	2.886	1.315	2.825
CFWC	0.736	0.365	0.843	0.318	0.591	0.374	0.806	0.340	0.726	0.367
TRCSUPWC	0.039	0.138	0.027	0.120	0.056	0.158	0.032	0.130	0.040	0.139
EXPORTIN	0.117	0.322	0.078	0.269	0.170	0.376	0.055	0.228	0.126	0.332
DOMESTIC	0.880	0.324	0.913	0.282	0.836	0.370	0.929	0.256	0.874	0.332
CHAMBER	0.371	0.483	0.274	0.446	0.503	0.500	0.254	0.435	0.387	0.487
WEB	0.675	0.468	0.592	0.492	0.787	0.410	0.565	0.496	0.690	0.463

Source: EBRD-World Bank Business Environment and Enterprise Performance Survey III (BEEPS-III).



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