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Determinants of Credit Constrained Firms: Evidence from Central and Eastern Europe Region

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Determinants of Credit Constrained Firms: Evidence from Central and Eastern Europe Region

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Abstract

Based on survey data covering 6,547 firms in 10 Central and Eastern European countries we examine the impact of the banking sector environment, as well as the institutional and regulatory environment, on credit constrained firms. We find that small and foreign-owned firms are less likely to demand credit compared to audited and innovative firms. On the other hand, small, medium, publicly listed, sole proprietorship and foreign-owned firms had a higher probability of being credit constrained in 2008–2009 than in 2012–2014. The banking sector’s environment analysis reveals that firms operating in more concentrated banking markets are less likely to be credit constrained. However, higher capital requirements, increased levels of loan loss reserves and a higher presence of foreign banks have a negative impact on the availability of bank credit. The evaluation of the institutional and regulatory environment in which firms operate shows that credit information sharing is negatively correlated with access to credit. Furthermore, we show that banking sector contestability can mitigate this negative effect. Finally, we find that in a better credit information sharing environment, foreign banks are more likely to provide credit.

JEL classification: E51, G21, F34, L10

Keywords: access to credit, credit constraints, credit demand, credit information sharing

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Non-Technical Summary

In the context of the global financial crisis one of the recurring topics for both policymakers and academics is the limited access to bank credit. It has gained considerable interest in Europe amid pronounced financial market fragmentation issues, and has been a constant dilemma for countries in the immediate vicinity of the EU, in particular for Central and Eastern Europe (CEE) countries. The present paper examines at the firm and country level, the banking sector, as well as the institutional and regulatory environment in which credit constrained firms in CEE operate.

We start by examining the firm level determinants of credit demand, and we continue with the firm level determinants of credit constrained firms. Next, we estimate the impact of the banking sector's environment on credit constrained firms, and finally, we explore the institutional and regulatory environment in which these firms operate. The analysis is conducted on two consecutive rounds of the Business Environment and Enterprise Performance Survey (BEEPS) covering data from 2008-2009 and 2012-2014. This allows us to cover the early stage of the global financial crisis and the post-crisis period, facilitating the comparison of the main financing conditions during and after the crisis. We define credit constrained firms as those that are either rejected or discouraged from applying for a bank loan. By doing that we differentiate between firms that did not apply for a loan because they did not need one and those that did not apply because they were discouraged, but actually needed a loan.

From the demand-side analysis we find evidence that while small and foreign owned firms are less likely to need credit, audited and innovative firms have higher credit demand. Second, the credit constraint analysis at firm level shows that small, medium, publicly listed, sole proprietorship and foreign-owned firms were more likely to be discouraged from applying for a loan or rejected in 2008.2009. However, in 2012.2014 only young and small firms were facing higher credit constraints. These results indicate that there are considerable differences in firm level determinants and highlight the heterogeneity across years.

Third, the evaluation of the banking sector environment implies that firms operating in a more concentrated market are less likely to be credit constrained. However, higher capital requirements, increased loan loss reserves ratio and higher presence of foreign banks have a negative effect on the availability of bank credit and therefore increase the probability of being constrained. Fourth, the institutional and regulatory environment in which firms operate reveals that credit information sharing is negatively correlated with access to bank credit. Moreover, we show that banking sector contestability can mitigate the negative impact of high credit information sharing. In addition, and since gaining access to soft information can be more difficult for foreign banks, we show that having better credit information sharing will make foreign banks more able and willing to extend credit.

1 Introduction

In the context of the global financial crisis one of the recurring topics for the policymakers and academics is the limited access to bank credit, which is a major growth constraint for developed and developing economies (Beck and Demirguc-Kunt, 2006). It has gained considerable interest in Europe amid pronounced financial market fragmentation issues, but has been a constant dilemma for countries in the immediate vicinity of the EU, and in particular for Central and Eastern Europe (CEE) countries.¹ Although the enterprise sector in the region grew significantly over the past decades, the challenges faced by firms in these countries remain elevated. Limited access to bank credit was among the highest barriers along unfavourable tax rates, political instability, practices of competitors and an inadequately educated workforce (Fig. 1). In this context the present paper examines at the firm and country level the banking sector, as well as the institutional and regulatory environment in which credit constrained firms in CEE operate.

In order to better understand the determinants of bank credit availability we ask four important questions. First, is the bank credit problem due to supply credit constraints or due to low credit demand? It is not clear whether the sharp decline in bank lending observed after the recent financial crisis was primarily attributable to weak loan demand due to the contraction of economic activity or due to a reduction in loan supply. Some papers (Puri *et al.*, 2011; Jimenez *et al.*, 2012) have identified that since the onset of the crisis supply-side problems have contributed to lower aggregate lending as a result of a sharp decline in global risk appetite and capital flows. On the demand side, recent studies (Holton *et al.*, 2012) have shown that credit demand has also declined as borrowers ended up overly indebted. However, there are also cases where some firms do not have bank credit because they do not need or want one. Therefore, the importance of differentiating between supply and demand for credit is vital to analyse the extent to which credit constrained firms are affected by the environment in which they operate. This will allow policymakers to better design public interventions towards financial sector development.

Second, which are the specific firm characteristics that affect firm's ability to access bank credit? For example, are small firms more likely to be credit constrained than large firms? Recent studies provide evidence that small and medium enterprises around the world face greater financing obstacles than large firms (Beck *et al.*, 2005; Beck *et al.*, 2006). In fact, the probability of being credit constrained decreases with the firm size, while a firm's age does not relate to the credit constrained status (Kuntchev *et al.*, 2013). However, for newly founded firms the information asymmetries faced by banks are more severe than older firms which already have a track record, and, therefore, the likelihood to be financed is higher. Similarly, one should expect that firms with foreign ownership, privatised, and exporting firms will be more likely to access credit, as well as firms willing to become more transparent through reporting their balance-sheets according to international accounting standards and having them audited by a certified external auditor.

¹Our definition of Central and Eastern Europe follows that of the International Monetary Fund (IMF) and includes the following 10 countries: 3 Baltic countries (Estonia, Latvia and Lithuania), 5 Central Europe countries (Czech Republic, Hungary, Poland, Slovak Republic and Slovenia) and 2 Southeastern Europe countries (Bulgaria and Romania).

Third, in addition to describing which firms are credit constrained, it is equally important to analyse the link between access to credit and the banking sector environment. In which way does competition and concentration in the banking sector can affect firms access to bank credit? What is the effect of increased levels of loan loss reserves, tighter capital requirements, and high presence of foreign banks on the probability of being credit constrained? Theoretical literature provides two explanations in which banking sector competition can affect bank credit (Carbo-Valverde *et al.*, 2009, Ryan *et al.*, 2014). The market power hypothesis argues that lower competition (greater market power) results in restricted credit supply and higher lending rates, thus intensifying credit constraints. This is in line with economic theory, which suggests that greater competition is associated with lower prices. On the other hand, the information hypothesis argues that competitive banking markets can weaken relationship-building by depriving banks of the incentive to invest in soft information, thus alleviating financing constraints (Petersen and Rajan, 1995). The intuition is that lower competition stimulates incentives for banks to invest in soft information and leads to elevated access to bank credit.

In a similar way concentration can affect access to finance. However, a clear distinction between the two should be made. While competition is a measure of market conduct, concentration is a measure of market structure. Regarding credit requirements, and despite extensive research there is still much debate on the impact of banks' capital requirements on the supply of credit. It has been documented that banks trying to satisfy more stringent capital requirements reduce their supply of credit, and as a result firms are facing higher credit constraints (Puri *et al.*, 2011; Francis and Osborne, 2012).² However, it has been also well documented that an increase in bank capital increases the supply of loans (Bernanke and Lown, 1991; Buch and Prieto, 2014). On the other hand, more ambiguous is the effect of foreign banks on access to credit. Gormley (2010) and Detragiache *et al.* (2008) provide evidence that foreign banks "cherry pick" profitable and transparent firms, while Giannetti and Ongena (2009) argue that foreign banks bring expertise and knowledge that is expected to improve access to credit. Finally, there is a clear consensus about the effect of non performing loans (NPLs); higher levels of NPLs reduce banks' aspiration to increase lending.

Fourth, it is also important to explore the extent to which the institutional and regulatory environment can help firms to overcome credit constraints. For example, Safavian and Sharma (2007) find that the quality of the legal system and its enforcement are complements of credit access. Prior research (Qian and Strahan, 2007; Bae and Goyal, 2009) has shown that firms can benefit from a high level of creditor protection by accessing credit at more favorable terms, such as longer maturities and lower interest rates. On the other hand, theoretical and empirical literature offers mixed results regarding the effect of credit information sharing on access to credit. 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

²The main challenge of these studies is to disentangle the credit supply and credit demand effect. A weakening of the borrowers' balance sheets can cause a contraction of lending (demand side), but also a banks' shortage of equity capital may lead to a decrease in loan supply (supply side). However, our firm survey data contain information that allow us to separate demand from supply.

Pagano (1997) and negative in the multiple-bank lending model of Benardo *et al.* (2015). The effect of lending also depends on the type of information being shared: in the model of Padilla and Pagano (2000), sharing only default information increases lending above the level reached when banks also share their data about borrowers' characteristics. Therefore, a better understanding of the impact of the institutional and regulatory environment on credit access can have relevant policy implications for both banks and firms.

Building on this literature, our paper combines several cross-country datasets to examine the determinants of credit constrained firms at two periods of the credit cycle. To achieve that we use the two latest rounds of BEEPS – the BEEPS IV (2008–2009) and the BEEPS V (2012–2014) – which contain detailed firm level data for 6,547 firms in 10 countries in Central and Eastern Europe. We start by examining the firm level determinants of credit demand and then we continue with the firm level determinants of credit constrained firms. Next, we estimate the impact of the banking sector's environment on credit constrained firms, and finally we explore whether and how the institutional and regulatory environment affects access to credit.

From the demand-side analysis we can infer a few messages which stand out. First, the demand for loans varies with the firm size, with small and medium firms less likely to need a loan than large firms. Second, foreign owned firms have less need for bank credit, as they rely more on the parent company's support for financing their activities. Third, innovative, state-subsidised, audited and firms perceiving competition as more intense, have a higher probability of demanding a loan.

The credit constraint firm level determinants analysis allows us to conclude the following. The age of the firm, the size, the legal status, the ownership, the transparency and the innovation all play a significant role in promoting or demoting access to bank credit. Results indicate that there are considerable differences in firm level determinants of credit constraints across the years. For instance, in 2008–2009 publicly listed, sole proprietorship and foreign owned firms were more likely to be constrained, but at the same time audited and process innovative firms had more access to finance. However, while in 2012–2014 foreign owned firms could access finance more easily, younger and smaller firms were facing higher credit constraints.

Evaluating the banking sector environment allows us to draw the following conclusions. Among the banking sector characteristics we find that higher levels of market concentration make credit more accessible and firms less constrained, while increased loan loss reserves ratios have negative effect on the availability of bank credit, as banks became more reluctant to borrow. We also find that tighter credit requirements and a higher presence of foreign banks increase the probability of being constrained.

The institutional and regulatory environment in which firms operate also plays a significant role in the access of firms to external finance. Our analysis shows that credit information sharing is negatively correlated with access to bank credit. More importantly, we show that the banking sector's contestability can mitigate this negative impact of high credit information sharing. In addition, and since gaining access to soft information can be more difficult for foreign banks, we show that having better credit information sharing will make foreign banks more able and willing to extend credit.

To the best of our knowledge this is the first cross-country paper to focus on the CEE region and study the impact of the banking sector environment, as well as the institutional and regulatory environment, on credit constrained firms at two different points of the business cycle. In doing so, we contribute in several important ways to the extant literature. First, current research examines firm level accounting and survey data, without isolating firm level credit demand from credit supply. We instead elicit information by examining and separating the determinants of credit demand from those of credit supply. Second, we add to the literature on the effect of credit information sharing on access to finance. In particular, we present new evidence on the interaction of credit information sharing with the degree of competition. Third, we provide evidence that better credit information sharing, e.g., through the public credit bureau can facilitate the entry of foreign banks. Fourth, unlike most published work, which examines loan demand and credit constrained firms by focusing on a single country at a single period of time, our combination of multi-year and cross-country data across 10 CEE countries allows us to examine how substantial differences in the firm, banking and country structure affect firms' access to credit.

The paper is organised as follows. Section 2 explains our data while Section 3 introduces the methodological approach. Section 4 reports and discusses the results of our analysis. Section 5 presents the robustness tests. Section 6 concludes.

2 Data

We combine firm and country level data from three main sources. Table 1 provides a full list of all variables used in the paper. The main source of firm level data is the Business Environment and Enterprise Performance Survey (BEEPS), a joint initiative of the European Bank of Reconstruction and Development (EBRD) and the World Bank (WB).³ We focus our study on 10 countries from Central and Eastern Europe (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia) using data from two BEEPS rounds: the 4th round (BEEPS IV) which is conducted in 2008–2009 (3,194 firms)⁴ and the 5th round (BEEPS V) which is conducted in 2012–2014 (3,353 firms)⁵.

The two rounds rely on the same sampling frames and use identical questionnaires in all countries. To ensure that the samples are representative of the relevant population of firms, the surveys use stratified random sampling.⁶ The sample includes very small firms with as few as only one employee and firms with up to 37,772 employees. In addition, the data include firms in the rural areas as well as large cities. Hence, these data enable us to analyse diverse firms in a large number of countries. Finally, the data set contains a panel component, where 582 firms that were surveyed in BEEPS IV were surveyed again in BEEPS V.

³Data are available at www.ebrd-beeps.com.

⁴From the 3,194 firms interviewed during the 2008–2009 BEEPS, 2,503 firms (78.4%) were interviewed in 2008 and 691 firms (21.6%) in 2009.

⁵From the 3,353 firms interviewed during the 2012–2014 BEEPS, 39 firms (1.2%) were interviewed in 2012, 3,108 firms (92.7%) interviewed in 2013 and 206 firms (6.1%) in 2014.

⁶For example, in each country, the sectoral composition of the sample in terms of manufacturing versus services was determined by their relative contribution of GDP.

However, our analysis relies primarily on the pooled 2008–2009 and 2012–2014 data, since many variables of interest have a retrospective component in each survey date. In addition, it is hard to detect robust relationships with a small panel of heterogeneous firms, especially when we use many control variables.

The BEEPS IV was undertaken at a time when emerging Europe experienced the global financial crisis, whereas the BEEPS V took place few years after the credit bust (Fig. 2). While year-on-year GDP growth amounted to 7% on average over the period 2005–2007, growth declined to 2.4% in 2008 and turned negative in 2009 (-7.7%). After that drop GDP growth stabilised at around 1.8% a year for the period between 2012 and 2014. This dramatically different environment in 2008–2009 and 2012–2014 will allow us to compare credit constraints at two very contrasting points during the credit cycle where the firm and bank credit environment changed.

Even though it is well acknowledged that CEE countries managed to embark on structural and institutional reforms earlier than the beginning of the credit crunch, there are few significant cross-country differences in the credit cycle between the two rounds (Fig. 2 and 3). While the crisis started early in the Baltics and the credit cycle started to turn as early as 2007, in other countries (*i.e.* Bulgaria and Slovenia) credit tapered off towards the third quarter of 2008 (Berglof *et al.*, 2010; Terazi and Senel, 2011). However, Poland never went into recession and the impact of the financial crisis was generally muted. On the other hand, during the second period three countries (Czech Republic, Hungary and Slovenia) were in recession, in Latvia and Lithuania GDP growth was decreasing, while all other countries were growing at reasonable rates.

2.1 Firm level data

To gauge credit constraints at the firm level, we follow Popov and Udell (2012) and Popov (2015) and use three questions from BEEPS V which allow us to identify whether firms need bank credit, whether they apply for bank credit or are discouraged from doing so, and whether their loan applications are approved or rejected. We start with question K16 which asks: “Referring to the last fiscal year, did the establishment apply for any loans or lines of credit?”. Those firms that did apply for a loan are classified as *applied*. For those firms that did not apply for a loan question K17 asks: “What was the main reason why this establishment did not apply for any line of credit or loan?”. We classify firms as *discouraged* if they did not apply because: “Application procedures were complex”, “Interest rates were not favourable”, “Collateral requirements were too high”, “Size of loan and maturity were insufficient”, “It is necessary to make informal payments to get bank loans” or “Did not think it would be approved”. Therefore, our first main variable, *loan needed*, is a dummy variable which equals one for those firms which are either *applied* or *discouraged*.

Following the firms that applied for bank credit, question K20 asks: “Referring only to this most recent application for a line of credit or loan, what was the outcome of that application?”. Four answers are available: “Application was approved“, “Application was rejected“, “Application withdrawn by the

establishment“, or “Application is still in progress“.⁷ Firms whose application was approved are classified as *credit unconstrained*. On the other hand, we classify firms as *credit constrained* if their application was rejected or if they were discouraged. This is our second main variable. By following this strategy we are able to differentiate between firms that did not apply for a loan because they did not need one⁸ and those that did not apply because they were discouraged (but actually needed a loan).⁹

Table 2 provides an overview of the responses of firms to questions K16, K17 and K20 (K18a). While the number of firms applied for loan decreased from 41% to 27% between 2008–2009 and 2012–2014, the rate of approved and rejected applications remained at the same level – 87.5% and 9.5% on average, respectively. Importantly, BEEPS V allow us to identify firms that withdrew their loan application (2%), as well as cases where the application procedure were still in progress (1%) at the time the survey took place. However, this information is not available in the BEEPS IV. The main reason that firms did not apply for a loan is because they do not need a loan (76% on average). This brings the level of discouragement to 24% on average, with unfavorable interest rates (7.5% on average), high collateral requirements (4% on average), and complex application procedures (4% on average) being the most prominent reasons. Finally, the number of bank credit constrained firms – those that are either discouraged or rejected – increased from 33% in 2008–2009 to 43% in 2012–2014.

Summary statistics in Table 3 indicate that 56% of all sample firms in 2008–2009 needed a loan, while 44% did in 2012–2014. Thirty-three% of firms were credit constrained in 2008–2009, while 43% were constrained in 2012–2014, pointing to a substantial tightening of financing constraints in 2012–2014. Given that demand declined and constraints increased between the two rounds of BEEPS, it is important to differentiate between both. Behind these averages lies substantial variation across and within countries (Tables 4 and 5, and Fig. 4). While 38% of firms in Slovakia were credit constrained in 2008–2009 and 39% in 2012–2014, 23% of firms in Lithuania were credit constrained in 2008–2009 and 54% in 2012–2014. The variation over time also differs considerably across countries. While the share of credit constrained firms dropped in Poland from 37% to 35%, it increased from 47% to 68% in Latvia between the two rounds.

We also include several firm level control variables that may influence the extent of firms’ credit constraints. These include: whether a firm is located in a capital (*Capital*) or a city (*City*); firm age (*Age*); size (*Small* firm and *Medium* firm); whether a firm is *Publicly listed*; *Sole proprietorship*; *Privatised*; *Foreign owned*; *Government owned*; *Exporter*; *Audited*; whether a firm innovates – either in product or process (*Innovation*). Table 3 highlights the substantial increase in the number of small firms from 38% in 2008–2009 to 58% in 2012–2014, as well as the decline in the number of innovative firms (from 77% to 37%) between the two rounds. Only very few firms – less than 1% – in 2012–2014 were publicly listed

⁷From our sample we exclude firms with unknown loan status and firms with a loan from an unknown source.

⁸These are firms that answered “No” to question K16 and “No need a loan” in question K17.

⁹In BEEPS IV question K20 has been replaced by question K18a, which asks: “In last fiscal year, did this establishment apply for any new loans or new lines of credit that were rejected?”. The two available answers are: “Yes” or “No”. We classify firms that answered “No” to K16 and “No” to K18a as credit unconstrained, while we classify firms as credit constrained if they answered “Yes” to K18a or answered “Application procedures were complex”, “Interest rates were not favorable”, “Collateral requirements were too high”, “Size of loan and maturity were insufficient”, “It is necessary to make informal payments to get bank loans” or “Did not think it would be approved” to K17.

compared to 7% in 2008–2009, while 37% of firms were audited compared to 51% between the two periods, respectively. In some of our analysis, we use additional firm characteristics that we will discuss later.

2.2 Country level data

Our country level data can be divided into two categories, those that measure the performance of the banking sector environment within a country, and those that measure the performance of the institutional and regulatory environment.¹⁰

2.2.1 Banking sector environment

In order to measure the performance of the banking sector environment we use the Bureau van Dijk Electronic Publishing (BvDEP) Bankscope database, which contains balance sheet and income statement information for banks participating in each country. Only banks classified as commercial, cooperative, savings and bank holding companies are considered in the analysis. We leave out central banks and investment banks, because they are not directly involved in providing loans to firms.

We are measuring the banking sector competition by using a non-structural approach, the Lerner index (Lerner, 1934).¹¹ The index measures the markup that firms charge their customers by calculating the disparity between price and marginal cost expressed as a percentage of the price:

$$Lerner\ index = \frac{P - MC}{P}, \quad (1)$$

where P is the price of banking output¹² and MC is the marginal cost. In other words, the Lerner index shows the ability of an individual bank to charge a price above marginal cost. The index ranges between 0 and 1, with zero corresponding to perfect competition and larger values reflecting greater market power (less competition).¹³

We also use a measure of concentration in the banking industry, the Herfindahl-Hirschman index (HHI), which is the sum of the squares of the percentage market shares held by each bank:

$$HHI = \sum_{i=1}^n s_i^2, \quad (2)$$

where s_i is the market share of bank i . The HHI index stresses the importance of larger banks by assigning them a greater weight than smaller banks, and it incorporates each bank individually, so that arbitrary

¹⁰All country level variables are collected, calculated or constructed for years 2008 and 2013. This is due to the fact that the majority of the firms in BEEPS IV and BEEPS V were interviewed in 2008 and 2013, respectively.

¹¹We are aware of other competition measures, such as the adjusted-Lerner index (Koetter *et al.*, 2012), the Boone index (Boone, 2008), the profit elasticity (Boone *et al.*, 2005), the H-statistic (Panzar and Rosse, 1987). Each one has its own metrics and drawbacks. However, we prefer the Lerner index for its simplicity and direct applicability. We do not take a stand on which is the best measure of competition.

¹²The price of banking output is calculated as the ratio of total revenue (sum of interest income, commission and fee income, and other operating income) to total assets.

¹³Appendix B describes the methodology used to calculate the Lerner index.

cut-offs and insensitivity to the share distribution are avoided. Higher values of *HHI* indicate higher market concentration.

To gain further insights into the banking sector, we additionally compute and employ three explanatory variables that are expected to influence access to credit. In order to control for the capitalisation of the banking sector we compute the bank capital to assets ratio as the ratio of total capital to total assets; for the health of bank loans we compute the ratio of loan loss reserves to total gross loans; and for the effect of foreign banks¹⁴ presence on credit constraints we calculate the assets share of foreign controlled banks in the domestic banking sector. The first two variables are constructed at the country level as the mean of all bank level capital to assets ratios and loan loss reserves to gross loans ratios, respectively, while the third variable is constructed at the country level as the share of total assets held by foreign banks to the total assets held by all banks participating in the country.

Despite extensive research there is still much debate on the impact of capital requirements on the supply of credit. For example, Bernanke and Lown (1991), Woo (2003), Albertazzi and Marchetti (2010) and Busch and Prieto (2014) all find a positive relationship between banks capital to assets ratio and loan growth. In particular, they provide evidence that low (high) bank capitalisation is associated with a contraction (expansion) of credit supply. On the other hand, in response to tighter capital requirements, banks can cut down lending and therefore increase the probability of a firm being credit constrained. It has been documented that banks trying to satisfy more stringent capital requirements reduce their supply of credit. For example, Puri *et al.* (2011), Francis and Osborne (2012), Bridges *et al.* (2014) conclude that a one percentage point increase in banks capital to assets ratio causes a decline of 1–2% to 4.5% in the supply of credit.

In order to overcome the major shortcoming of the non-performing loans (NPLs) indicator, which is the cross-country and within country comparison, we compute the loan loss reserves (LLRs) as the ratio of loan loss reserves to total gross loans. By doing that we robust our measure from differences in definitions of NPLs and the level of stringency with which NPLs are calculated. High and rising levels of LLRs in many CEE countries continue to exert strong pressure on banks' balance sheet, with possible adverse effect on banks' lending. The upward trend started immediately with the outbreak of the financial crisis in 2008, but the sharp increase occurred a year later, when GDP contracted. This trend reflects non only the consequences of macroeconomic factors (high unemployment, currency depreciation, tight financial conditions), but it is also due to the non-negligible contribution of banks' specific factors (high cost efficiency, moral hazard).¹⁵ Recent evidence (EIB, 2014) suggests that NPLs are expected to depress lending by increasing asymmetric information and uncertainty about asset quality and, thus, bank capitalisation. Therefore, we expect the probability of a firm being credit constrained to be positively correlated with NPLs and LLRs.

In the existing literature there is controversy about the effect of foreign banks on access to credit.

¹⁴A bank is foreign-owned if more than 50% of the shares is held by foreign shareholders.

¹⁵See, for instance, Klein (2013).

One can argue that foreign banks can bring expertise and capital into the host market, which might have an advantage in overcoming informational and legal obstacles to lending and therefore improve access to finance, especially for large firms (Giannetti and Ongena, 2009). In addition, the presence of foreign banks can also affect the behavior of domestic banks, such as that domestic banks start lending to more opaque firms and thereby benefit all firms (Dell’Ariccia and Marquez, 2004). On the other hand, foreign banks might focus on particularly profitable (“cherry pick”) projects, which are easily identifiable because they are transparent. Therefore, access to credit might become more difficult (Gormley, 2010; Claessens and Van Horen, 2014). Indeed, Detragiache *et al.* (2008) show that the presence of foreign banks in low-income countries is associated with less credit being extended. However, foreign banks might also exert competitive pressures on the domestic banking industry, which in response cuts back its lending activities, thereby hurting the overall provision of credit to firms and growth. Additionally, Maurer (2008) found that rather than benefiting the majority of firms, as has apparently been the case in middle income countries, in transition economies only the most transparent firms, i.e. firms that use international accounting standards, benefit from foreign bank entry.

Tables 4 and 5 present summary statistics for our bank level variables. We find considerable variation in the banking sector environment not just between countries, but also between years. Although Table 3 reports a constant level of banking sector competition (Lerner index equal to 0.39 on average) between the two rounds of BEEPS, there are significant changes across years. While in 2008–2009 the Czech Republic had the most competitive banking sector, in 2012–2014 the Lerner index increase by 16% resulted in the less competitive market in our group of countries. The most concentrated market of our sample is Estonia, even though HHI decreased from 0.68 to 0.46 between the two rounds. On the opposite side, Poland is the less concentrated market with 17 and 19 banks in 2008–2009 and 2012–2014, respectively.

For the majority of the countries, the capital to assets ratio is at or above 8%, while LLRs soared dramatically from 3% to 9% on average from BEEPS IV to BEEPS V. However, in Latvia and Romania LLRs increased by 12%, while in Estonia and Slovakia only by 1%. Foreign participation is very high within the region, with foreign-owned banks controlling on average 78% of all bank assets. However, lower-than-average foreign bank ownership in Latvia, Poland and Slovenia stems from the fact that the largest banks in these countries are domestically-owned.¹⁶

2.2.2 Institutional and regulatory environment

Berger and Udell (2006) argue that availability of credit and ease of access of firms to external funds depend, among other things, on the lending infrastructure. This includes the information environment, the legal environment, the judicial and bankruptcy environment, the social environment, as well as the tax and regulatory environment. Based on that, we additionally control for institutional and regulatory factors that could influence both demand and supply of loans, such as the level of inflation, the strength of

¹⁶For example, NLB in Slovenia, ABLV in Latvia and PKO in Poland.

legal rights, the public credit registry coverage¹⁷, the government effectiveness and the regulatory quality. We obtain inflation from the World Bank's World Development Indicator (WDI) database, while all other variables come from the World Bank Doing Business Survey.¹⁸

Theory suggests that in highly inflationary environments the costs of loans are higher than normal and banks are more hesitant to extend credit in conditions of heightened uncertainty and risk. In addition, better protection of borrowers and lenders rights through stronger bankruptcy and collateral laws is expected to promote access to finance. However, theoretical and empirical literature suggests that credit information sharing could either increase or decrease bank credit. Information sharing is unambiguously expected to increase bank credit only in the moral hazard model of Padilla and Pagano (1997). In other models of credit market performance (Pagano and Jappelli, 1993; Padilla and Pagano, 2000; Bennardo *et al.*, 2015), credit information sharing may either increase or decrease bank credit. Therefore, the question of how credit information sharing affects access to finance is ultimately left to empirical scrutiny (Brown *et al.* 2009).

Tables 4 and 5 reveal that heterogeneity across countries is prominent. Creditors' rights ranging from a low of 4 in Slovenia to a high of 10 in Latvia, the index ranges from 0 (weak) to 12 (strong). Credit information sharing was as low as 5% on average in 2008–2009, ranging from 0 in Estonia, Hungary and Poland to 31% in Bulgaria. However, credit information sharing increased considerable after the crisis, reaching 16% on average in 2012–2014, with Latvia and Bulgaria having the highest number of firms listed in a public credit registry (64% and 56%, respectively). Romania and Slovenia experience the lowest (–0.32) and the highest (1.02) level of government effectiveness, respectively, while policies and regulations are better designed to permit and promote private sector development in Estonia (1.43 in 2008–2009) and Lithuania (1.10 in 2012–2014) compared to Romania (0.58 and 0.54 in the rounds, respectively). These two measures range from approximately –2.5 (weak) to 2.5 (strong).

¹⁷Information sharing institutions typically take one of two forms: either a public credit registry or a private credit bureau. A public registry is maintained by the public sector, generally the central bank, while a private bureau is managed by the private sector. In theory, the two institutions should be perfect substitutes – it should not matter whether information is supplied by a public or private entity. However, empirical studies provide ambiguous results. Love and Mylenko (2003) found that public credit registries had no impact on perceived financing constraints. Their study includes 51 developed and developing countries in all regions of the world for the period 1999 to 2000. On the other hand, OECD indicates that public credit registries are associated with higher perceived financing constraints. A large part of the reason for this is the underlying purpose of the different entities. In most cases, public registries are set up, at least originally, to support banking supervision, although the data are often accessible by lenders, who use this to evaluate potential borrowers. According to a survey conducted by the World Bank in 2003, 46% of public credit registries were originally established to assist in bank supervision, while only 34% were set up to improve the quality and quantity of data available to lenders (Miller, 2003).

¹⁸Details on how these variables are constructed are available on World Bank's Doing Business Survey website at <http://www.doingbusiness.org/methodology>.

3 Empirical methodology

To estimate the relationship between firm and country level characteristics and the probability that a firm is credit constrained, first we estimate the following probit model:

$$\Pr(\text{firm being credit constrained}) = F(\text{explanatory variables}) \quad (3)$$

where the function $F(\cdot)$ will be devised using a cumulative normal distribution function. Since in our sample a credit constrained firm is only observed if it expresses the need for a loan, we use a probit model with sample selection based on Heckman (1979). Thus we control for potential selection bias by estimating a bivariate selection model that takes into account interdependencies between the selection and the outcome equation. At the first step we estimate the selection equation:

$$\text{Loan needed}_{ijt} = a_1 X_{ijt} + a_2 \text{Competition} + a_3 \text{Subsidised} + a_4 C_j + a_5 I_j + u_{1,ijt}, \quad (4)$$

where Loan needed_{ijt} is a dummy variables equal to 1 if firm i in country j at time t has a demand for bank credit and zero otherwise¹⁹; X_{ijt} is a matrix of firm covariates to control for observable firm level heterogeneity; C_j and I_j are country and industry fixed effects in order to wipe out (un)observable variation at the aggregation level.

At the second step we use the sub-sample for which we observe credit constrained firms and estimate the outcome equation:

$$\text{Credit constrained}_{ijt} = \beta_1 X_{ijt} + \beta_2 C_j + \beta_3 I_j + \beta_4 \lambda_{ijt} + u_{2,ijt}. \quad (5)$$

where $\text{Credit constrained}_{ijt}$ is a dummy variable equal to 1 if firm i in country j at time t is credit constrained, and zero otherwise; and λ_{ijt} is the inverse Mills' ratio obtained from the first-step (selection equation) Heckman procedure using all observations.

The identification of the selection equation requires at least one variable that determines credit demand, but is irrelevant in the outcome equation. Thus, following Popov and Udell (2012), Hainz and Nabokin (2013) and Beck *et al.* (2015), we rely on two additional variables. Specifically, we include *Competition* – whether a firm declares “practices of competitors in the formal sector” as major or very severe obstacle – and *Subsidised* – whether a firm has received subsidies from national, regional or local government or the European Union.²⁰ The economic intuition is that firms in bank competitive markets have higher demand

¹⁹We observe the loan demand status for all firms in the sample.

²⁰Both variables are positively and statistically significant at 1% level correlated with the demand for loans. However, we cannot ensure that the exclusion restriction is not violated. On the one hand, *Competition* and *Subsidised* are not readily observed by the bank as it is the size, the ownership and other RHS variables in the outcome equation. On the other hand, the firm might demand bank credit, but based on its competitive position, banks might reject the loan application. Strong competitive forces might mean lower profit margins, the inability to fulfill credit obligations and higher credit risk. Moreover, firms in competitive environments could be more efficient, and if a firm is backed by subsidies, it can be viewed as less risky. If banks had this information, the validity of the exclusion restriction could be put into question – we need to acknowledge

for bank credit due to lower profit margins. In other words, competition reduces mark-ups and therefore firms' ability to finance investment internally. All else equal, firms will then demand more external funding. A firm's application for a subsidy may also signal that it is in need of external funding.²¹

We then extend our model by incorporating B_{jt} , which is a matrix of banking sector variables:

$$\textit{Credit constrained}_{ijt} = \beta_1 X_{ijt} + \beta_2 B_{jt} + \beta_3 I_j + \beta_4 \lambda_{ijt} + u_{2,ijt}, \quad (6)$$

and L_{jt} , which is a matrix of institutional and regulatory variables:

$$\textit{Credit constrained}_{ijt} = \beta_1 X_{ijt} + \beta_2 L_{jt} + \beta_3 I_j + \beta_4 \lambda_{ijt} + u_{2,ijt}. \quad (7)$$

However, we exclude country fixed effects from equations 6 and 7 as the explanatory variables are expressed at the country level. Finally, in all estimations standard errors are clustered at the country level, thus allowing for errors to be correlated across firms within a country, reflecting possible country-specific unobserved shocks.²² As a robustness check we also estimate our model using country-industry clustered standard errors.

Panel A of Table 6 presents correlations of bank level variables. As a start, it is useful to note that many of the correlations are statistically significant; out of the 90 correlations 72 are significant at the 1% level. The univariate correlations suggest that a less concentrated banking sector, tighter capital requirements in terms of increased capital to assets ratio, and higher presence of foreign banks can increase the probability for a firm being credit constrained. They also highlight the adverse effect of LLRs on credit constraints from 2008–2009 to 2012–2014, which is attributed to the fact that the bank asset quality has deteriorated in the region since the onset of the global financial crisis. Moving to Panel B, we find that in countries with high levels of government effectiveness and better regulatory quality, firms are less credit constrained. Interestingly, we find that stronger laws for protection of borrowers and lenders rights, as well as greater credit information sharing impose higher credit constraints to firms. This can be explained by the extremely high presence of foreign banks in the region (78% on average), in association with the moderate legal rights index (7.5 of 12) and the low credit registry coverage (10.5% on average). We will examine the negative impact of credit information sharing on access to finance in the next section.

this caveat.

²¹Another variable that could probably satisfy the exclusion restriction is whether a firm leased fixed assets, such as machinery, vehicles, equipment, land, or building. Under the preservation of capital theory firms rely on their fixed assets to generate income and to cover their operating expenses or investments, but at the same time to conserve scarce working capital. Therefore, by leasing fixed assets a firm signals that its capital position is tight and that its demand for bank credit is high. However, this information is only available in the 2012–2014 BEEPS.

²²We assume that country-level measures of competition are exogenous to the firm-level measure of credit constrained. In other words, each individual firm is small enough to affect country-level measures of bank competition.

4 Results

In this section we present our main empirical results on the determinants of firms financing needs and constraints.

4.1 Demand for bank loans

Table 7 presents results from a simple probit model without sample selection (columns [1]–[3]) and from a first stage probit model with Heckman sample selection procedure (columns [4]–[6]), using equation 4. The dependent variable is a dummy that is one if the firm has a demand for bank loan and zero otherwise. The probit with sample selection regression includes two additional exogenous variables – *Competition* and *Subsidised* – as we discussed earlier. We saturate the model with country and industry fixed effects. We run the analysis on each BEEPS round separately, but we also pool the two rounds together (columns [3] and [6]). This will allow us to examine the determinants of credit constrained firms during a cyclical downturn.

The results, which are in line with previous research (Ongena and Popov, 2011; Brown *et al.*, 2011; Popov and Udell, 2012; Beck *et al.*, 2015), indicate that small-sized firms demand fewer loans than large firms. This can be explained in light of the funding sources of small firms in CEE region, which are entirely based on internal funding – internal funds or retained earnings and owner’s contribution account for 72% of total funds (Fig. 5). As expected, foreign owned firms rely more on the parent firm’s support and funding than other firms, while firms having their financial accounts externally audited are more likely to need a bank loan. Firms that have introduced new or significantly improved products or services during the last three years are also more likely to need a loan. Finally, firms that declare competition as an obstacle and firms that received subsidies are positively and significantly correlated with a firm’s demand for credit.

4.2 Credit constraints

Next, in Table 8 we present regression specifications in line with equation 5 and we report coefficient estimates (columns [1], [3] and [5]), as well as marginal effects at the mean (columns [2], [4] and [6]). For identification reasons we drop from the second step estimation *Competition* and *Subsidised*. Results for 2008–2009 indicate that, compared to large firms, small and medium firms – although they need fewer loans – are more likely to be credit constrained. The economic magnitude of this effect is substantial: small firms are 27% more likely to be credit constrained than large firms, while medium firms are 13% more likely to be credit constrained than large firms. We also find that publicly listed, sole proprietorship and foreign-owned firms are more credit constrained than privatised or government-owned firms. On the other hand, firms with audited balance sheets are 8% less likely to be rejected or discouraged from applying for a bank loan, implying gains from the reduction of information opacity. Finally, firms that innovate are 12% more likely to get a loan than non-innovative firms. This result is not surprising if we think that one

of the core functions of banks is the establishment of long-term relationships with firms in order to get a deeper understanding of their borrowers. Thus, banks may be well placed to fund innovative firms, as such enduring relationships will allow them to understand the business plans, products and technologies involved. At the second-stage Heckman regression the inverse Mills's ratio does not enter significantly, indicating that selection bias does not distort our probit results in 2008–2009.

Turning our analysis to 2012–2014 we find that firm age turns to be negative and highly significant indicating that the younger the firm the more credit constrained it is. Small firms continue to experience tighter credit constraints as in 2008–2009, but not medium-sized firms. Interestingly and opposite of results in column [1], foreign owned firms – although less likely to demand a loan – are more likely to receive one if they apply for (21% probability of being unconstrained). This might be because foreign firms can obtain financing from their parent company and thus do not need to borrow from local banks, but more importantly it also indicates the different macroeconomic and credit environments in which the two BEEPS rounds were conducted. Controlling for selection bias with the Heckman procedure produces a positive and significant Inverse Mills' ratio, which means that the selection problem is apparent in this model and as a result it would have been incorrect to estimate the credit constraint equation without taking it into account.²³

In last two columns we pool the 2008–2009 and 2012–2014 data and we find that the only significant variables are small and publicly listed firms, which are more likely to be credit constrained, and innovative firms, which can access external credit more easily. However, by aggregating the data and ignoring heterogeneity across years we lose important information regarding specific firm level characteristics that influence a firm's access to finance, such as sole proprietorship, foreign ownership and transparency.

4.3 Country level determinants

We next extend our model to include country level variables in order to account more comprehensively the banking sector and the institutional and regulatory environment in which firms operate. Coefficient estimates and marginal effects reported in Table 9 point out that along the firm level determinants there are also specific country level characteristics that influence the likelihood of a firm being credit constrained.

4.3.1 Banking sector environment

We find that the Herfindahl-Hirschman index has a significant impact on the probability of firms being credit constrained. The effect has a negative sign, namely, a more concentrated market (higher level of HHI) has a negative impact on credit constraints and therefore improves credit access. This result implies that firms face less difficulty in gaining access to credit if they operate in a more concentrated market of banks. Numerically, a one-standard deviation increase in average HHI decreases the probability of firms

²³The positive Mills' ratio coefficient indicates that in the 2012-2014 BEEPS wave firms that were more likely to need bank credit were also more likely to be credit constrained.

being constrained by about 5.5% in 2008–2009 and 8.8% in 2012–2014.

Turning to bank capital to assets ratio, the variable has a positive impact of the probability of being constrained and indicates that banks facing higher capital requirements will reduce credit supply and make firms more constrained towards bank credit. A one-standard deviation increase in average capital requirements would increase the probability of firms being constrained by about 2.3% in 2008–2009 and by 9.4% in 2012–2014. This result confirms previous studies (Albertazzi and Marchetti, 2010; Aiyar *et al.*, 2014) that in response to tighter capital requirements banks decrease lending.

In addition, and consistent with previous studies, we find a significant positive impact of the level of loan loss provisions on credit constraints. This effect averages to a 11% increase in the probability of being constrained for a one-standard deviation increase in loan loss provisions in 2012–2014. In other words, a 1% increase in the fraction of loan loss provisions increases the probability of being credit constrained by almost 2.7%.²⁴

Results point out that the presence of foreign banks worsens access to credit. Based on the marginal effects reported in column 4, an increase in the share of foreign-owned banks of one-standard deviation would lead to a decrease in the supply of credit – or to an increase in the probability of being constrained – of about 5.3%. The intuition is that foreign banks are better than domestic banks at monitoring hard information, such as accounting information or collateral values, but not at monitoring soft information, such as borrower’s entrepreneurial ability or trustworthiness. As a result, foreign-owned banks will “cherry pick” hard information borrowers and lend only to the largest and most transparent firms. Detragiache *et al.* (2008) and Claessens and Van Horen (2014) find that one-standard deviation increase in foreign presence is associated with a decline in private credit of 5 to 6 percentage points.

Moreover, the negative effect of foreign banks on credit constrained could also reflect the fact that Western European parent banks have had a particular need to strengthen their balance sheets, restore profitability and comply with more stringent capital requirements in the wake of the crisis. One way of doing that has been to reduce their international operations.

4.3.2 Institutional and regulatory environment

The institutional and regulatory environment in which firms operate also plays a significant role in the access of firms to external finance. More specific, the coefficient of the legal rights index is found to be positive and significant in 2008–2009, indicating that firms in countries with stronger collateral and bankruptcy laws are facing higher credit constraints than their peers in other countries. Similarly, greater availability of credit information imposes more credit constraints. A one-standard deviation increase in credit information sharing will increase the probability of being constrained by 6.8%, over the pooled sample.

²⁴EIB (2014) studies the effects of the evolution of NPLs on credit growth to the corporate sector in the euro area, by focusing on the largest banks in each country for the period 2004–2013. The study finds a significant negative impact of the level of NPLs on corporate lending. A 1% increase in NPLs decreases the growth of corporate credit by 3%.

This negative effect of credit information sharing on private credit can be explained in three ways. First, from the severity of adverse selection in the absence of credit information sharing (Pagano and Jappelli, 1993). If adverse selection in the absence of credit information sharing is so severe that safe types of borrowers are priced out of the market, then credit information sharing will increase lending. On the other hand, if safe borrowers participate in the credit market even in the absence of credit information sharing, then credit information sharing will reduce lending. This is because the elimination of uncertainty about borrower types caused by credit information sharing coincides with lenders' possibility to engage in price discrimination. The increase in lending to safe borrowers does not compensate for decrease in lending to the risky borrowers.

Second, from the type of information shared by banks (Padilla and Pagano, 2000): when banks share information only about defaults, high quality borrowers try harder to avoid default in order to avoid being pooled with low quality borrowers. As a result, default and interest rates will be lower and bank lending is expected to increase. However, when banks share information not only about defaults, but rather a more complete information including his/her intrinsic quality, this may in fact lead to a collapse of the credit market. If a high quality borrower knows that the bank will disclose such information, default per se carries no stigma. Therefore, borrowers' incentives to avoid default are no greater than if no information is shared. Consequently, the elimination of informational rents will force banks to require a higher probability of repayment in order to be willing to lend, and may thus choose to refrain lending altogether.

Third, from the aggregate indebtedness (Bennardo *et al.*, 2015). Nowadays, most clients borrow from several banks simultaneously. This multiple bank lending can thus generate a negative contractual externality among lenders as each bank's lending may increase default risk for other banks. Therefore, banks will react to the increased probability of default by rationing credit. The introduction of credit information sharing will allow them to adjust loan offers to applicants' credit exposure, which rules out strategic defaults, offers better protection against other banks' opportunistic lending, and expand credit availability. However, when the value of borrowers' collateral is very uncertain and creditor rights are poorly protected, the expected gain of competing banks' from opportunistic lending is particularly high. The predatory rates charged by these banks can exploit additional information to better target creditworthy customers and thereby make the market unavailable to other lenders. In this case a unique equilibrium of market collapse can be induced.

Moreover, this result shows that a country that has a public credit registry has higher perceived financing constraints among firms. One possible explanation for this result might be that public registries have been established in countries where accessing finance is in general more difficult. Alternatively, the public registry could be either an government response to the weak credit environment or the by-product of a particular regulatory or legal framework that is itself a cause of the weak credit environment. Indeed, Djankov *et al.* (2007) have shown that countries with legal systems of French origin have both a weaker credit environment and more public credit registries.

What is more, an empirical study by Jappelli and Pagano (2002) provide evidence that in countries with poorly functioning legal systems, banks might be unable to sustain effective lending based on ex post creditor rights, and may depend on credit information sharing for their lending activities. One measure that can assess the overall performance of the judicial system is the enforcing contract indicator of Doing Business database published by the World Bank.²⁵ Data reveal that the number of procedural steps involved in a commercial dispute, the time to resolve a dispute and the costs for settling a dispute are more/longer/higher for CEE countries compared to EU-28 averages. Maresch *et al.* (2015) using the Survey on Access to Finance of Enterprises (SAFE) dataset from the European Central Bank for the period between 2009–2012, find that firms operating in such an environment have higher probability of being constrained. Taking into account the very low level of credit information sharing in the region (Table 3), it is not surprising that this variable is positively related to credit constraints faced by firms.

5 Robustness checks

In this section we perform several checks in order to assess the robustness of our results.

We start by examining more carefully the negative effect of credit information sharing on access to finance. This effect could be either mitigated or exacerbated by certain features of the environment in which banks operate, such as competition in the banking sector or the presence of foreign banks in the market. In this section, we present results in which we interact our credit information sharing variable with the Lerner index and the share of foreign banks.

Results are reported on Table 10. We find that the interaction term between competition and credit information sharing has positive and significant effect. Using the marginal effects in column [2], in a country with a less competitive banking sector (the Lerner index increased by one-standard deviation), a one-standard deviation increase in credit information sharing (equal to 0.15) results in a approximately 10% probability of being credit constrained. However, in a country with high-competition banking sector (Lerner index decreased by one-standard deviation) the probability of being credit constrained is equal to 7.7%. Taking into account results reported on previous section, a more competitive banking sector significantly mitigates the negative impact of high credit information sharing and increases access to credit by approximately 4%.

We also want to investigate whether foreign bank presence affects the relationship between credit information sharing and credit constrained firms. Indeed, we find that in countries with higher availability of credit information history, greater presence of foreign banks increases the probability for firms to access finance. In particular, the interaction term is negative and significant and the marginal effect suggests that moving from a country with low share of foreign banks and high credit information to one with a high

²⁵The indicator measures the efficiency of the judicial system by following the evolution of a commercial sale dispute over the quality of goods and tracking the time, cost and number of procedures involved from the moment the plaintiff files the lawsuit until payment is received. Data are available at: www.doingbusiness.org.

share of foreign banks (by one-standard deviation) and high credit information, can reduce the probability of being constrained by 5.6% on average.

We also run some econometric robustness checks. We re-estimate the regressions by using a different econometric approach, namely the linear probability model, instead of the probit regression. This allows us to check whether our results are sensitive to the econometric approach used in our estimations. Results reported in Tables 11 (columns [1]–[3]) and 12 (columns [1]–[3]). Interestingly, there is no change in the significance and the sign of the variables entered in the regressions.

We then retest our credit constraint model of equations 5, 6 and 7, but this time using a simple probit model without the Heckman sample selection procedure. Results in Tables 11 (columns [4]–[6]) and 12 (columns [4]–[6]) show that there are no changes in the sign and the significance level with respect to the regressions presented in Tables 8 and 9. Only few variables which were previously insignificant or significant at 10% level become now more significant. This change, as well as fact that in our baseline regressions the inverse Mill’s ratio is highly significant, indicate that failure to control the sample selection bias can yield to misleading results.

The standard errors in the baseline regressions are clustered at the country level for 10 different country clusters. Although this might be a sufficiently large number of clusters, the underlying assumption for calculating cluster-robust standard errors requires the number of clusters to go to infinity. To assess whether this assumption is problematic in our regressions, we re-estimate (Tables 13 and 14) the baseline regressions with standard errors clustered at the country-industry level. Hereby the number of clusters increases to 30. By doing that we take into account correlations in errors of firms within the same industry in one country. All results of the baseline analysis are confirmed.

In tables 15–16 we drop the largest country of our sample in terms of firms participation in the BEEPS, which is also the largest country in terms of population and GDP (Romania). Again, we confirm our findings. Finally, we re-estimated the regressions reported in Table 9 by excluding Estonia, Hungary and Poland, the countries where a public credit bureau does not exist. The results are not reported here. Nevertheless, no significant change emerges.

6 Conclusion

This paper uses firm and country level information and examines the main determinants of credit constraints encountered by firms in 10 Central Eastern European countries. The analysis is conducted on two consecutive rounds of the BEEPS covering data from 2008–2009 and 2012–2014. This allows us to cover the early stage of the 2007–2008 financial crisis and the 2012–2014 post-crisis period, facilitating the comparison of the main financing conditions during and after the crisis.

First, from the demand-side analysis we find evidence that while small and foreign owned firms are less likely to need credit, audited and innovative firms have higher credit demand. Second, the credit

constraint analysis at firm level shows that small, medium, publicly listed, sole proprietorship and foreign-owned firms were more likely to be discouraged from applying for a loan or rejected in 2008–2009. However, in 2012–2014 only young and small firms were facing higher credit constraints. These results indicate that there are considerable differences in firm level determinants and highlight the heterogeneity across years.

Third, the evaluation of the banking sector environment implies that firms operating in a more concentrated market are less likely to be credit constrained. However, higher capital requirements, increased loan loss reserves ratio and higher presence of foreign banks have a negative effect on the availability of bank credit and therefore increase the probability of being constrained.

Fourth, the institutional and regulatory environment in which firms operate reveals that credit information sharing is negatively correlated with access to bank credit. Moreover, we show that banking sector contestability can mitigate the negative impact of high credit information sharing. In addition, and since gaining access to soft information can be more difficult for foreign banks, we show that having better credit information sharing will make foreign banks more able and willing to extend credit.

Our results have important policy implications. Public policy aimed at increasing credit availability for firms in Central and Eastern Europe it is vital to focus particularly at the needs of small and medium enterprises (SMEs), which are the back-bone of the European economy. Diversity on the sources of finance accessible to SMEs, as well as on lending techniques within the banking system, need to be achieved. Well-developed capital markets would improve the resilience of Europe’s financing structures beyond the traditional financing channels of banking. This will be of great importance especially during economic downturns where lending is reduced and delayed.

Facilitating the collection and access of credit information – “hard” information and “soft” information – through wider and more accurate coverage of public credit bureaus, is of great importance in supporting firm access to finance. Better and common for all countries legal and regulatory framework for credit reporting registries across Europe, with a clear incentive not only to support banking supervision, but also to improve the quality and quantity of data available to lenders, is another important policy message supported by our findings. In relation to this, the competitive banking sector, as well as foreign banks can promote access to finance and alleviate the negative trade-off between credit information sharing and bank credit. However, bank competitive and foreign bank entry policies should be designed and implemented in a way that recognise explicitly the uniqueness of banks, but at the same time limit and avoid the transmission of shocks to other sectors.

Finally, future research should focus on the specific policies (i.e., adoption of low barriers to bank entry and exit, fostering competitive pressures from non-bank competitors, measures to ensure consumer protection) that regulators and policy makers can implement, in order to increase competition in the banking sector.

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Table 1. Data

<i>Firm level variables</i>	<i>Definition</i>	<i>Source</i>
Loan needed	Dummy=1 if firm needs a loan; 0 otherwise.	BEEPS
Credit constraint	Dummy=1 if firm needs a loan and application was either rejected or discouraged; 0 otherwise.	BEEPS
Capital	Dummy=1 if locality is the capital of the country; 0 otherwise.	BEEPS
City	Dummy=1 if locality has between 50,000 and 1 million inhabitants; 0 otherwise.	BEEPS
Age	Firm age in years.	BEEPS
Small	Dummy=1 if firm has less than 19 employees; 0 otherwise.	BEEPS
Medium	Dummy=1 if firm has between 20 and 99 employees; 0 otherwise.	BEEPS
Publicly listed	Dummy=1 if firm is a shareholder company with publicly traded shares; 0 otherwise.	BEEPS
Sole proprietorship	Dummy=1 if firm is a sole proprietorship; 0 otherwise.	BEEPS
Privatised	Dummy=1 if firm is a former state-owned enterprise; 0 otherwise.	BEEPS
Foreign-owned	Dummy=1 if firm is owned by private foreign individuals or companies; 0 otherwise.	BEEPS
Government-owned	Dummy=1 if firm is owned by government or state; 0 otherwise.	BEEPS
Exporter	Dummy=1 if firm's production is at least partially exported; 0 otherwise.	BEEPS
Audited	Dummy=1 if firm has its financial accounts externally audited; 0 otherwise.	BEEPS
Innovation	Dummy=1 if firm has introduced i) new or significantly improved products or services or ii) new or significantly improved production or supply methods; 0 otherwise.	BEEPS
Competition	Dummy=1 if pressure from competitors is moderate, major or very severe obstacle; 0 otherwise.	BEEPS
Subsidised	Dummy=1 if firm has received state subsidised during the last three years; 0 otherwise.	BEEPS
<i>Country level variables</i>		
Lerner index	Lerner index constructed using balance sheet data from Bankscope.	Bankscope
HHI	Herfindahl-Hirschman index calculated as the sum over all banks in the country of the squared market share of each bank.	Bankscope
Capital to assets ratio	Bank capital to assets ratio (%).	Bankscope
Loan loss reserves	Loan loss reserves to total gross loans (%).	Bankscope
Share of foreign banks	Assets share of foreign controlled banks in domestic banking system (%)	Bankscope
Inflation	Inflation, GDP deflator (annual %).	WDI
Legal rights	Strength of legal rights index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The index ranges from 0 (weak) to 12 (strong) with higher scores indicating that these laws are better designed to expand access to credit.	WDI
Credit information sharing	Public credit bureau coverage reports the number of individuals and firms listed in a public credit registry with current information on repayment history, unpaid debt, or credit outstanding. The number is expressed as a percentage of the adult population.	WDI
Government effectiveness	Government effectiveness reflects perceptions of the quality of public services, civil services and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. It ranges from approximately -2.5 (weak) to 2.5 (strong).	WGI
Regulatory quality	Regulatory quality reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. It ranges from approximately -2.5 (weak) to 2.5 (strong).	WGI

Note: WDI denotes the World Development Indicators database of World Bank. WGI denotes the Worldwide Governance Indicators database of Kaufmann *et al.* (2010).

Table 2. Responses to BEEPS questions on credit to access

	2008-2009					2012-2014						
	Obs.	Mean	Median	Sd	Min	Max	Obs.	Mean	Median	Sd	Min	Max
Applied for loan	3135	0.41	0	0.49	0	1	3238	0.27	0	0.44	0	1
Application approved	1293	0.87	1	0.34	0	1	866	0.88	1	0.33	0	1
Application rejected	1293	0.11	0	0.31	0	1	866	0.08	0	0.28	0	1
Application withdrawn by the establishment			NA				866	0.02	0	0.13	0	1
Application still in progress			NA				866	0.01	0	0.12	0	1
Reasons for not having applied:												
1) No need a loan	1811	0.75	1	0.43	0	1	2320	0.77	1	0.42	0	1
2) Application procedure were too complex	1811	0.04	0	0.21	0	1	2320	0.04	0	0.19	0	1
3) Interest rates were not favorable	1811	0.07	0	0.26	0	1	2320	0.08	0	0.28	0	1
4) Collateral requirements were too high	1811	0.04	0	0.20	0	1	2320	0.04	0	0.19	0	1
5) Size of loan and maturity were insufficient	1811	0.01	0	0.10	0	1	2320	0.01	0	0.09	0	1
6) It is necessary to make informal payments	1811	0.00	0	0.07	0	1	2320	0.00	0	0.02	0	1
7) Did not think it would be approved	1811	0.02	0	0.15	0	1	2320	0.02	0	0.14	0	1
8) Other	1811	0.05	0	0.21	0	1	2320	0.04	0	0.20	0	1
Discouraged	1811	0.24	0	0.43	0	1	2320	0.23	0	0.42	0	1
Credit constrained (discouraged+rejected)	1722	0.33	0	0.47	0	1	1406	0.43	0	0.49	0	1

Note: This table summarises the responses of firms to questions K16 (K16), K17 (K17) and K20 (K18a) of the BEEPS V (BEEPS IV) survey. K16 elicits whether firms applied for a loan or line of credit during the last fiscal year. For those who applied, K20 (K18a) elicits whether the application was (i) approved, (ii) rejected, (iii) withdrawn by the establishment or (iv) is still in progress. However, question K18a in 2008-2009 BEEPS survey elicits only whether the application was (i) approved or (ii) rejected. For those firms that did not apply for a loan K17 elicits the reason(s) for not applying. For all questions we exclude observations where the answer was "Don't know (spontaneous)", while for K20 we drop observations where the answer was (i) "Application withdrawn by the establishment", (ii) "Application still in progress", or (iii) "Don't know (spontaneous)". Sd denotes standard deviation.

Table 3. Summary Statistics

	2008-2009					2012-2014						
	Obs.	Mean	Median	Sd	Min	Max	Obs.	Mean	Median	Sd	Min	Max
<i>Firm level variables</i>												
Loan needed	3087	0.56	1	0.50	0	1	3186	0.44	0	0.50	0	1
Constrained	1722	0.33	0	0.47	0	1	1406	0.43	0	0.49	0	1
Capital	3194	0.22	0	0.41	0	1	3353	0.22	0	0.41	0	1
City	3194	0.36	0	0.48	0	1	3353	0.34	0	0.47	0	1
Age	3117	2.49	2.64	0.68	0	5.21	3319	2.68	2.83	0.60	0	5.09
Small	3194	0.38	0	0.49	0	1	3353	0.58	1	0.49	0	1
Medium	3194	0.33	0	0.47	0	1	3353	0.28	0	0.45	0	1
Publicly listed	3187	0.07	0	0.25	0	1	3353	0.00	0	0.08	0	1
Sole proprietorship	3187	0.13	0	0.34	0	1	3353	0.10	0	0.29	0	1
Privatised	3184	0.14	0	0.35	0	1	3346	0.09	0	0.28	0	1
Foreign-owned	3130	0.12	0	0.32	0	1	3292	0.10	0	0.30	0	1
Government-owned	3130	0.01	0	0.12	0	1	3293	0.00	0	0.07	0	1
Exporter	3172	0.27	0	0.44	0	1	3297	0.27	0	0.44	0	1
Audited	3105	0.51	1	0.50	0	1	3265	0.37	0	0.48	0	1
Innovation	3173	0.77	1	0.42	0	1	3325	0.37	0	0.48	0	1
Competition	2925	0.22	0	0.41	0	1	3127	0.19	0	0.39	0	1
Subsidised	3141	0.16	0	0.36	0	1	3333	0.17	0	0.37	0	1
<i>Country level variables</i>												
Lerner index	3194	0.39	0.36	0.06	0.29	0.48	3353	0.39	0.39	0.04	0.32	0.45
HHI	3194	0.24	0.23	0.14	0.10	0.68	3353	0.20	0.18	0.09	0.10	0.46
Capital to assets ratio	3194	0.10	0.10	0.03	0.08	0.19	3353	0.11	0.10	0.02	0.09	0.15
Loan loss reserves	3194	0.03	0.03	0.00	0.02	0.04	3353	0.09	0.10	0.04	0.04	0.15
Share of foreign banks	3194	0.79	0.88	0.23	0.12	0.99	3353	0.77	0.83	0.21	0.16	0.95
Inflation	3194	0.08	0.07	0.04	0.02	0.15	3353	0.03	0.03	0.01	0.00	0.05
Legal rights	3194	7.40	8.00	1.77	4.00	10.00	3353	7.72	9.00	1.80	4.00	10.00
Credit information sharing	3194	0.05	0.03	0.08	0	0.31	3353	0.16	0.06	0.22	0	0.64
Government effectiveness	3194	0.53	0.62	0.50	-0.32	1.19	3353	0.57	0.66	0.44	-0.31	1.02
Regulatory quality	3194	0.95	1.03	0.26	0.58	1.43	3353	0.89	0.97	0.26	0.54	1.40

Note: This table shows summary statistics for all variables used in the empirical analysis. Sd denotes standard deviation.

Table 4. Summary Statistics by country, 2008–2009 BEEPS

	2008–2009									
	BGR	CZE	EST	HUN	LVA	LTU	POL	ROM	SVK	SVN
<i>Firm level variables</i>										
Number of firms	288	250	273	291	271	276	455	540	274	276
Loan needed	0.56	0.53	0.53	0.41	0.59	0.58	0.51	0.60	0.52	0.64
Constrained	0.52	0.31	0.27	0.31	0.47	0.23	0.37	0.31	0.38	0.15
Capital	0.25	0.12	0.36	0.28	0.51	0.22	0.04	0.20	0.11	0.20
City	0.49	0.32	0.16	0.31	0.07	0.32	0.56	0.56	0.37	0.17
Age	2.43	2.49	2.47	2.50	2.39	2.34	2.75	2.39	2.32	2.82
Small	0.48	0.33	0.41	0.34	0.34	0.38	0.48	0.32	0.35	0.38
Medium	0.33	0.40	0.30	0.33	0.33	0.34	0.28	0.34	0.35	0.30
Publicly listed	0.03	0.08	0.23	0.01	0.01	0.01	0.06	0.07	0.04	0.13
Sole proprietorship	0.25	0.26	0.00	0.01	0.03	0.18	0.37	0.06	0.12	0.04
Privatised	0.11	0.09	0.09	0.15	0.15	0.15	0.14	0.14	0.15	0.22
Foreign-owned	0.11	0.15	0.16	0.17	0.17	0.08	0.07	0.11	0.10	0.11
Government-owned	0.00	0.00	0	0.00	0.00	0.01	0.02	0.02	0.03	0.03
Exporter	0.20	0.39	0.30	0.30	0.24	0.32	0.23	0.15	0.26	0.48
Audited	0.43	0.53	0.78	0.75	0.72	0.35	0.35	0.38	0.56	0.46
Innovation	0.63	0.78	0.81	0.78	0.91	0.93	0.71	0.62	0.75	0.95
Competition	0.28	0.27	0.06	0.25	0.28	0.23	0.25	0.25	0.13	0.13
Subsidised	0.04	0.24	0.19	0.19	0.14	0.17	0.13	0.11	0.17	0.25
<i>Country level variables</i>										
Number of banks	18	20	4	22	18	10	31	10	8	19
Lerner index	0.36	0.29	0.41	0.41	0.35	0.34	0.43	0.48	0.32	0.36
HHI	0.17	0.24	0.68	0.16	0.16	0.29	0.10	0.23	0.24	0.24
Capital to assets ratio	0.19	0.08	0.14	0.09	0.09	0.11	0.08	0.10	0.08	0.10
Loan loss reserves	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.04
Share of foreign banks	0.88	0.96	0.99	0.94	0.60	0.91	0.69	0.88	0.91	0.12
Inflation	0.08	0.02	0.07	0.05	0.14	0.10	0.04	0.15	0.03	0.04
Legal rights	9.00	6.00	6.00	7.00	10.00	5.00	8.00	9.00	8.00	4.00
Credit information sharing	0.31	0.05	0	0	0.03	0.09	0	0.04	0.01	0.03
Government effectiveness	-0.05	1.01	1.16	0.71	0.56	0.62	0.48	-0.32	0.87	1.19
Regulatory quality	0.69	1.16	1.43	1.19	1.02	1.12	0.82	0.58	1.12	0.83

Note: This table shows country means for all variables and all firms participated in 2008–2009 BEEPS round. Absolute zeros mean that there are no observations for that variable in that country. Sd denotes standard deviation.

Table 5. Summary Statistics by country, 2012–2014 BEEPS

	2012–2014									
	BGR	CZE	EST	HUN	LVA	LTU	POL	ROM	SVK	SVN
<i>Firm level variables</i>										
Number of firms	293	254	273	309	336	270	542	539	267	270
Loan needed	0.50	0.35	0.39	0.51	0.25	0.46	0.36	0.62	0.38	0.49
Constrained	0.63	0.24	0.29	0.54	0.68	0.54	0.35	0.43	0.39	0.26
Capital	0.20	0.18	0.23	0.33	0.39	0.26	0.10	0.17	0.23	0.17
City	0.49	0.22	0.11	0.22	0.11	0.22	0.76	0.45	0.23	0.06
Age	2.69	2.79	2.71	2.60	2.49	2.45	2.85	2.62	2.70	2.88
Small	0.59	0.53	0.65	0.61	0.64	0.57	0.55	0.58	0.54	0.57
Medium	0.27	0.33	0.25	0.24	0.26	0.31	0.31	0.29	0.31	0.28
Publicly listed	0.00	0	0	0	0.00	0.01	0.00	0.02	0	0.01
Sole proprietorship	0.14	0.18	0	0	0.00	0.12	0.24	0	0.18	0.12
Privatised	0.10	0.09	0.06	0.09	0.06	0.11	0.10	0.09	0.05	0.10
Foreign-owned	0.07	0.14	0.11	0.06	0.10	0.06	0.06	0.12	0.13	0.14
Government-owned	0	0	0	0.02	0.00	0.00	0.01	0.00	0	0.01
Exporter	0.22	0.42	0.32	0.18	0.28	0.31	0.22	0.20	0.30	0.39
Audited	0.40	0.50	0.38	0.48	0.43	0.35	0.17	0.39	0.49	0.30
Innovation	0.32	0.55	0.31	0.27	0.26	0.32	0.38	0.54	0.25	0.38
Competition	0.31	0.23	0.07	0.08	0.17	0.32	0.14	0.32	0.12	0.10
Subsidised	0.08	0.29	0.18	0.24	0.09	0.22	0.17	0.10	0.14	0.28
<i>Country level variables</i>										
Number of banks	20	22	7	29	19	8	37	17	11	20
Lerner index	0.45	0.45	0.40	0.32	0.36	0.39	0.39	0.43	0.34	0.39
HHI	0.11	0.22	0.46	0.18	0.13	0.30	0.10	0.21	0.18	0.19
Capital to assets ratio	0.14	0.09	0.15	0.11	0.11	0.12	0.10	0.09	0.10	0.09
Loan loss reserves	0.10	0.05	0.04	0.13	0.15	0.08	0.04	0.15	0.04	0.12
Share of foreign banks	0.72	0.93	0.95	0.93	0.63	0.93	0.73	0.83	0.88	0.16
Inflation	0.02	0.01	0.03	0.03	0.03	0.03	0.02	0.05	0.01	0.00
Legal rights	9.00	6.00	7.00	7.00	10.00	5.00	9.00	9.00	8.00	4.00
Credit information sharing	0.56	0.06	0	0	0.64	0.24	0	0.14	0.03	0.03
Government effectiveness	0.14	0.92	0.96	0.62	0.83	0.83	0.66	-0.31	0.83	1.02
Regulatory quality	0.54	1.06	1.4	0.97	1.00	1.10	0.96	0.54	1.03	0.61

Note: This table shows country means for all variables and all firms participated in 2012–2014 BEEPS round. Absolute zeros mean that there are no observations for that variable in that country. Sd denotes standard deviation.

Table 6. Correlation Matrix for Bank and Country Level Variables

Panel A. Banking sector environment						
	2008–2009					
	Constrained	Lerner index	HHI	Capital to assets ratio	Loan loss reserves	Share of foreign banks
Constrained	1					
Lerner index	-0.0210	1				
HHI	-0.0783***	-0.0245	1			
Capital to assets ratio	0.0767***	0.0153	0.2259***	1		
Loan loss reserves	-0.0460*	-0.0561***	-0.1049***	-0.2032***	1	
Share of foreign banks	0.0720***	0.0423**	0.2816***	0.2040***	-0.3520***	1
2012–2014						
Constrained	1					
Lerner index	-0.0349	1				
HHI	-0.0823***	0.1297***	1			
Capital to assets ratio	0.1090***	0.0100	0.2567***	1		
Loan loss reserves	0.1155***	-0.0144	-0.2010***	-0.1887***	1	
Share of foreign banks	0.0619**	0.0176	0.2872***	0.2409***	-0.2808***	1
Pooled sample						
Constrained	1					
Lerner index	-0.0145	1				
HHI	-0.0944***	0.0137	1			
Capital to assets ratio	0.0852***	0.0167	0.2468***	1		
Loan loss reserves	0.1276***	0.0351***	-0.2113***	-0.0569***	1	
Share of foreign banks	0.0651***	0.0290**	0.2217***	0.2425***	-0.2042***	1

Panel B. Institutional and regulatory environment						
	2008–2009					
	Constrained	Inflation	Legal rights	Credit information sharing	Government effectiveness	Regulatory quality
Constrained	1					
Inflation	0.0382	1				
Legal rights	0.1777***	0.3083***	1			
Credit information sharing	0.1077***	0.1753***	0.2225***	1		
Government effectiveness	-0.0925***	-0.3757***	-0.3134***	-0.2265***	1	
Regulatory quality	-0.0381	-0.3235***	-0.2610***	-0.2599***	0.3028***	1
2012–2014						
Constrained	1					
Inflation	0.0740***	1				
Legal rights	0.1089***	0.3124***	1			
Credit information sharing	0.2030***	0.1349***	0.2156***	1		
Government effectiveness	-0.0748***	-0.3110***	-0.2122***	-0.1634***	1	
Regulatory quality	-0.0452*	-0.2129***	-0.1881***	-0.2425***	0.3322***	1
Pooled sample						
Constrained	1					
Inflation	-0.0267	1				
Legal rights	0.1530***	0.3053***	1			
Credit information sharing	0.1836***	-0.1132***	0.2436***	1		
Government effectiveness	-0.0883***	-0.3246***	-0.3080***	-0.1878***	1	
Regulatory quality	-0.0593***	-0.1948***	-0.2265***	-0.2704***	0.3568***	1

Note: This table shows pairwise correlations between banking sector variables (Panel A) and institutional and regulatory variables (Panel B). ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Table 7. Coefficient Estimates of Credit Demand Determinants

	Probit without sample selection			First stage Heckman selection		
	2008–2009	2012–2014	Pooled sample	2008–2009	2012–2014	Pooled sample
	[1]	[2]	[3]	[4]	[5]	[6]
Capital	–0.110 (0.068)	–0.092 (0.095)	–0.094** (0.045)	–0.071 (0.061)	–0.082 (0.089)	–0.071 (0.044)
City	–0.079 (0.070)	0.102 (0.084)	–0.005 (0.060)	–0.074 (0.079)	0.132* (0.077)	0.018 (0.059)
Age	–0.031 (0.044)	0.204 (0.053)	–0.017 (0.036)	–0.029 (0.050)	–0.009 (0.041)	–0.020 (0.035)
Small	–0.331*** (0.090)	–0.185*** (0.069)	–0.269*** (0.059)	–0.297*** (0.094)	–0.143** (0.066)	–0.237*** (0.062)
Medium	–0.180*** (0.056)	–0.076 (0.091)	–0.144*** (0.042)	–0.161*** (0.057)	–0.036 (0.088)	–0.119*** (0.045)
Publicly listed	–0.148 (0.138)	0.237 (0.361)	–0.095 (0.139)	–0.134 (0.132)	0.346 (0.347)	–0.070 (0.137)
Sole proprietorship	0.050 (0.062)	–0.102 (0.139)	–0.012 (0.054)	0.048 (0.061)	–0.069 (0.143)	–0.008 (0.054)
Privatised	0.091 (0.069)	0.097** (0.048)	0.094* (0.052)	0.088 (0.079)	0.117 (0.072)	0.105* (0.064)
Foreign-owned	–0.481*** (0.143)	–0.417*** (0.059)	–0.456*** (0.097)	–0.456*** (0.144)	–0.375*** (0.079)	–0.423*** (0.101)
Government-owned	0.173 (0.289)	0.574* (0.302)	0.262 (0.256)	0.058 (0.319)	0.491 (0.338)	0.162 (0.284)
Exporter	0.153 (0.105)	0.076 (0.058)	0.101* (0.061)	0.139 (0.091)	0.069 (0.048)	0.089* (0.048)
Audited	0.173** (0.086)	0.151*** (0.057)	0.169*** (0.054)	0.176** (0.072)	0.117** (0.056)	0.148*** (0.046)
Innovation	0.115 (0.096)	0.148*** (0.056)	0.150** (0.068)	0.132 (0.086)	0.115* (0.060)	0.138** (0.067)
Competition				0.133*** (0.045)	0.302*** (0.083)	0.210*** (0.055)
Subsidised				0.274** (0.111)	0.348*** (0.047)	0.319*** (0.077)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE			Yes			Yes
Number of obs.	2,903	3,010	5,913	2,658	2,813	5,471
Pseudo R-squared	0.040	0.057	0.048	0.047	0.069	0.056

Note: This table shows probit model regressions (without sample selection in columns [1]–[3]) and first-stage Heckman selection regressions results (columns [4]–[6]) of our model in equation (4). In all regressions the dependent variable is “*Loan needed*”, which is a dummy variable taking value one if the firm demands credit and zero otherwise. Columns [1] and [4] show 2008–2009 estimates, columns [2] and [5] show 2012–2014 estimates, while columns [3] and [6] show pooled sample estimates. Robust standard errors are clustered by country and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Table 8. Coefficient Estimates of Credit Constraint Determinants - Firm Level

	2008–2009		2012–2014		Pooled sample	
	[1]	[2]	[3]	[4]	[5]	[6]
Capital	0.229** (0.106)	0.080** (0.037)	−0.012 (0.145)	−0.004 (0.057)	0.092 (0.074)	0.023 (0.028)
City	0.032 (0.057)	0.011 (0.020)	−0.073 (0.107)	−0.028 (0.042)	−0.078 (0.068)	−0.029 (0.025)
Age	0.025 (0.072)	0.009 (0.025)	−0.197*** (0.049)	−0.077*** (0.019)	−0.078* (0.045)	−0.029* (0.017)
Small	0.728*** (0.242)	0.256*** (0.085)	0.567*** (0.204)	0.222*** (0.042)	0.603*** (0.197)	0.226*** (0.073)
Medium	0.385** (0.152)	0.135** (0.053)	0.063 (0.164)	0.025 (0.064)	0.186* (0.106)	0.069* (0.039)
Publicly listed	0.553*** (0.063)	0.194*** (0.022)	−0.242 (0.330)	−0.095 (0.129)	0.469*** (0.088)	0.176*** (0.033)
Sole proprietorship	0.234** (0.102)	0.082** (0.036)	−0.217 (0.223)	−0.085 (0.087)	0.086 (0.086)	0.032 (0.032)
Privatised	−0.061 (0.123)	−0.021 (0.043)	0.218 (0.136)	0.086 (0.053)	0.034 (0.094)	0.013 (0.035)
Foreign-owned	0.284** (0.144)	0.099** (0.051)	−0.526*** (0.196)	−0.206*** (0.077)	−0.146 (0.102)	−0.055 (0.038)
Government-owned	0.304 (0.249)	0.107 (0.088)	0.505 (0.384)	0.198 (0.150)	0.281 (0.281)	0.105 (0.105)
Exporter	−0.029 (0.102)	−0.010 (0.036)	−0.051 (0.158)	−0.020 (0.062)	−0.009 (0.073)	−0.003 (0.027)
Audited	−0.245** (0.099)	−0.086** (0.035)	−0.173 (0.128)	−0.068 (0.050)	−0.151 (0.099)	−0.056 (0.037)
Innovation	−0.343*** (0.097)	−0.120*** (0.034)	−0.037 (0.093)	−0.014 (0.036)	−0.146** (0.069)	−0.055** (0.026)
Inverse Mills' ratio	−0.134 (0.663)		1.398*** (0.379)		0.799** (0.378)	
Country FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	
Year FE					Yes	
Number of obs.	1,468		1,239		2,707	
Pseudo R-squared	0.103		0.150		0.116	

Note: This table shows probit model regressions results with sample selection/second stage Heckman selection procedure of our model in equation (5). In all regressions the dependent variable is “*Credit Constrained*”, which is a dummy taking value one if the firm declares that its loan application was rejected or that it did not apply for a loan because it was discouraged and zero otherwise. Columns [1], [3] and [5] show coefficient estimates, while columns [2], [4] and [6] show marginal effects at the mean. Inverse Mills' ratio is the inverse of Mills' ratio from the probit model with sample selection in Table 7, where the omitted categories are *Competition* and *Subsidised*. Robust standard errors are clustered by country and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Table 9. Coefficient Estimates of Credit Constraint Determinants - Country Level

Panel A. Banking sector environment						
	2008–2009		2012–2014		Pooled sample	
	[1]	[2]	[3]	[4]	[5]	[6]
Lerner index	−0.962 (1.046)	−0.340 (0.377)	0.796 (0.602)	0.312 (0.235)	0.469 (0.689)	0.176 (0.257)
HHI	−1.106*** (0.269)	−0.391*** (0.097)	−2.486*** (0.729)	−0.976*** (0.282)	−1.448*** (0.262)	−0.543*** (0.101)
Capital to assets ratio	2.178* (1.279)	0.769* (0.439)	11.963*** (1.616)	4.694*** (0.648)	5.619*** (0.832)	2.109*** (0.295)
Loan loss reserves	0.247 (0.386)	0.087 (0.104)	6.822*** (1.352)	2.676*** (0.524)	5.952*** (1.069)	2.234*** (0.397)
Share of foreign banks	0.463 (0.410)	0.164 (0.142)	0.649*** (0.138)	0.254*** (0.054)	0.523*** (0.184)	0.196*** (0.068)
Inverse Mills' ratio	0.104 (0.365)		0.879*** (0.247)		0.966*** (0.202)	
Country FE	No		No		No	
Industry FE	Yes		Yes		Yes	
Year FE					Yes	
Number of obs.	1,468		1,239		2,707	
Pseudo R-squared	0.085		0.141		0.108	
Panel B. Institutional and regulatory environment						
Inflation	−0.008 (0.087)	−0.003 (0.052)	0.561 (0.871)	0.220 (0.343)	0.335 (0.385)	0.126 (0.521)
Legal rights	0.169*** (0.021)	0.059*** (0.007)	−0.051 (0.039)	−0.020 (0.015)	0.049 (0.039)	0.018 (0.014)
Credit information sharing	1.028*** (0.276)	0.361*** (0.097)	1.302*** (0.225)	0.511*** (0.087)	1.207*** (0.225)	0.453*** (0.082)
Government effectiveness	0.169* (0.091)	0.059* (0.032)	−0.339 (0.435)	−0.133 (0.170)	−0.197 (0.167)	−0.074 (0.063)
Regulatory quality	0.357 (0.264)	0.125 (0.093)	−0.021 (0.031)	−0.008 (0.069)	0.075 (0.098)	0.028 (0.074)
Inverse Mills' ratio	0.089 (0.593)		0.929** (0.368)		1.010** (0.476)	
Country FE	No		No		No	
Industry FE	Yes		Yes		Yes	
Year FE					Yes	
Number of obs.	1,468		1,239		2,707	
Pseudo R-squared	0.102		0.130		0.111	

Note: This table shows probit model regressions results with sample selection/second stage Heckman selection procedure of our model in equations (6) and (7), Panel A and Panel B, respectively (the excluded variables in the first stage are *Competition* and *Subsidised*). In all regressions the dependent variable is “*Credit Constrained*”, which is a dummy variable taking value one if the firm declares that its loan application was rejected or that it did not apply for a loan because it was discouraged and zero otherwise. Columns [1], [3] and [5] show coefficient estimates, while columns [2], [4] and [6] show marginal effects at the mean. Each regressions contains all firm level variables used in Table 8. Inverse Mills' ratio is the inverse of Mills' ratio from the probit model with sample selection in Table 7, where the omitted categories are *Competition* and *Subsidised*. Robust standard errors are clustered by country and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Table 10. Coefficient Estimates of Credit Constraint Determinants - Interaction

	Pooled sample			
	Lerner index		Foreign banks	
	[1]	[2]	[3]	[4]
Credit information sharing \times Lerner index	2.368*** (0.489)	0.888*** (0.184)		
Credit information sharing \times Foreign banks			-1.337*** (0.377)	-0.502*** (0.141)
Credit information sharing	2.722** (1.275)	1.022** (0.484)	0.921*** (0.275)	0.346*** (0.103)
Lerner index	0.441 (0.548)	0.165 (0.207)		
Foreign banks			0.518*** (0.148)	0.195*** (0.055)
Inverse Mills' ratio	0.968*** (0.244)		0.901*** (0.236)	
Country FE	No		No	
Industry FE	Yes		Yes	
Year FE	Yes		Yes	
Number of obs.	2,707		2,707	
Pseudo R-squared	0.114		0.113	

Note: This table shows probit model regressions results with sample selection/second stage Heckman selection procedure of our model in equation (6) for the pooled sample. In all regressions the dependent variable is “*Credit Constrained*”, which is a dummy variable taking value one if the firm declares that its loan application was rejected or that it did not apply for a loan because it was discouraged and zero otherwise. Columns [1], [3] and [5] show coefficient estimates, while columns [2], [4] and [6] show marginal effects at the mean. Each regressions contains all firm level variables used in Table 8. Inverse Mills' ratio is the inverse of Mills' ratio from the probit model with sample selection in Table 7, where the omitted categories are *Competition* and *Subsidised*. Robust standard errors are clustered by country and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

APPENDIX A

Table 11. Linear probability model and probit without sample selection - Firm Level

	Linear probability model			Probit without sample selection		
	2008–2009	2012–2014	Full	2008–2009	2012–2014	Full
	[1]	[2]	[3]	[4]	[5]	[6]
Capital	0.094** (0.033)	0.030 (0.056)	0.061* (0.027)	0.285*** (0.089)	0.077 (0.165)	0.176** (0.078)
City	0.010 (0.017)	−0.068** (0.029)	−0.026 (0.019)	0.049 (0.054)	−0.193** (0.079)	−0.067 (0.057)
Age	0.934 (1.852)	−0.619*** (0.143)	−0.208 (0.128)	0.026 (0.057)	−0.191*** (0.046)	−0.067* (0.037)
Small	0.221*** (0.048)	0.244*** (0.056)	0.243*** (0.047)	0.684*** (0.146)	0.704*** (0.152)	0.714*** (0.133)
Medium	0.100*** (0.027)	0.031 (0.044)	0.068** (0.023)	0.354*** (0.091)	0.115 (0.134)	0.244*** (0.069)
Publicly listed	0.165*** (0.039)	−0.096 (0.055)	0.159*** (0.040)	0.548*** (0.104)	−0.457 (0.345)	0.517*** (0.121)
Sole proprietorship	0.079** (0.031)	−0.041 (0.071)	0.031 (0.026)	0.217** (0.088)	−0.113 (0.200)	0.089 (0.072)
Privatised	−0.014 (0.028)	0.020 (0.046)	−0.008 (0.019)	−0.076 (0.098)	0.050 (0.147)	−0.049 (0.071)
Foreign-owned	0.072 (0.047)	−0.034 (0.034)	0.027 (0.027)	0.239 (0.147)	−0.098 (0.109)	0.093 (0.089)
Government-owned	0.073 (0.072)	0.076 (0.080)	0.057 (0.073)	0.292 (0.218)	0.169 (0.281)	0.218 (0.231)
Exporter	−0.023 (0.026)	−0.040 (0.053)	−0.029 (0.019)	−0.064 (0.085)	−0.111 (0.155)	−0.078 (0.059)
Audited	−0.082* (0.038)	−0.102* (0.049)	−0.084* (0.041)	−0.256** (0.105)	−0.308** (0.139)	−0.253** (0.114)
Innovation	−0.105*** (0.026)	−0.051 (0.035)	−0.076** (0.027)	−0.302*** (0.069)	−0.148** (0.102)	−0.219*** (0.074)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE			Yes			Yes
Number of obs.	1,611	1,325	2,936	1,611	1,325	2,936
Pseudo R-squared	0.130	0.175	0.145	0.108	0.138	0.116

Note: This table shows linear probability model regressions (columns [1]–[3]) and probit model without sample selection (columns [4]–[6]) regressions results of our model in equation (5). In all regressions the dependent variable is “*Credit Constrained*”, which is a dummy variable taking value one if the firm declares that its loan application was rejected or that it did not apply for a loan because it was discouraged and zero otherwise. Robust standard errors are clustered by country and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Table 12. Linear probability model and probit without sample selection - Country Level

Panel A. Banking sector environment						
	Linear probability model			Probit without sample selection		
	2008–2009	2012–2014	Pooled sample	2008–2009	2012–2014	Pooled sample
	[1]	[2]	[3]	[4]	[5]	[6]
Lerner index	–0.042 (0.028)	–0.067 (0.241)	–0.322 (0.259)	–1.251 (0.835)	–0.318 (0.691)	–0.931 (0.751)
HHI	–0.039*** (0.007)	–0.996*** (0.245)	–0.513*** (0.092)	–1.218*** (0.238)	–2.881*** (0.712)	–1.533*** (0.268)
Capital to assets ratio	0.094** (0.033)	4.279*** (0.549)	1.635*** (0.223)	2.415** (0.962)	12.240*** (1.485)	4.428*** (0.601)
Loan loss reserves	0.131 (0.518)	1.485*** (0.421)	1.471*** (0.411)	3.018 (16.288)	4.312*** (1.159)	4.078*** (1.112)
Share of foreign banks	0.017 (0.010)	0.214*** (0.030)	0.196** (0.067)	0.513 (0.346)	0.628*** (0.088)	0.588*** (0.222)
Country FE	No	No	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE			Yes			Yes
Number of obs.	1,611	1,325	2,936	1,611	1,325	2,936
Pseudo R-squared	0.113	0.164	0.134	0.093	0.130	0.106

Panel B. Institutional and regulatory environment						
Inflation	–0.004 (0.021)	1.659 (2.539)	–0.146 (0.449)	–0.399 (0.646)	0.574 (0.756)	–0.407 (1.317)
Legal rights	0.056*** (0.007)	0.004 (0.123)	0.032** (0.010)	0.175*** (0.019)	0.016 (0.035)	0.096*** (0.029)
Credit information sharing	0.461*** (0.064)	0.482*** (0.075)	0.412*** (0.085)	1.194*** (0.181)	1.366*** (0.209)	1.137*** (0.234)
Government effectiveness	0.088*** (0.021)	0.006 (0.115)	0.006 (0.048)	0.208*** (0.059)	0.076 (0.351)	0.022 (0.146)
Regulatory quality	0.062 (0.052)	0.201 (1.675)	0.055 (0.086)	0.262 (0.161)	0.008 (0.499)	0.167 (0.263)
Country FE	No	No	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE			Yes			Yes
Number of obs.	1,611	1,325	2,936	1,611	1,325	2,936
Pseudo R-squared	0.128	0.157	0.138	0.106	0.123	0.109

Note: This table shows linear probability model regressions (columns [1]–[3]) and probit model without sample selection (columns [4]–[6]) regressions results of our model in equations (6) and (7). In all regressions the dependent variable is “*Credit Constrained*”, which is a dummy variable taking value one if the firm declares that its loan application was rejected or that it did not apply for a loan because it was discouraged and zero otherwise. Each regressions contains all firm level variables used in Table 8. Robust standard errors are clustered by country and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Table 13. Country-industry clustered standard errors (Firm Level)

	2008–2009		2012–2014		Pooled sample	
	[1]	[2]	[3]	[4]	[5]	[6]
Capital	0.229*	0.080*	−0.012	−0.004	0.092	0.034
	(0.119)	(0.042)	(0.133)	(0.052)	(0.089)	(0.033)
City	0.032	0.011	−0.073	−0.028	−0.078	−0.029
	(0.070)	(0.025)	(0.097)	(0.038)	(0.058)	(0.022)
Age	0.025	0.009	−0.197***	−0.077***	−0.078*	−0.029*
	(0.068)	(0.024)	(0.058)	(0.023)	(0.044)	(0.016)
Small	0.728***	0.256***	0.567***	0.222***	0.603***	0.226***
	(0.219)	(0.076)	(0.168)	(0.066)	(0.143)	(0.053)
Medium	0.385***	0.135***	0.063	0.025	0.186**	0.069**
	(0.131)	(0.046)	(0.154)	(0.060)	(0.089)	(0.033)
Publicly listed	0.553***	0.194***	−0.242	−0.095	0.469***	0.176***
	(0.119)	(0.043)	(0.537)	(0.211)	(0.119)	(0.045)
Sole proprietorship	0.234**	0.082**	−0.217	−0.085	0.086	0.032
	(0.096)	(0.033)	(0.172)	(0.067)	(0.083)	(0.031)
Privatised	−0.061	−0.021	0.218	0.086	0.034	0.013
	(0.107)	(0.038)	(0.142)	(0.056)	(0.105)	(0.039)
Foreign-owned	0.284	0.099	−0.526***	−0.206***	−0.146	−0.055
	(0.213)	(0.075)	(0.172)	(0.067)	(0.132)	(0.049)
Government-owned	0.304	0.107	0.505	0.198	0.281	0.105
	(0.305)	(0.107)	(0.369)	(0.145)	(0.253)	(0.095)
Exporter	−0.029	−0.010	−0.051	−0.020	−0.009	−0.003
	(0.102)	(0.036)	(0.128)	(0.050)	(0.069)	(0.026)
Audited	−0.245**	−0.086**	−0.173*	−0.068*	−0.151**	−0.056**
	(0.096)	(0.034)	(0.096)	(0.037)	(0.068)	(0.026)
Innovation	−0.343***	−0.120***	−0.037	−0.014	−0.146***	−0.055***
	(0.119)	(0.042)	(0.080)	(0.031)	(0.054)	(0.020)
Inverse Mills' ratio	−0.134		1.398***		0.799**	
	(0.645)		(0.342)		(0.317)	
Country FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	
Year FE					Yes	
Number of obs.	1,468		1,239		2,707	
Pseudo R-squared	0.103		0.150		0.116	

Note: This table shows probit model regressions results with sample selection/second stage Heckman selection procedure of our model in equation (5). In all regressions the dependent variable is “*Credit Constrained*”, which is a dummy variable taking value one if the firm declares that its loan application was rejected or that it did not apply for a loan because it was discouraged and zero otherwise. Columns [1], [3] and [5] show coefficient estimates, while columns [2], [4] and [6] show marginal effects at the mean. Inverse Mills' ratio is the inverse of Mills' ratio from the probit model with sample selection in Table 7, where the omitted categories are *Competition* and *Subsidised*. Robust standard errors are clustered at country-industry level and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Table 14. Country-industry clustered standard errors - Country Level

Panel A. Banking sector environment						
	2008–2009		2012–2014		Pooled sample	
	[1]	[2]	[3]	[4]	[5]	[6]
Lerner index	–0.962 (0.696)	–0.340 (0.249)	0.796 (0.750)	0.312 (0.294)	0.469 (0.584)	0.176 (0.219)
HHI	–1.106*** (0.231)	–0.391*** (0.083)	–2.486*** (0.564)	–0.976*** (0.226)	–1.448*** (0.020)	–0.543*** (0.081)
Capital to assets ratio	2.178** (0.102)	0.769** (0.034)	11.963*** (0.221)	4.694*** (0.092)	5.619*** (0.009)	2.109*** (0.035)
Loan loss reserves	0.247 (0.313)	0.087 (0.092)	6.822*** (0.113)	2.676*** (0.043)	5.952*** (0.008)	2.234*** (0.038)
Share of foreign banks	0.463* (0.273)	0.164* (0.095)	0.649*** (0.175)	0.254*** (0.068)	0.523*** (0.152)	0.196*** (0.256)
Inverse Mills' ratio	0.104 (0.397)		0.879*** (0.233)		0.966*** (0.197)	
Country FE	No		No		No	
Industry FE	Yes		Yes		Yes	
Year FE					Yes	
Number of obs.	1,468		1,239		2,707	
Pseudo R-squared	0.085		0.141		0.108	
Panel B. Institutional and regulatory environment						
Inflation	–0.008 (1.403)	–0.003 (0.493)	0.561 (0.695)	0.220 (0.274)	0.335 (1.086)	0.126 (0.408)
Legal rights	0.169*** (0.023)	0.059*** (0.008)	–0.051 (0.032)	–0.020 (0.012)	0.049* (0.027)	0.018* (0.010)
Credit information sharing	1.028** (0.429)	0.361** (0.157)	1.302*** (0.196)	0.511*** (0.092)	1.207*** (0.194)	0.453*** (0.074)
Government effectiveness	0.169 (0.154)	0.059 (0.054)	–0.339 (0.352)	–0.133 (0.138)	–0.197 (0.146)	–0.074 (0.055)
Regulatory quality	0.357 (0.274)	0.125 (0.096)	–0.021 (0.333)	–0.008 (0.131)	0.075 (0.192)	0.028 (0.072)
Inverse Mills' ratio	0.089 (0.555)		0.929*** (0.326)		1.010*** (0.339)	
Country FE	No		No		No	
Industry FE	Yes		Yes		Yes	
Year FE					Yes	
Number of obs.	1,468		1,239		2,707	
Pseudo R-squared	0.102		0.130		0.111	

Note: This table shows probit model regressions results with sample selection/second stage Heckman selection procedure of our model in equations (6) and (7), Panel A and Panel B, respectively (the excluded variables in the first stage are *Competition* and *Subsidised*). In all regressions the dependent variable is “*Credit Constrained*”, which is a dummy variable taking value one if the firm declares that its loan application was rejected or that it did not apply for a loan because it was discouraged and zero otherwise. Columns [1], [3] and [5] show coefficient estimates, while columns [2], [4] and [6] show marginal effects at the mean. Each regressions contains all firm level variables used in Table 8. Inverse Mills' ratio is the inverse of Mills' ratio from the probit model with sample selection in Table 7, where the omitted categories are *Competition* and *Subsidised*. Robust standard errors are clustered at country-industry level and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Table 15. Excluding Romania - Firm Level

	2008–2009		2012–2014		Pooled sample	
	[1]	[2]	[3]	[4]	[5]	[6]
Capital	0.210** (0.107)	0.074** (0.038)	−0.187 (0.163)	−0.073 (0.064)	0.037 (0.068)	0.014 (0.026)
City	0.020 (0.075)	0.007 (0.027)	0.114 (0.078)	0.045 (0.031)	−0.001 (0.072)	−0.000 (0.027)
Age	−0.014 (0.069)	−0.005 (0.025)	−0.229*** (0.073)	−0.090*** (0.029)	−0.106** (0.051)	−0.039** (0.019)
Small	0.524** (0.225)	0.185** (0.079)	0.359* (0.195)	0.141* (0.077)	0.378** (0.175)	0.142** (0.065)
Medium	0.261* (0.135)	0.092* (0.047)	0.002 (0.197)	0.001 (0.077)	0.075 (0.087)	0.028 (0.032)
Publicly listed	0.546*** (0.081)	0.192*** (0.029)			0.544*** (0.108)	0.204*** (0.040)
Sole proprietorship	0.297** (0.081)	0.105** (0.029)	−0.234 (0.229)	−0.092 (0.089)	0.113 (0.085)	0.042 (0.032)
Privatised	0.014 (0.137)	0.005 (0.048)	0.226 (0.178)	0.089 (0.069)	0.069 (0.120)	0.026 (0.045)
Foreign-owned	0.282 (0.184)	0.099 (0.065)	−0.733*** (0.240)	−0.288*** (0.094)	−0.203 (0.136)	−0.076 (0.051)
Government-owned	0.447** (0.211)	0.158** (0.074)	0.821**** (0.226)	0.322*** (0.089)	0.445* (0.241)	0.166* (0.090)
Exporter	0.019 (0.127)	0.007 (0.045)	−0.026 (0.204)	−0.010 (0.080)	0.016 (0.094)	0.006 (0.035)
Audited	−0.257** (0.118)	−0.091** (0.042)	−0.252* (0.148)	−0.099* (0.058)	−0.222* (0.123)	−0.083* (0.046)
Innovation	−0.315*** (0.109)	−0.111*** (0.038)	−0.031 (0.111)	−0.012 (0.043)	−0.174** (0.086)	−0.065** (0.032)
Inverse Mills' ratio	0.308 (0.602)		1.900*** (0.425)		1.146*** (0.401)	
Country FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	
Year FE					Yes	
Number of obs.	1,232		945		2,184	
Pseudo R-squared	0.106		0.170		0.123	

Note: This table shows probit model regressions results with sample selection/second stage Heckman selection procedure of our model in equation (5). In all regressions the dependent variable is “*Credit Constrained*”, which is a dummy variable taking value one if the firm declares that its loan application was rejected or that it did not apply for a loan because it was discouraged and zero otherwise. Columns [1], [3] and [5] show coefficient estimates, while columns [2], [4] and [6] show marginal effects at the mean. Publicly listed variable dropped from 2012–2014 regression due to insufficient number of observations. Inverse Mills' ratio is the inverse of Mills' ratio from the probit model with sample selection in Table 7, where the omitted categories are *Competition* and *Subsidised*. Robust standard errors are clustered by country and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Table 16. Excluding Romania - Country Level

Panel A. Banking sector environment						
	2008–2009		2012–2014		Pooled sample	
	[1]	[2]	[3]	[4]	[5]	[6]
Lerner index	–0.482 (1.178)	–0.171 (0.421)	1.379 (1.239)	0.542 (0.487)	0.733 (0.856)	0.275 (0.320)
HHI	–1.099*** (0.275)	–0.390*** (0.102)	–1.959*** (0.694)	–0.772*** (0.269)	–1.317*** (0.277)	–0.494*** (0.108)
Capital to assets ratio	2.203 (1.538)	0.783 (0.527)	10.047*** (3.343)	3.949*** (1.312)	5.548*** (1.381)	2.082*** (0.497)
Loan loss reserves	–0.616 (0.622)	–0.219 (0.264)	8.708*** (1.578)	3.423*** (0.619)	7.364*** (1.384)	2.764*** (0.506)
Share of foreign banks	0.464 (0.383)	0.165 (0.134)	0.736*** (0.253)	0.289*** (0.099)	0.545** (0.231)	0.205** (0.086)
Inverse Mills' ratio	0.114 (0.476)		1.026*** (0.339)		1.107*** (0.332)	
Country FE	No		No		No	
Industry FE	Yes		Yes		Yes	
Year FE					Yes	
Number of obs.	1,232		945		2,184	
Pseudo R-squared	0.085		0.156		0.113	
Panel B. Institutional and regulatory environment						
Inflation	0.009 (0.014)	0.003 (0.005)	0.308*** (0.088)	0.121*** (0.034)	0.203 (0.126)	0.076 (0.047)
Legal rights	0.152*** (0.021)	0.053*** (0.007)	–0.155*** (0.044)	–0.061*** (0.017)	0.028 (0.040)	0.011 (0.015)
Credit information sharing	0.813* (0.493)	0.287* (0.173)	0.693*** (0.204)	0.272*** (0.078)	1.156*** (0.303)	0.433*** (0.109)
Government effectiveness	0.084 (0.166)	0.029 (0.058)	–1.136*** (0.271)	–0.446*** (0.107)	–0.280 (0.220)	–0.105 (0.083)
Regulatory quality	0.251 (0.210)	0.088 (0.075)	–0.752*** (0.269)	–0.295*** (0.105)	–0.012 (0.149)	–0.004 (0.056)
Inverse Mills' ratio	0.367 (0.543)		1.613*** (0.363)		1.246*** (0.475)	
Country FE	No		No		No	
Industry FE	Yes		Yes		Yes	
Year FE					Yes	
Number of obs.	1,232		945		2,184	
Pseudo R-squared	0.105		0.162		0.117	

Note: This table shows probit model regressions results with sample selection/second stage Heckman selection procedure of our model in equations (6) and (7), Panel A and Panel B, respectively (the excluded variables in the first stage are *Competition* and *Subsidised*). In all regressions the dependent variable is “*Credit Constrained*”, which is a dummy variable taking value one if the firm declares that its loan application was rejected or that it did not apply for a loan because it was discouraged and zero otherwise. Columns [1], [3] and [5] show coefficient estimates, while columns [2], [4] and [6] show marginal effects at the mean. Each regressions contains all firm level variables used in Table 8. Inverse Mills' ratio is the inverse of Mills' ratio from the probit model with sample selection in Table 7, where the omitted categories are *Competition* and *Subsidised*. Robust standard errors are clustered by country and shown in parentheses. ***, **, * correspond to the 1%, 5%, and 10% level of significance, respectively.

Fig. 1. Biggest Obstacle Faced by Firms in CEE region

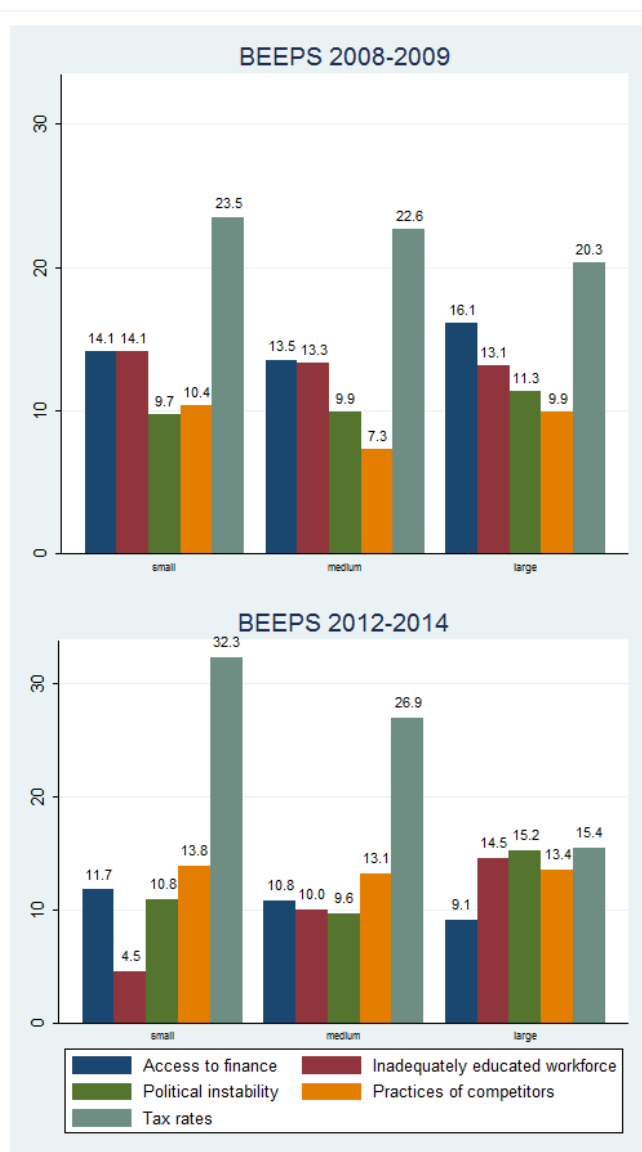


Fig. 2. Average GDP growth across CEE region (%)



Fig. 3. GDP growth (%), by country



Fig. 4. Credit constrained firms (%)

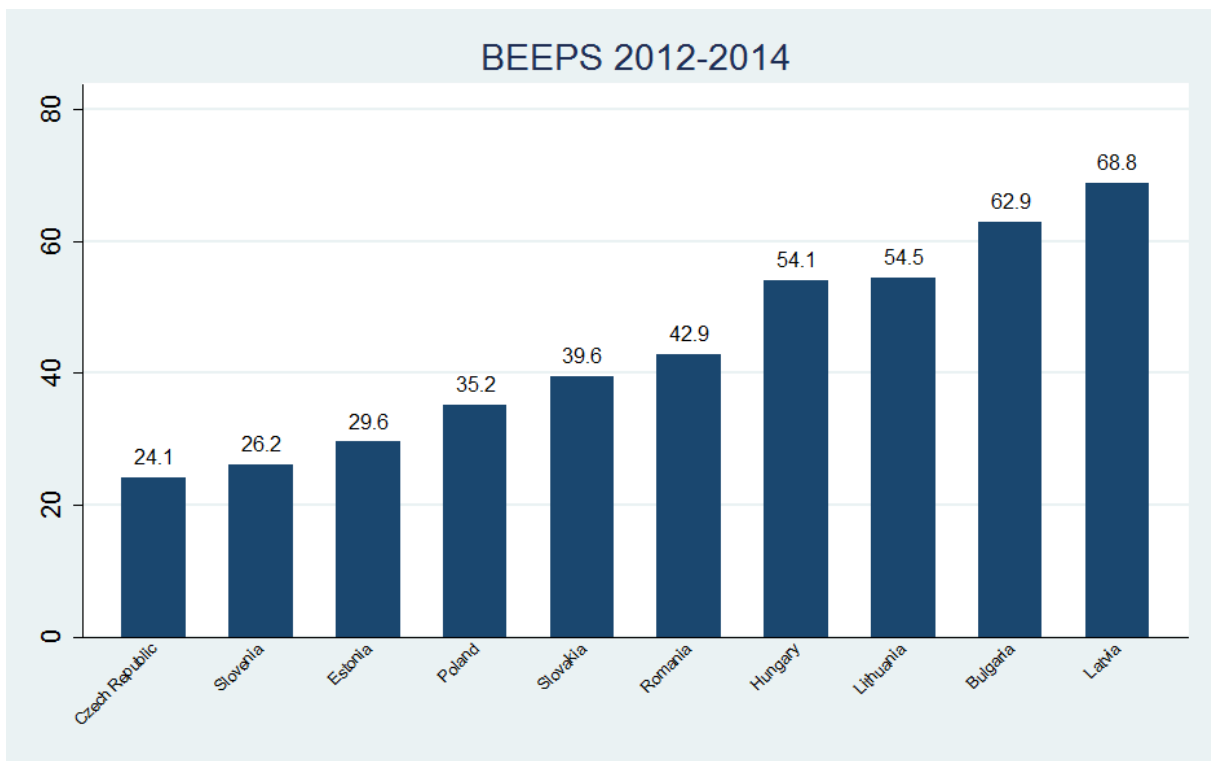
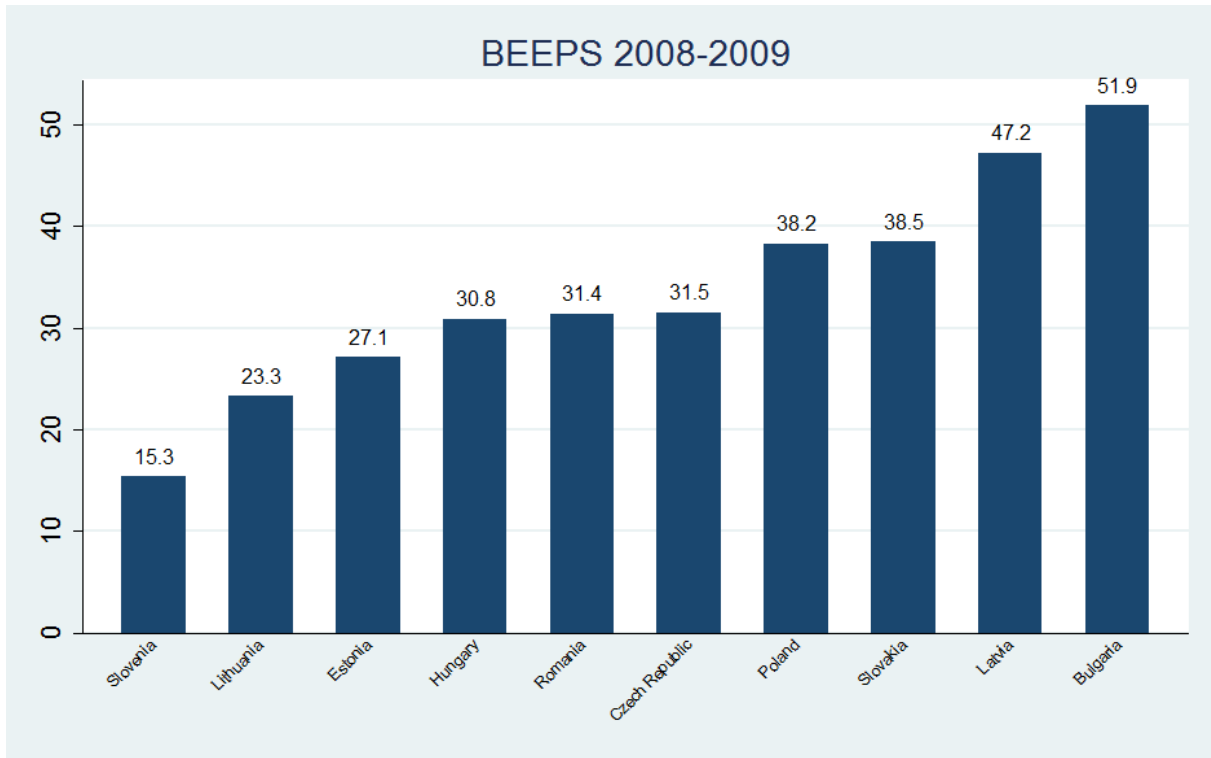
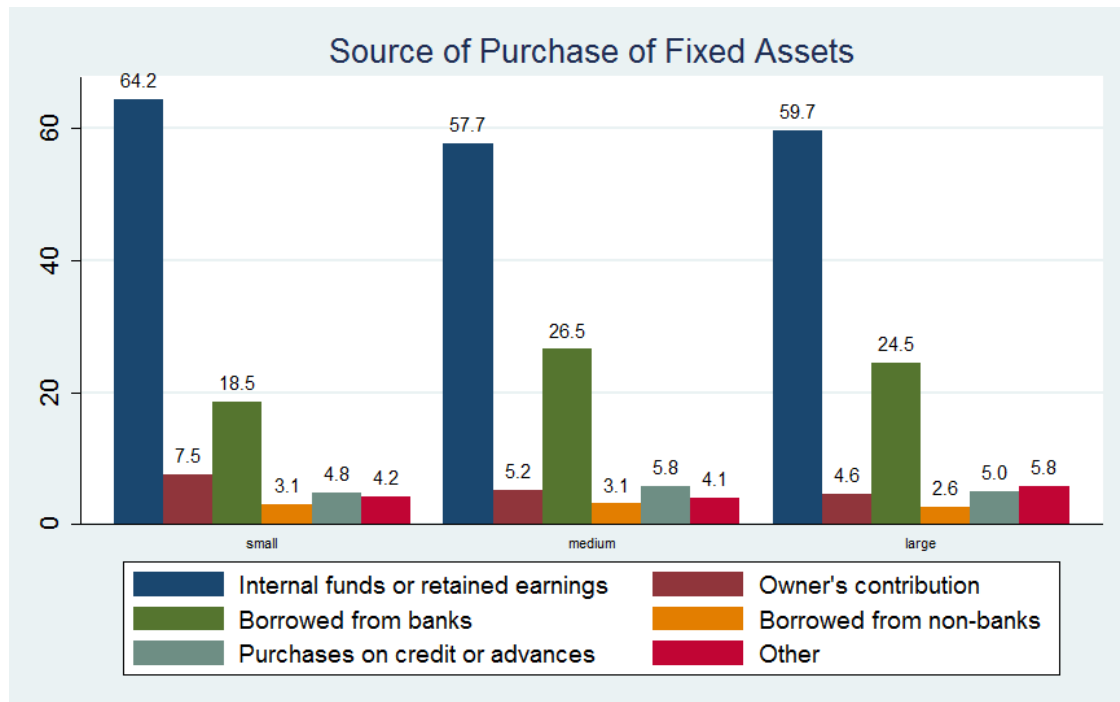


Fig. 5. Firms financing sources of working capital



APPENDIX B

Computation of Lerner index

Following the methodology used in Demircuc-Kunt and Martinez Peria (2010), first we estimate the following log cost function for each bank:

$$\begin{aligned}
 \log(C_{it}) = & a_{0i} + \beta_1 \log(Q_{it}) + \beta_2 [\log(Q_{it})]^2 + \beta_3 \log(W_{1,it}) + \beta_4 \log(W_{2,it}) + \beta_5 \log(W_{3,it}) + \\
 & + \beta_6 \log(Q_{it}) \times \log(W_{1,it}) + \beta_7 \log(Q_{it}) \times \log(W_{2,it}) + \beta_8 \log(Q_{it}) \times \log(W_{3,it}) + \quad (1) \\
 & + \beta_9 [\log(W_{1,it})]^2 + \beta_{10} [\log(W_{2,it})]^2 + \beta_{11} [\log(W_{3,it})]^2 + \beta_{12} \log(W_{1,it}) \times \log(W_{2,it}) + \\
 & + \beta_{13} \log(W_{1,it}) \times \log(W_{3,it}) + \beta_{14} \log(W_{2,it}) \times \log(W_{3,it}) + Y_t + \epsilon_{it},
 \end{aligned}$$

where C_{it} is the total cost for bank i in year t and is equal to the sum of interest rate expenses, commission and fee expenses, personnel expenses, other admin expenses, and other operating expenses; Q_{it} is the quantity of output measured as total assets; $W_{1,it}$ is the ratio of interest expenses to total deposits and money market funding; $W_{2,it}$ is the ratio of personnel expenses to total assets; $W_{3,it}$ is the ratio of other operating and administrative expenses to total assets; and Y_t are the full set of year dummies. All quantities are measured in millions of euro. We take the natural logarithm of all variables and estimate the regression for each country in our database using pooled ordinary least squares (OLS). We further impose restrictions to ensure homogeneity of degree one in the input prices:

$$\begin{aligned}
 \beta_3 + \beta_4 + \beta_5 = 1; \quad \beta_6 + \beta_7 + \beta_8 = 0; \quad \beta_9 + \beta_{12} + \beta_{13} = 0 \\
 \beta_{10} + \beta_{12} + \beta_{14} = 0; \quad \beta_{11} + \beta_{13} + \beta_{14} = 0.
 \end{aligned} \quad (2)$$

Finally, we omit outlying observations that lie at the 1st and 99th percentile of the distribution to reduce the influence of outliers. We then use the estimated coefficients to calculate the marginal cost for each bank in each year:

$$\begin{aligned}
 MC_{it} &= \frac{\partial C_{it}}{\partial Q_{it}} \\
 &= \frac{C_{it}}{Q_{it}} [\beta_1 + \beta_2 \log(Q_{it}) + \beta_6 \log(W_{1,it}) + \beta_7 \log(W_{2,it}) + \beta_8 \log(W_{3,it})]. \quad (3)
 \end{aligned}$$

Therefore, the Lerner index for a country in a particular year is the average of all bank level Lerner indices for that year.

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Call for Entries: Visiting Research Program

The Oesterreichische Nationalbank (OeNB) invites applications from external researchers for participation in a Visiting Research Program established by the OeNB's Economic Analysis and Research Department. The purpose of this program is to enhance cooperation with members of academic and research institutions (preferably post-doc) who work in the fields of macroeconomics, international economics or financial economics and/or with a regional focus on Central, Eastern and Southeastern Europe.

The OeNB offers a stimulating and professional research environment in close proximity to the policymaking process. Visiting researchers are expected to collaborate with the OeNB's research staff on a prespecified topic and to participate actively in the department's internal seminars and other research activities. They will be provided with accommodation on demand and have, as a rule, access to the department's data and computer resources and to research assistance. Their research output may be published in one of the department's publication outlets or as an OeNB Working Paper. Research visits should ideally last between 3 and 6 months, but timing is flexible.

Applications (in English) should include

- a curriculum vitae,
- a research proposal that motivates and clearly describes the envisaged research project,
- an indication of the period envisaged for the research visit, and
- information on previous scientific work.

Applications for 2016 should be e-mailed to eva.gehringer-wasserbauer@oenb.at by May 1, 2016.

Applicants will be notified of the jury's decision by mid-June. The following round of applications will close on November 1, 2016.