Determinants of SME Finance: Evidence from Three Central European Countries

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Abstract: This paper explores the determinants of access to finance for small and medium enterprises (SMEs) in the context of three Central European countries: Czech Republic, Slovak Republic, and Hungary. The data set of the research is obtained from the BEEPS survey, which is conducted by the World Bank and the European Bank for Reconstruction and Development. This paper empirically analyses firms not only from the SMEs point of view, but also shows results for micro, small and medium enterprises separately. Additionally, we have analysed the determinants of access to finance for SMEs at each country level for an in-depth understanding of country-level variations in SME financing. The results indicate that micro firms and firms owned and operated by women are experiencing a shortage of credits from banks. On the other hand, we found a positive relationship between the pledge of collateral and access to finance. With respect to the medium firms, we found evidence that innovative firms have a larger amount of credit from banks. The empirical results also suggest that the loan size increases as the interest rates increase in particular for SMEs on the whole and for micro-firms, although the interest rate is in a negative relationship with the loan size in Czech Republic.

Key words: Access to finance, SMEs, Czech Republic, Slovak Republic, Hungary

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Introduction

A number of studies have focused on SMEs and bank financing due to the extreme importance of SMEs to the world economies (Beck et al., 2006; Ayyagari et al., 2007; Lee et al., 2015; Hanedar et al., 2014; Belas and Sopkova, 2016). Ayyagari et al. (2007) showed that SMEs are solely responsible for the creation of about 60 percent of employment in the manufacturing sector in their analysis of 76 developed and developing countries. Beck et al. (2006) using the World Business Environment Survey

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(WBES) found that lack of long-term bank finance is the second most important financing difficulty faced by the SMEs, while high-interest rates and collateral requirement are on the first and third place. Regardless of significant contribution to the economy, the survival rate of SMEs is significantly lower than that of large corporate firms due to various reasons, including restricted access to bank finance, high interest rates, lack of skilled labour force, existence of technological and financial risks, severe competition from large firms etc.

Particularly, SMEs face credit discrimination from banks because of their information opacity. It is quite common that SMEs do not have audited financial statements and, in fact, it is difficult for the SMEs to show their credit quality, hence, they are credit rationed by banks (Berger and Udell, 2002; Petersen and Rajan, 2002). In the face of information opacity, commercial banks make loan decisions based on their own credit rating models that depend on their own methodological structure. Due to the ambiguous nature of the credit rating models and information asymmetry between banks and the SMEs, banks can impose not only higher prices of the loans, but also non-price related restrictions in SME lending, for example, collateral, shorter maturity, and smaller loan size (Hanedar et al., 2014; Godlewski and Weill, 2011; Ortiz-Molina and Penas, 2008; Hernandez-Canovas and Koeter-Kant, 2011; Farinha and Felix, 2015; Kirschemann, 2016). In contrast, large firms can produce better financial statements, which can help them to get easy access to bank finance (Cenni et al., 2015; Leon, 2015; Knyazeva and Knyazeva, 2012; Berger and Udell, 2002).

The data of this study came from the survey of BEEPS V, which is a joint project of the European Bank for Reconstruction and Development (EBRD) and the World Bank (WB). BEEPS conducted surveys in 30 transition economies covering Europe, Eastern Europe, Central Asia and Turkey. In this paper, we aim to explore the determinants of access to finance for SMEs in three Central European countries - Czech Republic, Slovak Republic, henceforth CR, SKR and Hungary. We have purposefully selected these countries, as our persuasion is that these countries have similar economic conditions and hence exploring the bank financing differences may highlight important findings for SMEs. On the other hand, research shows that SMEs contribute about 65% of total employment in the Czech Republic, 59% in the Slovak Republic, and 46% in Hungary (Ayyagari et al., 2007). Considering the importance of SMEs in the economic systems of these three countries, investigating the factors that may affect access to bank finance can help the SMEs to overcome the shortage of bank finance and subsequently can enable them to invest more in activities with added economic value.

Empirical research explored many factors that affect the access to finance for SMEs, such as information asymmetry, firm characteristics, availability of collateral, borrower characteristics, lender characteristics, bank market structure and others (Hernandez-Canovas and Martinez-Solano, 2010; Cenni et al., 2015; Berger and Udell, 2002; Chakraborty and Hu, 2006; Menkhoff et al., 2012; Irwin and Scott, 2010; Stefani and Vacca, 2015; Petersen and Rajan, 2002; Beck et al., 2011; Leon, 2015; Godlewski and Weill, 2011). It could mean that firms with low information asymmetry, lower risk and pledging collateral to banks might get a larger loan. On the other hand, firms with higher information asymmetry, poor borrower quality or higher probability of defaults can receive a smaller loan size or may face credit rationing. Therefore, we may argue

that the firms which can show better credit quality to banks might receive larger loans and firms with poor credit quality or higher information asymmetry may be credit rationed or can only obtain a small loan. We used loan size, as a proxy to measure the hypotheses of access to finance and examining the effect of firm size, firm age, female owner, firm innovativeness, crime as a proxy of firm riskiness, collateral and interest rates in relation to access to finance.

This study may have a significant impact on policy making for the Central European countries. Moreover, our data set allows us to divide the analysis based on countries and thus, we can find out the important factors that affect the access to credit for SMEs from the country perspective. Overall, the paper makes a significant contribution to understanding the SME finance in the context of bank-based European countries and adds value to the SME bank financing literature.

The structure of the paper is organised as follows. Section 2 reviews the literature and the hypotheses. Section 3 describes the data set and model as well as descriptive statistics. Section 4 presents our empirical results and it is followed by the concluding remarks.

Literature Review and Hypotheses

Studies used firm size as a proxy for better credit quality and showed that it can positively affect the access to credit (Cenni et al., 2015; Hernandez-Canovas and Martinez-Solano, 2010; Cole, 1998). As the firm gets larger, it can acquire more tangible assets that can be useful for banks in assessing the credit risk of the firm (Gompers, 1995). At the same time, large firms can gain more bargaining power and they can negotiate with banks the credit terms which may facilitate loans with fewer restrictions and larger loan sizes (Cenni et al., 2015). Brancati (2015) showed that micro firms in the Italian market are more credit constrained than the small or medium firms as information opacity is even more severe for the micro firms. It is obvious that micro firms have a lower level of asset tangibility and it is difficult to assess their future growth rate. Similarly, large firms can more easily show better information transparency to banks by producing audited financial statements (Ortiz-Molina and Penas, 2008; Berger and Udell, 2002; Petersen and Rajan, 2002). Overall, the above studies show that lower information opacity of large firms and reduced information asymmetry can positively affect the access to bank finance for SMEs. Therefore, we expect that the firm size may be positively related to the access to finance.

On the other hand, research shows that younger firms are more vulnerable to having restricted access to bank finance because information transparency is lower. It also argues that younger firms have a lower level of asset intensity and because of it they are credit rationed (Ferri and Murro, 2015). Similarly, banks are reluctant to lend money to younger firms, as it is found that survival rates of younger firms are lower than of older firms (Dierkes et al., 2013). Kirschemann (2016) in her study found out that younger firms are more likely to be credit rationed since they previously did not receive any loans from banks and as a result, it is difficult for banks to judge the loan repayment history. Moreover, access to credit also depends on the survival analysis of firms and Shumway (2001) showed that default rates of younger firms are higher than those of the

older firms. From a bank-borrower relationship point of view, older firms can make a long-term relationship with banks which is less likely for the younger firms. Thus, based on the relationship banking, older firms can receive more credit from banks (Comeig et al., 2015; Cenni et al., 2015; Uchida et al., 2012; Bolton et al., 2013). Bearing in mind the above-mentioned literature, we hypothesised that there may be a positive relationship between firm age and access to bank finance.

Hypothesis 1: Firm size is positively related to access to finance because of better information transparency.

Hypothesis 1a: Firm age is positively related to access to finance.

Gender discrimination in loan markets is under severe scrutiny from both policy makers and researchers. It is a serious concern that the firms owned and operated by women face difficulties in getting access to bank finance due to stereotype gender discrimination (Carter and Rosa, 1998). Financial institutions refuse to provide women with credit, as it is difficult for banks to make a correct evaluation of their credit risk due to lack of skills, technical knowledge and previous experience (Irwin and Scott, 2010). Moreover, women are reluctant to accept bank credit since they are afraid to lose control over their business (Watson et al., 2009). Stefani and Vacca (2015) in the context of Germany, Italy, France and Spain found that women are less motivated to get loans from banks since they are afraid that their application will be rejected. Hence, women are more interested to use credit from their family members, friends and relatives. The research also showed that women-owned firms mainly operate in the service and retail sectors and as a result, they do not have sufficient collateral to pledge and due to this they are credit rationed. Alesina et al. (2013) found that women-owned firms in Italy pay higher interest rates than the men-owned, but they did not find any evidence that women-owned firms in Italy are riskier than male-owned firms. A study by Muravyev et al. (2009) by examining the BEEPS data also found some financing difficulties for women-based firms. Research found that women are credit rationed not only due to their business characteristics, but also because of their individual characteristics, such as lack of education, experience and less family support (Garwe and Fatoki, 2012). A similar study by Belluchi et al. (2010) in the context of Italian women-based SMEs shows that firms owned and operated by female entrepreneurs face stricter credit conditions from banks, for example lower credit limits, higher collateral and interest rates on their loan contract. Hence, the study suggests that women-owned firms face more financial constraints than the male-owned firms. Taking the above-mentioned arguments in consideration, we hypothesized that women-owned firms may face more credit constraint from banks and it may also lower their credit limits on the loan contracts and because of that access to finance may be negatively related to female ownership.

H2: Female ownership of firms is negatively related to access to finance.

Research shows that innovation is significantly important for the long-term growth of firms in order to attract new customers. By innovating, a firm can create a competitive advantage over its competitors which helps to earn extra profit margin for the innovative firm (Baregheh et al., 2009). Previous studies found that European SMEs are more likely to depend on bank loans to support their innovative ideas because they

cannot raise funds from the external financial market (Lee et al., 2015; Freel, 2007). However, the lack of support from commercial banks is negatively affecting the ability of the firms to innovate (Mohnen and Roller, 2005). Investments in innovative activities are usually risky since returns from the investments are uncertain (Hall, 2002). Lee et al. (2015) in the context of UK showed that innovative firms look for more external sources of finance than the non-innovative firms. They also show that innovative firms are more likely to be credit rationed than the non-innovative ones. Pederzoli et al. (2013) showed that default rates of the innovative firms are higher than those of the firms that do not innovate. They argue that in most of the cases R&D investments for SMEs do not pay off as it was estimated before and hence innovative SMEs experience more defaults. Brancati (2015) studied the financing possibilities for innovative firms in the Italian market and found that hi-tech firms are credit rationed by banks more than the non-technological or non-innovative firms. The author argues that commercial banks cannot evaluate the growth prospects of innovative firms and that may lead to the lack of finance. Because of the uncertainties related to the innovative SMEs, they are considered as risky investment by banks and, hence, it is more likely that innovative SMEs may receive lower amount of loans from banks. Therefore, we suppose that there may exist a negative relationship between firm innovativeness and access to finance.

H3: *Firm innovativeness is negatively related to access to finance.*

Empirical research examines the borrower risk profile and financial constraints for SMEs from various perspectives. Because of higher borrower risk, lenders may reduce the loan size and hence, SMEs may face more credit rationing (Kirschemann, 2016). Ortiz-Molina and Penas (2008) showed that risky borrowers receive loans with shorter maturity. Godlewski and Weill (2011) found that high-risk firms provide more collateral than the less risky firms do. Therefore, the literature suggests that riskier borrowers are more financially constrained and they experience more stringent credit terms than the less risky firms. We examine the firm riskiness in terms of theft, robbery, arson and vandalism. It is likely that the losses which SMEs incurred due to theft or robbery can have a significant negative effect on their profit margin. This may raise question about their survival. Hander et al. (2014) using the data provided by BEEPS showed that the firms which face crime and lose products due to theft and robbery are required to provide more collateral as it signals higher credit risk to the lender. Therefore, we argue that the riskier firms are more likely to be financially constrained than firms with low-risk profile. Because of that access to finance may be negatively related to firm riskiness.

H4: *Firm riskiness is negatively related to access to finance.*

The collateral requirement in a loan contract is a conventional way of reducing credit risk to the borrower. Due to information asymmetry in SME lending, commercial banks face difficulties in pricing the loans and lending decision leading to credit rationing may be difficult for them (Stiglitz and Weiss, 1981). Hence, to show better credit quality to banks, firms usually pledge collateral and by doing so, they can reduce credit rationing. Research also shows that collateral is a positive signal for banks to reduce adverse selection and moral hazard as it is less likely that poor quality borrowers may pledge collateral. Because loan defaults may cause the poor-quality borrowers to lose control over the asset and hence poor quality borrowers have less incentives to provide

collateral (Bester, 1987; Chan and kanatas, 1985; Besanko and Thakor, 1987; Godlewski and Weill, 2011; Hainz et al., 2013). Therefore, the above-mentioned literature concluded that collateral acts as a signalling device for the lenders to sort out quality borrowers from the risky borrowers. Thus, if collateral is in fact a signal for better borrower quality, pledging collateral may positively affect the access to finance for SMEs because of lower credit risk.

H5: *Availability of collateral increases access to finance.*

Higher interest rates are significant obstacles for small business lending and SMEs are discouraged to take loans from banks, as they cannot agree with the price of the loans. Beck et al. (2006) used the World Business Environment Survey (WBES) and showed that a high interest rate is the most important financing obstacle for SMEs among 12 examined financing obstacles. Farinha and Felix (2015) found that banks with lower interest rates received more loan applications as compared to banks with higher interest rates in Portugal. A study also showed that higher interest rate is one of the most significant factors for SMEs causing loan default as the higher price of loans increases the debt burden for SMEs (Chaibi and Ftiti, 2015). Nevertheless, many factors affect interest rates on loan contract, such as relationship lending, availability of collateral, credit market concentration and competition, bank size and bank ownership type, borrower characteristics, firm characteristics, loan maturity, loan size and others (Berger and Udell, 2002; Cole, 1998; Carter et al., 2004; Rahman et al., 2016a; Menkhoff et al., 2012; Steijvers et al., 2010; Godlewski and Weill, 2011; Berger et al., 2011; Brick and Palia, 2007; Chakraborty and Hu, 2006; Hernandez-Canovas and Martinez-Solano, 2010; Petersen and Rajan, 2002; Bonini et al., 2015; Beck et al., 2011; Mian, 2003; Rahman et al., 2016b; Neuberger and Rathke-Doppner, 2015; Stefani and Vacca, 2015). An empirical research shows that borrowers are discouraged to get loans from banks when the cost of loans are too high because it increases their debt burden and that can negatively affect the value of the firm (Hernandez-Canovas and Martinez-Solano, 2010). As such, we expect to find a negative relationship between access to finance and interest rates, as higher borrowing costs may discourage the borrowers to take larger loans from the bank.

H6: *Interest rate is negatively related to access to finance.*

Statistical Model and the Variables

We run the following ordinary least square regression in order to achieve the objectives of the paper.

Ln (LoanSize) = β_0 + β_1 FirmSize + β_2 FirmAge + β_3 FirmAgeSquare + β_4 Female + β_5 Innovation + β_6 Crime + β_7 Collateral + β_8 InterestRate + μ

The dependent variable loan size, which is a proxy for access to finance, is converted from the local currencies to US dollars to give the analysis more uniformity. We obtained the loan size information from the BEEPS survey question where the firm manager was asked about the particular question "Referring only to this most recent loan or line of credit, what was its value at the time of approval".

To test the hypotheses, we arranged the variables according to firm and loan characteristics. Regarding the firm-specific characteristics, we observed five (*FIRM AGE, FIRM SIZE, FEMALE, INNOVATION, CRIME/THEFT)* variables that can affect commercial bank decisions for granting credit to the firms. *FIRM SIZE* is examined through the number of full-time employees the firm was employing during the survey period. It is more likely that larger firms can gain more bargaining power and acquire more assets that can show better credit quality of the firm. Hence, we expect to find a positive relationship between *FIRM SIZE* and *LOAN SIZE. FIRM AGE* is the number of years the firm is in existence with continuous operation. We added also firm age squared in the model in order to capture the non-linearity. We believe that as a firm gets older, it can more easily prove its credit worthiness to the bank by presenting its past business track records and it can make a long-term relationship with the bank. Therefore, we expect to find a positive relationship between access to finance and *FIRM AGE. FEMALE* (1) dummy represents if the firm is owned by female and zero otherwise. *FEMALE* dummy is employed to find whether women-owned firms are facing any financial constraints in the loan market. As literature shows, women-owned firms are facing more credit rationing than the male-owned firms do. In that context, we expect to find a negative relationship between *LOAN SIZE* and *FEMALE. INNOVATION* (1) dummy represents if the firm has introduced any new products and services within the last three years and otherwise zero. It is widely accepted that the returns from the innovation and R&D activities are uncertain and as a result, firms with innovation activities are experiencing lack of finance from banks. Hence, we expect to find a negative relationship between *INNOVATION* and *LOAN SIZE. CRIME/THEFT* (1) dummy represents if the firm experienced any losses caused by theft, robbery, vandalism or arson and zero otherwise. *CRIME/THEFT* shows the firm riskiness of defaults and we expect that firms that experienced losses due to theft and robbery are more likely to receive smaller loans from banks and thus, we expect a negative relationship between *CRIME/THEFT* and *LOAN SIZE.* One could question how the validity of the claim that innovation *(INNOVATION)* activity of the firm and information regarding firm's past losses due to crime, vandalism or arson (*CRIME/THEFT*) could be established in the context of our current research? It is worthwhile to mention that, we completely rely on the voluntary disclosure of all information from the SMEs during the period of BEEPS survey. Moreover, depreciation on R&D activities or how much firms spent on R&D in terms of total sales could be more appropriate proxy to find out the innovation tendency of the SMEs, however the survey did not have any information regarding this topic, hence, we used innovation activity of the firms to investigate the relationship between innovation and access to finance.

The loan characteristic variables of the paper include two items, presence of collateral and interest rates. *COLLATERAL* (1) is a dummy variable that represents if the firm has pledged any sort of collateral while getting credit from the bank and zero otherwise. As research shows that collateral signals a better credit quality of the borrower by eliminating moral hazard and adverse selection problem, we expect to find a positive connection between *COLLATERAL* and *LOAN SIZE. INTEREST RATE* is the rate of interest that is charged on the loan contract. The research assumes to find a negative relationship between *INTEREST RATE* and *LOAN SIZE* since a higher interest rate will discourage the borrowers to access larger loans from the bank.

Table 1 Variable Definitions and Sources

Variable	Definition	Source
LOAN SIZE	Value of the loan in terms of ($)	Own calculation
Firm Characteristics		
FIRM SIZE	Number of full-time employees	BEEPS
FIRM AGE	Number of years the firm has been in operation	BEEPS
FEMALE	Dummy = 1 if the owner of the firm is female and zero otherwise	BEEPS
INNOVATION	Dummy = 1 if the firm has launched any new products or services within the last three years and zero otherwise	BEEPS
CRIME/THEFT	Dummy = 1 if the firm has experienced any losses due to theft, robbery, vandalism or arson and zero otherwise	BEEPS
Loan Characteristics		
COLLATERAL	Dummy = 1 if the firm has pledged collateral to obtain bank loans and zero otherwise	BEEPS
INTEREST RATES	Appropriate interest rates charged on the loan	BEEPS

Note: The table presents variable definitions of our study. BEEPS = Business Environment and Enterprise Performance Survey.

Data and Descriptive Statistics

The data set we have used for the analysis is obtained from the BEEPS V survey, which is a joint project of the European Bank for Reconstruction and Development (EBRD) and the World Bank (WB). BEEPS survey V was conducted in between 2012-2014 in 30 developed, developing and emerging markets to examine the business environment conditions of SMEs in the examined countries. The data set covers 15,883 enterprises, which range from micro, small, medium to large firms. The paper defined SMEs according to the conventions of both OECD and BEEPS - the number of employees is less than 250. We did not consider any subsidiaries or business partner that are linked with the SMEs because these external entities may also influence the bank decision in lending to the SMEs and that may distort the aim of the research.

The loan amount that we used for our empirical analysis is drawn from the BEEPS survey V (2012-2014), and we found that most of the recent loans of the SMEs were approved during the period of 2010-2011 and afterwards. It may be stressed that after the recent financial crisis banks are providing more loans to the SMEs. However, the survey did not cover how many loans are taken by the firm in the same fiscal year which would have helped us in better understanding the characteristics of the firms that are taking more loans per year and also their investment strategy.

The BEEPS data set covers 254 firms in the CR, where 236 firms are covered by the BEEPS V and 18 firms were from earlier surveys. Out of these 254 firms, 16 firms had more than 250 employees so we had to exclude them from empirical analysis and finally obtained 238 SMEs for analysis.

In terms of SKR, the BEEPS survey examined 276 firms but due to poor data quality it dropped 8 firms and reported 268 firms in the main database. To comply with the aim of this paper, we excluded the large firms and obtained 260 SMEs.

Finally, we found information about 310 firms in Hungary. Out of them, data on 247 firms were covered by the BEEPS latest survey and data on 63 others were obtained from the pooled survey. After deleting the large firms and other missing data, we were able to use 295 firms which are within the scope of this paper.

Altogether we obtained data on 793 SMEs from the three mentioned countries. Among these 793 firms, 268 firms are classified as micro firms, 385 firms as small firms and 140 firms as medium firms. The paper used BEEPS definition for firm level classification, therefore, a firm is considered as micro firm when the number of employees is less than 10, small firms are identified when the number of employees is more than 9 but fewer than 50 (10-49) and medium firms are defined as the firms having between 50-249 employees.

Among these 793 firms we found 227 firms that obtained loans from banks and about 75 per cent of the loans were secured with collateral. The survey shows that about 40 per cent of firms have at least one owner who is female. The data set also highlights that about 30 per cent of the firms have launched new products and services within the period of last three years. Considering the crime factors in the examined countries, it is quite surprising that about 20 per cent of the firms reported that they have incurred losses due to the theft, robbery or arson. Seeing these results, it may signal that SMEs

are still facing hostile business conditions in the European countries. On average, the firms in the sample received loans with 5 per cent interest rate. The detailed results can be seen in table 2.

With respect to the firm level analysis, we found that 55 micro firms received bank loans with an average interest rate of about 5.30 per cent and nearly 71 per cent of the loans were secured. Interestingly, women-owned firms are more present in the micro segment than any other segments. About 47 per cent firms in this segment have a female owner. It may signal that women prefer to establish firms that are easier to manage. Within the segments of small and medium firms, 119 small firms and 53 medium firms received loans from banks. The descriptive study shows that the average interest rates for the small firms was approximately 4.96 per cent while the average interest rate for the medium firms were around 4.35 per cent, which is the lowest rate among the segments. However, the average value of collateral suggests that about 74 per cent of loans are secured for small firms and about 82 per cent loans are pledged with collateral for the medium firms. Hence, it suggests that medium firms pledge more collateral than micro or small firms. According to the results, it may signal that banks in these three countries require higher collateral from firms which have more assets to pledge as collateral. Therefore, firms with more assets can be a suitable choice for banks to impose collateral requirements on the loan contract.

Table 3 presents the country level descriptive statistics and the results show that average firm age is about 17 years, which is similar in all three countries. We can also see that women own both in CR and SKR similar share of firms; about 33 in CR and 30 per cent in SKR. In contrary, female ownership is significantly higher in Hungary where women own 53 per cent of firms. Results from the CR show that about 50 per cent of firms have developed new products and services within the last three years. On the other hand, only 18 per cent of firms in SKR and 21 per cent of firms in Hungary have innovative activities. It reflects that firms in CR have a stronger innovation orientation in comparison to the firms in SKR or Hungary. The data also shows that about 35 per cent of firms in the CR reported that they incurred losses as a result of theft, robbery and arson, which is much higher than in SKR and Hungary. Interestingly, the descriptive results suggest that the collateral requirement is similar for small business lending in these countries (about 75 per cent of firms provide collateral for bank loans). It may mean that these three countries share similar creditor protection rights, which may harmonise the collateral requirements for SMEs. Finally, the survey finds that SMEs in CR pay higher interest rates (average interest rate is 5.6 %) than in SKR (average interest rate 4.5 %) and Hungary (average interest rate 4.6%). As firms in CR face much higher obstacles due to crime and theft, this may reflect that firms in CR are riskier than those in two other countries.

Table 2 Descriptive Statistics Firms' Level

Variable	SMEs					Micro					Small					Medium				
	Obs.	Mean	Std. dev.	Min	Max	Obs.	Mean	Std. dev.	Min	Max	Obs.	Mean	Std. dev.	Min	Max	Obs.	Mean	Std. dev.	Min	Max
FIRM SIZE	793	32.6	45.69	1	245	268	6.2	1.897	1	9	385	20.36	9.489	10	49	140	117	52.06	50	245
FIRM AGE	785	16.98	7.024	1	69	267	15.75	6.44	2	53	380	16.71	6.506	1	69	138	19.91	8.543	3	63
FEMALE (%)	793	39.5		0	1	268	46.6		0	1	385	34.5		0	1	140	39.3		0	1
INNOVATION (%)	793	29.1		0	1	268	26.5		0	1	385	31.7		0	1	140	27.1		0	1
CRIME/THEFT (%)	793	19.3		0	1	268	13.8		0	1	385	21		0	1	140	25		0	1
COLLATERAL (%)	342	74.9		0	1	92	70.7		0	1	174	74.1		0	1	76	81.6		0	1
INTEREST RATE	263	4.91	3.865	1	27	72	5.264	4.988	1	27	137	4.956	3.408	2	20	54	4.352	30.2	2	19
LOAN SIZE ($1000)	227	1360	1070	0.88	1540	55	3041	2070	0.88	1540	119	342.2	812	0.880	5003	53	1902	6429	0.45	4550

This table reports descriptive statistics for dependent variable and independent variables at firm level. FEMALE, INNOVATION, CRIME/THEFT and COLLATERAL are dummy variables. Source: BEEPS (2015).

Table 3 Descriptive Statistics by Country

Variable	Czech Republic					Slovak Republic					Hungary				
	Obs.	Mean	Std. dev.	Min	Max	Obs.	Mean	Std. dev.	Min	Max	Obs.	Mean	Std. dev.	Min	Max
FIRM SIZE	238	31.5	42.5	2	235	260	35.2	48	1	245	295	31.3	46.1	2	242
FIRM AGE	238	17.4	5.34	1	25	257	17	6.56	2	60	290	16.6	8.49	2	69
FEMALE (%)	238	33		0	1	260	30		0	1	295	53		0	1
INNOVATION (%)	238	50		0	1	260	18		0	1	295	21		0	1
CRIME/THEFT (%)	238	35		0	1	260	13		0	1	295	12		0	1
COLLATERAL (%)	124	75		0	1	107	75		0	1	115	75		0	1
INTEREST RATE	83	5.64	2.83	2	19	78	4.51	3.94	2	27	102	4.64	4.45	1	20
LOAN SIZE (1000 $)	89	484	893	75	5003	69	860	5466	3	45531	69	2990	1868	0.880	15400

This table reports descriptive statistics for dependent variable and independent variables at country level. FEMALE, INNOVATION, CRIME/THEFT and COLLATERAL are dummy variables. Source: BEEPS (2015).

Correlation Analysis

The data set we used for our analysis consists of cross sectional data, hence, we cannot test the possibility of autocorrelation on our examined variables. However, the authors run correlation matrix and presented the results in order to find out whether there is a collinearity in the model. In table 4 we show the level of correlation between the independent variables and it suggests that this study might not have the collinearity problem.

Table 4 Correlation Analysis

	Firm Size	Firm Age	Female Ownership	Innovation	Crime/Theft	Collateral	Interest rate
Firm Size	1.0000						
Firm Age	0.0365	1.0000					
Female Ownership	-0.0336	0.0584	1.0000				
Innovation	-0.0505	-0.0962	-0.0333	1.0000			
Crime/Theft	0.1081	0.0419	-0.0392	0.1444	1.0000		
Collateral	0.0423	0.0904	-0.0281	0.0131	0.0208	1.0000	
Interest rate	-0.0658	-0.0409	-0.0164	-0.0082	0.0798	0.0337	1.0000

This table reports correlation analysis between the independent variables. Source: authors own estimation

Empirical Results

We present estimation results across firm size and across countries. We separate regression results to understand bank lending behaviour for micro, small and medium firms. Moreover, the paper presents cross-country regression results for SME financing to understand the differences in country level. Therefore, the analyses of the paper have valuable attributes to foster knowledge about SME financing behaviour not only from firm-level differences perspective but also on country level.

Table 5 presents the regression results for full sample and we show results from firm level segmentation perspective. With respect to the SMEs, we found that the coefficient of *FIRM SIZE* is statistically significant at 1 per cent and positively associated with our dependent variable which is *LOAN SIZE.* This indicates that as the firm size increases the loan size also increases. However, this result is not true for the micro firms when we look at it from the firm size perspective. The negative coefficient of the relationship between loan size and micro firms suggests that micro firms get lower amount of credits from banks in our examined countries. Brancati (2015) found similar results in the context of Italian market. The result may suggest that larger firms can show better credit quality by reducing information opacity and that helps them to get more loans from banks. Thus, we may say that reduction of information asymmetry can improve the financing possibilities of firms in the loan markets.

In the segment of SMEs, unexpectedly, we found that *FIRM AGE* is negatively related to *LOAN SIZE* but it is not statistically significant. Petersen and Rajan (1995) also found a negative relationship between the loan size and firm age in the context of USA. They found that mature and older firms need a relatively lower amount of debt from financial institutions since they have reserve cash for investment. Moreover, this result can be interpreted from the capital structure theory of firms. It could mean that the firms which are mature and already in the markets for a long time have accumulated more internal assets and can invest their retained earnings (Myers and Majluf, 1984). As a result, firms which are older require smaller amounts of loans from banks. The hypothesis is supported when we look at the micro firms. Therefore, we can say that as a micro firm matures, it can provide more information to banks in the form of past track record or it is also able to get loans by forming a good relationship with banks (Brancati, 2015; Neuberger et al., 2006).

We found a negative relationship between *FEMALE* ownership of firms and access to bank finance. However, the result is not statistically significant on the SMEs level. A statistically significant result is found for the micro firms. Hence, this study provides empirical evidence that women-owned firms get a lower amount of credit from the formal financial institutions than the male-owned firms do. Our results can be interpreted from different perspectives. Firstly, it might be caused by female owners receiving lower amount of finance due to the bank stereotype gender discrimination (Carter and Rosa, 1998). Similarly, women-owned firms may lack access to finance because they do not have enough assets to pledge as collateral to banks (Lee et al., 2015). In our case, it is more relevant that women-owned micro firms may have less physical assets to pledge as collateral to the bank and thus they face higher credit restrictions from banks.

Unexpectedly we did not find statistically significant results between *INNOVATION* and *LOAN SIZE* in the segment of SMEs or full sample. However, we found statistically significant positive result at 10 per cent level between *INNOVATION* and access to finance only in the case of medium sized firms. Thus, we can infer that innovative firms are not penalized by commercial banks in our examined countries. The positive sign of innovation and access to finance signals that commercial banks do value the innovation activities of the firms by providing financial support. It could mean that commercial banks provide funds to innovative firms by assuming that innovative firms have more growth prospects in the market.

We show that *CRIME/THEFT* is only statistically significant for micro enterprises. The result suggests that commercial banks perceive micro firms as riskier if they incur any losses due to robbery, theft or arson and based on that micro firms can be denied a larger loan. It is legitimate to argue that micro firms have limited resources and if they face additional losses because of criminal activities, it can seriously hamper their possibility of survival. Hence, it could mean that banks are stricter when rating the micro firms which reported that CRIME/THEFT had affected their business because it increases their probability of loan default.

The paper found that *COLLATERAL* has a positive sign and the results are statistically significant across all firm sizes. According to the results, the current study provides additional support that availability of collateral can ease the financing possibility for

SMEs. It is possible that collateral signals better credit quality and confidence of the borrower in loan repayment capacity in the examined countries (Bester, 1987; Chan and kanatas, 1985; Besanko and Thakor, 1987). On the other hand, it could mean that collateral has a disciplinary role and because of that banks are willing to lend to SMEs (Chakraborty and Hu, 2006; Menkhoff et al., 2012; Brick and Palia, 2007). Hence, the result suggests collateral is a significant determinant of SME finance in our examined countries.

Table 5 Results of the Regressions Across Firms' Size: Dependent Variable: Loan Size

Variables	SMEs	Micro Firms	Small Firms	Medium Firms
FIRM SIZE	0.0127***	-0.4001***	0.052	0.002
	(0.0042)	(0.1362)	(0.0336)	(0.0079)
FIRM AGE	-0.0535	0.5954**	-0.0222	0.0349
	(0.0693)	(0.02698)	(0.2183)	(0.044)
FIRM AGE SQUARE	0.0009	-0.0236	-0.0009	0.0084
	(0.0014)	(0.0089)	(0.0061)	(0.0045)
FEMALE (Yes=1)	-0.176	-1.1648**	0.5372	-1.042
	(0.3921)	(0.5203))	(0.6178)	(0.7621)
INNOVATION (Yes =1)	0.5737	0.1907	0.387	1.4462*
	(0.405)	(0.5607)	(0.6525)	(0.8079)
CRIME/THEFT (Yes =1)	0.4334	-1.3635*	1.0898	0.0698
	(0.4509)	(0.7406)	(0.7042)	(0.8138)
COLLATERAL (Yes =1)	1.6145***	2.5885***	1.4740**	0.1084*
	(0.4654)	(0.6085)	(0.7057)	(1.165)
INTEREST RATE	0.0943*	0.1052*	0.0956	0.025
	(0.0527)	(0.0582)	(0.088)	(0.1245)
Constant	9.3543***	8.8984***	8.1000***	11.3294***
	(0.9243)	(2.0198)	(1.9721)	(1.913)
Number of Firms	195	48	104	43
R-squared (%)	14.7	54.6	12.2	13.9

Note: This table reports results from OLS regression models for the entire sample of firms (SMEs) and firm level segmentation. The dependent variable is natural logarithm of loan amount (Loan Size). Firm size is the number of full-time employees (FIRM SIZE) and firm age is the number of years the firm has been in operation (FIRM AGE). Interest rate is the appropriate interest rates charged on the loan (INTEREST RATE). Other explanatory variables are dummy variables (FEMALE, INNOVATION, CRIME/THEFT, and COLLATERAL). Significance level: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are in parenthesises
Source: Authors own estimation

We find that the *INTEREST RATE* is statistically significant at 10 per cent level for the SMEs and micro-firms. This indicates that as the rate of interest increases, the loan size increases. It could mean that the higher the amount of loan the higher the risk. Therefore, banks may impose a higher interest rate as the loan size increases. Moreover, a large loan size can increase the moral hazard issue and for that reason, it might be possible that banks charge higher interest rates to receive their compensation as quickly as possible. One can raise question why a bank would provide credit to a borrower knowing it was substantially risky? We argue that inter-bank competition may affect the bank decision to provide credit to the risky borrowers and a high interest rate is an incentive for the lenders to increase their profit margin.

Table 6 Results of the Regressions at Country-Level: Dependent Variable: Loan Size

Variables	Czech Republic	Slovak Republic	Hungary
FIRM SIZE	0.0166***	0.0157	0.0106
	(0.0039)	(0.0135)	(0.0048)
FIRM AGE	-0.1608	-0.2201	-0.0881
	(0.189)	(0.1582)	(0.1243)
FIRM AGE SQUARE	0.0052	0.0032	0.0021
	(0.0059)	(0.00277)	(0.0029)
FEMALE (Yes= 1)	-0.2508	-0.0952*	-0.6525**
	(0.3362)	(1.0541)	(0.577)
INNOVATION (Yes =1)	0.3734	1.1481	-0.2704
	(0.3224)	(1.1798)	(0.5831)
CRIME/THEFT (Yes =1)	0.32	-0.0092*	-0.8404
	(0.3133)	(1.3931)	(0.797)
COLLATERAL (Yes =1)	0.6456	3.3339***	0.4740*
	(0.4196)	(1.2751)	(0.6112)
INTEREST RATE	-0.1765***	0.3821	0.0297
	(0.0571)	(0.1853)	(0.0594)
Constant	12.7082***	7.3551***	11.8276
	(1.5715)	(2.2071)	(1.4375)
Number of Firms	71	58	66
R-squared (%)	46.1	27.7	14.0

Note: This table reports results from OLS regression models at country level segmentation. The dependent variable is natural logarithm of loan amount (Loan Size). Firm size is the number of full-time employees (FIRM SIZE) and firm age is the number of years the firm has been in operation (FIRM AGE). Interest rate is the appropriate interest rates charged on the loan (INTEREST RATE). Other explanatory variables are dummy variables (FEMALE, INNOVATION, CRIME/THEFT, and COLLATERAL). Significance level: *** p<0.01, ** p<0.05, * p<0.1
Standard errors are in parenthesises
Source: Authors own estimation

Table 6 presents regression results at country level determinants of SME financing. We control for the same variables as we did for the firm size level.

At first, the result suggests that *FIRM SIZE* has a positive effect on access to finance in all countries. However, the result is statistically significant only in the case of CR. The result stresses that banks in Czech Republic consider firm's size to be a positive signal while considering a loan application. This positive effect of firm size and loan size shows further evidence that as firms get bigger it can signal positive information to banks about their credibility. Moreover, the results also support that higher information transparency can ease the possibility of getting a bank loan (Ferri and Murro, 2015; Bolton et al., 2013).

FIRM AGE has a negative coefficient in each country, but it is not statistically significant. This result signals that regardless of the country, mature firms ask for a lower amount of bank loans. It is more likely that they invest their cash reserve or financial slack.

The results for *FEMALE* dummy have significant negative coefficient with *LOAN SIZE* in SKR and Hungary, but the result is not significant in the context of CR. This result may indicate that banks in CR do not discriminate against loan size based on gender differences. However, results from the SKR and Hungary are suggesting that female borrowers do receive a smaller amount of credit from banks than male borrowers. Although we did not examine at what basis female borrowers receive smaller amount of loans, it may come from supply side gender discrimination effect from banks or it is possible that female borrowers restrict themselves from asking for larger loans.

The paper did not find any significant effect of *INNOVATION* and access to finance in our examined countries. Thus, we cannot deduce that the innovative firms are more financially constrained than the non-innovative firms. This result may encourage innovative firms to ask for bank loans as our result suggests that innovative firms get similar preferences from banks as the non-innovators.

We found that *CRIME/THEFT* has a negative coefficient in the context of SKR, but not in two other countries. Hence, we may infer that SMEs in SKR located in the area where the frequency of crime is higher are more likely to be financially constrained by banks. Hence, firm riskiness is an important determinant of access to finance in one out of our three examined countries.

COLLATERAL has a positive effect on getting bank loans in each examined country. However, only results from SKR and Hungary are statistically significant. This means that collateral is significantly valued by the banks in these countries while lending to SMEs. It is also possible that banks in SKR and Hungary take a conservative approach in lending to SMEs and hence ask for collateral to protect their loan portfolio from bad loans because in the event of defaulted loans a bank can liquidate the securitized collateral and get back the extended loans, which is also proposed by Blazy and Weill (2013). On the other hand, it may signal that SMEs in SKR and Hungary are more credit worthy and they would like to show their credit quality by providing more collateral. Considering this result, it might be possible to say that collateral acts as a signalling device for banks in sorting the high-quality borrowers from the bad borrowers, which is highlighted by Bester (1987), Chan and Kanatas (1985), Besanko and Thakor (1987).

Finally, we see that *INTEREST RATE* has a negative effect on loan size in CR and the result is statistically significant. This result shows that when interest rates are high, SMEs in this market demand a lower amount of bank loans as it increases their debt burden. However, we did not find any significant results for the other two countries. This result further supports our descriptive studies where we showed that banks in CR charge higher interest rates than banks in SKR and Hungary.

Conclusion

In this paper, we examined the determinants of access to finance for SMEs in the context of three Central European countries – CR, SKR, and Hungary. The access to finance was a proxy variable captured by the loan size. BEEPS V, , which is a joint project of European Bank for Reconstruction and Development (EBRD) and the World Bank (WB), provides the data set we used for our empirical analysis. We analysed five borrower characteristics and two loan specific characteristics for assessing the determinants of access to finance.

The results are mixed and we found that firm-level characteristics are more depended on the firm classification (for example: micro, small and medium firms) rather than comprehensive results for the whole SME segment. For example, while the result suggests firm size has a positive relationship with access to finance for SMEs, it has a negative coefficient for micro firms. That means micro firms are facing even more financing obstacles from commercial banks. With respect to the firm age, we found significant positive results for micro firms with access to finance. That means micro firms can show better information quality to banks when they get older and mature. The results for female ownership showed that women-owned firms experience more financial constraints than the men-owned firms do. This suggests that the potential gender discrimination in the loan market is also a concern for developed European countries.

With respect to innovation, our result indicates that innovative SMEs are not more financially constrained than the non-innovative firms. Rather a positive coefficient suggests that innovative firms are encouraged by banks in the form of access to finance. It is also possible to see that micro firms are facing financing barriers if they experienced crime/theft. Hence, crime/theft adds additional financial barriers for micro firms when they want to ask for loans from banks. The paper finds evidence that collateral has a positive effect on loan size for all firms; it also reflects the fact that banks in these three countries are more comfortable in collateral-based lending. Finally, we found evidence that the interest rate positively affects access to finance in the segment of SMEs on the whole, and for micro firms. It may reflect that as the loan size increases, banks are also charging higher loan price due to increased risk with loan size. On the other hand, micro firms are more vulnerable to defaults and for that reason, banks may ask for higher rates from the micro firms.

With respect to the country level perspective, we find that only firm size and interest rate are statistically significant in the CR. However, firm size has a positive effect while interest rate has a negative effect on access to finance. Therefore, we can say that commercial banks in the CR consider firm size to be a positive signal for extending

loans to SMEs. Conversely, a higher interest rate in CR in comparison to SKR and Hungary creates barriers for SMEs to asking for larger loans. In the context of SKR and Hungary, we found that female ownership and the pledge of collateral are statistically significant. According to our expectation, we found that female ownership reduces the likelihood of accessing to finance for the SMEs but the pledge of collateral can enhance it. Therefore, referring to our results we may say that gender discrimination is a prevailing fact in the loan markets and it is not only the case for developing countries, but also for the developed European markets. Finally, positive effect of collateral on access to finance suggests that the pledge of collateral may increase the confidence level of banks to extend credits to SMEs. Although we did not empirically examine whether the positive effect of collateral on access to finance comes from the reduction of adverse selection or moral hazard issue, it can be an interesting future research scope.

The results of this paper have a few policy implications. Firstly, an appropriate policy could be helpful for the firms which are credit constrained and owned by women. Implementing such a policy could encourage female entrepreneurs, which can foster economic growth of the country. Secondly, as we confirmed that SMEs are credit constrained due to the collateral requirement, it could be useful to rethink the collateral requirements in particular for the SMEs. Finally, regulators may take initiatives to reduce the interest rate for SMEs, which can foster the growth of the SMEs and, therefore, contribute to the economy.

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