

CEFIN Working Papers
No 34

*Collateral Requirements of SMEs:
The Evidence from Less-Developed Countries*

by Elmas Yaldiz Hanedar, Eleonora Broccardo, Flavio Bazzana

November 2012

**Collateral Requirements of SMEs:
The Evidence from Less–Developed Countries**

Elmas Yaldiz_Hanedar,

Ph. D, School of Social Sciences, University of Trento, *elmas.yaldiz@unitn.it*

Eleonora Broccardo

University of Trento - Department of Economics and Management, Via Inama, 5 -
38122 Trento, and Cefin (Centro Studi Banca e Finanza), *eleonora.broccardo@unitn.it*

Flavio Bazzana

University of Trento –
Department of Economics and Management, Via Inama, 5 - 38122 Trento,
flavio.bazzana@unitn.it

Abstract

The main objective of this paper is to investigate the determinants of collateral requirements on loans that are extended to small and medium enterprises (SMEs) in less–developed countries. Our primary data source is the Business Environment and Enterprise Performance Survey (BEEPS) results from Eastern European and Central Asian countries. We observe that country–specific variables are more important than firm–specific variables for determining both the presence of collateral in loan contracts and the collateral to loan value ratios of these contracts. The strongest evidence in our paper addresses the important role that information sharing among lenders plays in the reduction of collateral requirements.

JEL classification codes: G21, G32, O16

Keywords: collateral, SMEs, loan conditions, two–part models.

1. Introduction

Borrowing difficulties can be one of the most important obstacles to starting and running a business for small and medium enterprises (SMEs), particularly in less-developed transition economies. Both the information asymmetry between the bank and the firm (Berger and Udell, 1998; Baas and Schrooten, 2006), and the overall banking market structure (Petersen and Rajan, 2002; Berger and Udell, 2006) can influence the borrower–bank relationship. As theoretical models acknowledge, collateral requirements are stringent in these countries because the financial environment in these nations typically involves opaque information and weak enforcement (Hainz, 2003; Menkhoff et al., 2006; 2012). However, little evidence is available with respect to the determinants of collateral for loans that are extended to SMEs in emerging and less-developed markets. Beck et al. (2006) use the World Business Environment Survey (WBES) to examine 12 financing obstacles and report that collateral requirements are the third most important of these obstacles. The Business Environment and Enterprise Performance Survey (BEEPS) results for firms in Eastern Europe and Central Asia indicate that high collateral requirements are the fourth most important reason that firms do not apply for external loans; with respect to importance, this factor ranked immediately below the issues of complex application processes and high interest rates¹. Therefore, collateralisation appears to be a crucial aspect of a firm’s access to external financing; this access can determine the eventual disappearance or survival of a firm. An extensive body of literature refers to collateral requirements as a tool that can both reduce the cost of external funds for firms in the presence of agency problems and decrease credit rationing (Besanko and Thakor, 1987a; Bester, 1987; Coco, 1999; Berger et al., 2011b; Jiménez et al., 2011)². In developing countries, borrowers have

¹ See Table A.1 of the Appendix for a detailed depiction of these results.

² For a review of the burgeoning body of empirical research that addresses collateral as a remedy for credit rationing, see Steijvers and Voordeckers (2009).

relatively low probabilities of holding collateralisable assets and collateral requirements are relatively high; thus, firms in these nations are more likely to experience difficulties in obtaining access to external financing (Menkhoff et al., 2006 and 2012). The empirical literature on collateralisation has largely focused on developed countries, whereas only a few studies have examined this issue in the context of less-developed and transition economies. One example of a study of a less-developed economy is an investigation by Feder et al. (1988) that emphasises the role of collateral in decreasing the cost of creditworthiness assessments for lenders in rural Thailand; these decreased costs increase the credit supply of the examined region³. Using firm-level data from Mexico, Gelos and Werner (2002) address the importance of collateral in the form of real estate for investments by firms, particularly following the financial liberalisation of that nation. Caballero and Krishnamurthy (2001) relate the occurrences of financial crises in developing economies to shortages of international collateral⁴.

The objective of our paper is to understand the determinants of both (i) the presence of collateral and (ii) the collateral to loan ratios in loans that are extended to SMEs in less-developed countries. Using pooled cross-section data, we seek to investigate the importance of various firm- and country-specific factors are by testing (i) whether higher borrower quality reduces the collateral to loan ratio; (ii) whether information sharing among lenders can decrease collateralisation; and (iii) to what extent lending market and macroeconomic conditions affect the presence of collateral in loan contracts. Our main result indicates that country-specific variables are more important than firm-specific variables for determining both the presence and the degree of collateral for a loan. Accordingly, we find that not all of the borrower's characteristics

³ Using data from Thailand, Menkhoff et al. (2012) reveal that a lack of collateral is resolved through the use of substitutes for collateral, such as relationship lending, the modification of loan terms (e.g., reductions in loan size), and the inclusion of third-party guarantees.

⁴ In their theoretical model, international collateral determines the amount of financing that foreign investors extend to these firms. One example of international collateral that they consider is the export sector revenues that international investors can seize in the event of a loan default, whereas they regard real estate as an example of domestic collateral.

explain the collateral requirements; collateral requirements appear to represent a tool for resolving the problem of asymmetric information about a borrower's quality.

Our paper contributes to the existing literature in two ways. First, we perform a cross-country analysis. We examine survey data from BEEPS; this approach allows us to obtain deep and detailed information about not only borrower firms but also the perceptions of these firms regarding the business environment in which they operate. There have been few empirical studies that use this type of survey data; moreover, most of the research on collateral in the context of less-developed and transition economies has been conducted within a single country. Consequently, there is a paucity of empirical data regarding this topic. To address this deficiency, our paper presents a wide range of cross-country data from less-developed countries, including transition economies from Eastern Europe and Central Asia, and yields new results and important insights for businesses and policy makers that operate in these countries. Second, we contribute to the literature by investigating not only the presence of collateral in lending but also the volume of collateral in loan contracts. Most of the extant empirical studies employ discrete choice models that do not distinguish among different levels of collateral. To the best of our knowledge, few other studies of SMEs in less-developed markets focus on the collateral to loan ratio⁵.

The remainder of the paper is organised as follows. Section 2 reviews the theoretical and empirical literature on collateral requirements. Section 3 introduces the hypotheses and the empirical model of this study. Section 4 presents data and descriptive statistics. The results are discussed in Section 5, and Section 6 concludes the paper.

⁵ Most of the previous studies on collateralisation depend on the use of collateral in loan contracts and have used logit or probit regressions on a binary dependent variable. However, these discrete choice models do not describe the volume of collateral; for example, loan contracts with 1% or 1000% collateral to loan ratios are considered to be the same and are typically identically coded. For a review of empirical research that addresses the degree of collateral for loan contracts, see Menkhoff et al. (2006).

2. Literature review

An extensive body of theoretical literature addresses collateral as a tool for resolving informational asymmetry problems regarding the borrower's quality in the context of either ex-ante adverse selection or ex-post moral hazards. According to the adverse selection hypothesis, collateral acts as an indicator of the borrower's creditworthiness (Stiglitz and Weiss, 1981; Chan and Kanatas, 1985; Bester, 1987; Besanko and Thakor, 1987a; Chan and Thakor, 1987; Boot et al., 1991). The bank screens firms by offering both loan contracts with higher collateral and lower interest rates and loan contracts with lower collateral and higher interest rates. Although risk factors may not be readily observable, lower-risk borrowers will nonetheless pledge more and better collateral than riskier borrowers because this pledge is less costly for borrowers who have lower likelihoods of losing the proffered collateral. According to the moral hazard hypothesis, the probability of losing collateral acts as a disciplinary tool for the borrower. Thus, the pledge of collateral leads to a higher level of effort to satisfy loan conditions, reducing a borrower's default probability. Collateral therefore serves as a tool for resolving moral hazard problems (Boot et al., 1991; Aghion and Bolton, 1992; Boot and Thakor, 1994; Holmstrom and Tirole, 1997). To support these two divergent hypotheses regarding the role of collateral, empirical studies have investigated whether a reduction in asymmetric information impacts collateral decisions. As noted by Godlewski and Weill (2011), there is a clear dearth of substantial empirical support for the adverse selection hypothesis with respect to the use of collateral. Although several studies support the role of collateral as a tool for mitigating adverse selection problems (Jiménez et al., 2006; Berger et al., 2011b), other investigations (Cressy and Toivanen, 2001) find evidence that risk and collateral are not significantly correlated. Instead, a positive relationship between collateral and loan spread is consistently demonstrated: in other words, because banks are able to distinguish among borrowers of different quality, these financial institutions charge higher interest rates and require higher collateral for riskier borrowers, confirming the observed-risk hypothesis (Berger and Udell, 1990; Berger and Udell, 1995; Jiménez and Saurina, 2004; Gonas et al., 2004; Chen, 2006; Menkhoff

et al., 2006; Chakraborty and Hu, 2006; Brick and Palia, 2007)⁶. Within this debate, several authors indicate that both hypotheses might be empirically validated and reconciled by examining the degree of information asymmetries that are present in a country. Empirical evidence indicates that the observed-risk hypothesis tends to dominate in contexts that involve low levels of asymmetric information (Berger et al., 2011a; Godlewski and Weill, 2011). A recent study by Steijvers and Voordeckers (2011) suggests several explanations for why the observed results regarding this topic may differ across various empirical studies⁷.

Several studies assume that the strength of the lender-borrower relationship is an inverse proxy for the degree of asymmetric information (for an overview, see, e.g., Boot, 2000). In particular, these investigations suggest that if this relationship is stronger, then the borrower's risk information will be more reliable and therefore the borrower will be able to obtain a loan contract with more favourable terms (Boot and Thakor, 1994; Petersen and Rajan, 1995)⁸. However, another stream of literature predicts that a strong relationship may induce banks to exploit their information monopoly and extract a rent by requiring more collateral (Sharpe, 1990). Research investigations indicate that the variables that are employed as proxies for the strength of the relationship can affect the empirical results that are observed. For instance, although several studies either find no significant correlation between the duration of the bank-

⁶ A recent study by Niinimäki (2011) yields a new insight regarding the decision to pledge collateral. This study reveals that for high-risk borrowers, the choice between unsecured and secured lending is dependent on their expectations for changes in value of the collateral that they plan to pledge for their loans. In particular, borrowers are more likely to choose secured loan contracts if they expect the value of their collateral to depreciate.

⁷ They argue that the most relevant limitations in empirical research consist of not only (i) the exclusion of other tools for reducing information opacity, such as the strength of the borrower-lender relationship, loan maturity, and loan covenants, but also (ii) the ignoring of the moderating or interaction effects among the different tools that mitigate informational asymmetries.

⁸ However, it must be noted that if the lender obtains access to private information of the borrower, the required collateral for a loan may either decrease or increase, given that private information about borrower quality can be either favourable or unfavourable.

borrower relationship and the pledging of collateral (Menkhoff et al., 2006) or report a positive correlation between these two factors (Machauer and Weber, 1998; Ono and Uesegi, 2009, Uchida, 2011), the majority of the extant empirical studies demonstrate a negative relationship between these two variables (Berger and Udell, 1995; Harhoff and Körting, 1998; Degryse and Van Cayseele, 2000; Chakraborty and Hu, 2006; Jiménez et al., 2006; Brick and Palia, 2007). Empirical studies have also related the strength of the bank–borrower relationship to the number of banks with which the borrower has transactions, assuming that more exclusive relationships will also be stronger in nature; however, the results from these studies are conflicting. Investigations by Harhoff and Körting (1998), Chakraborty and Hu (2006), and Jiménez et al. (2006) find a negative relationship between borrower exclusivity and collateral, as these studies reveal that relationships with multiple banks increase the probability of pledging collateral for a loan. By contrast, studies by Machauer and Weber (1998), Menkhoff et al. (2006), Voordeckers and Steijvers (2006) and Hernández-Cánovas and Martínez-Solano (2006) report a positive relationship between these two considerations, suggesting that relationships with multiple banks lower the probability of pledging collateral for a loan. The “lender–based” theory of collateral assesses the presence of collateral in loans by considering two different banks in the credit market: one local bank that benefits from possessing an information advantage on the borrower and another bank that is distant from the borrower but introduces competition in the local market (Inderst and Mueller, 2007). Investigations of these types of situations have revealed that the presence of collateral allows local lenders to profit from their superior information advantage; for instance, empirical research by Jiménez et al. (2009) indicates that the use of collateral is higher for loans that are granted by local lenders⁹. Other researchers have examined the relationship between different types of lenders or loans and the pledging of collateral. The results from all of these studies have relevance for asymmetric information theories and/or the relationship issue. Chakraborty and Hu (2006) indicate

⁹ These researchers define organisational distance as the distance between the top decision-making power and the operating branches that serve customers in local markets and physical distance as the distance between borrowers and banks.

that loans that are not lines of credit are less likely to be collateralised if borrowers use more of a bank's services. Jiménez and Saurina (2004) conclude that for savings banks, which are the types of financial institutions that face the greatest adverse selection, collateral appears to be an effective device for decreasing borrower risk. Uchida (2011) finds that compared with large banks, small banks place greater emphasis on both the ability to pledge collateral and the lending relationship. However, Voordeckers and Steijvers (2006) conclude that compared with loan and lender characteristics, firm and relationship characteristics are more important determinants of collateral.

Another stream of literature investigates the role of market competition in collateralisation. An initial theoretical view argues that as bank competition increases, the bank's incentive to invest in information collection diminishes because the probability that borrowers will switch to other banks will rise; thus, under increasingly competitive conditions, a bank's power to extract rent will be reduced, increasing the likelihood of the use of collateral (Besanko and Thakor, 1987a; Petersen and Rajan, 1995). From an empirical perspective, by assuming a negative relationship between competition and loan market concentration, Jiménez et al. (2006) find support for a negative relationship between the use of collateral and loan market concentration¹⁰, thus suggesting that collateral and a bank's market power appear to be substitutes. A second theoretical view asserts that bank competition may induce banks to focus even more deeply on relationship-based lending; this focus can alleviate price competition pressures because a client-driven lending system can help a bank become more unique relative to its competitors (Boot and Thakor, 2000; Berlin and Butler, 2002). Voordeckers and Steijvers (2006) empirically demonstrate that if a company submits a credit request to more banks, the likelihood that the company will pledge any type of collateral as an aspect of its eventual loan diminishes. Finally, in Berger et al. (2011b), lending market concentration does not appear to have a significant effect on the use of collateral.

¹⁰ However, these authors find that credit market concentration does not change the effect that the relationship duration has on the likelihood of collateral use.

Moreover, the existing literature also explores whether collateral requirements help reduce the cost of external funds and the level of credit rationing¹¹. In addition, many published studies analyse whether collateral requirements improve a bank's monitoring activity¹². Recent empirical research supports these two theories¹³. To conclude, the theoretical literature also analyses (i) the existence of a "collateral channel" through which a large decline in asset markets decreases the value of collateralisable assets and adversely affects the real economy¹⁴; and (ii) the ways in which collateral affects recovery rates within the Basel II framework¹⁵.

3. The hypotheses and the empirical model

We investigate how collateral requirements are related to characteristics of the borrower and/or features of the credit market. We measure the collateral requirement not only by the presence of collateral but also by the collateral to loan ratio. With respect to borrower characteristics, we analyse whether the risk profile of the borrower positively affects the collateral requirement (hypothesis 1). With respect to market features, we investigate how information sharing (hypothesis 2) and the concentration of the bank market (hypothesis 3) affect collateral requirements. Thus, in accordance with the literature surveyed above, the following hypotheses will be tested.

¹¹ See Bester (1987), Besanko and Thakor (1987a), Feder et al. (1988), La Porta et al. (1997), Coco (1999), Gelos and Werner (2002), Jiminez and Saurina (2004), Berger et al. (2011b), and Menkhoff et al. (2012). For a review of recent empirical research on collateral as a remedy for credit rationing, see Steijvers and Voordeckers (2011).

¹² Berglöf and von Thadden (1994), Rajan and Winton (1995), Holmstrom and Tirole (1997), Repullo and Suarez (1998), Gorton and Kahn (2000), Longhofer and Santos (2000), Park (2000), Manove et al. (2001).

¹³ Feder et al. (1988), Voordeckers and Steijvers (2006), Ono and Uesugi (2009), Cerqueiro et al. (2011).

¹⁴ Mattesini (1990), Kiyotaki and Moore (1997), Krishnamurthy (2003), Niinimäki (2009), Benmelech and Bergman (2011).

¹⁵ Hui et al. (2006), Chalupka and Kopeckni (2009), Grunert and Weber (2009).

3.1. The hypotheses

H1 *As the default risk of borrowers increases, the presence of collateral in SME loan contracts becomes more likely, and collateral to loan ratios will be higher for these high-risk borrowers*

According to the observed-risk hypothesis, borrowers with observably higher risk will more likely be required to provide collateral for loans to defray the costs of the lender in the event of a default (Leeth and Scott, 1989; Berger and Udell, 1990; Jiménez and Saurina, 2004; Chen, 2006; Niinimäki, 2011). In a situation that involves hidden actions, collateral can serve as a means of aligning the interests of the lender and the borrower, acting as a deterrent that discourages the borrower from adopting opportunistic, risk-shifting behaviours that can hinder the success of the project that uses the borrowed funds (Boot et al., 1991; Boot and Thakor, 1994; Holmstrom and Tirole, 1997). The credible threat of losing the pledged collateral (Aghion and Bolton, 1992) disciplines the borrower's actions by producing a higher level of effort to satisfy loan requirements and therefore reducing the borrower's default probability. We expect to find evidence of a positive relationship between the risks of the SMEs and the collateral requirements to which these enterprises are subjected, particularly given that small and medium businesses typically display even higher perceived levels of risk in less-developed countries than in developed nations.

H2 *The collateral requirements in SME loan contracts are less restrictive in countries that feature more intensive information sharing among lenders*

Information sharing among lenders allows banks to inexpensively obtain information on the repayment histories and current debt exposure of loan applicants. Thus, information sharing is an important tool for reducing informational asymmetries and eventually decreasing adverse selection problems. Pagano and Jappelli (1993) demonstrate that information sharing increases the volume of lending by easing loan conditions, particularly for situations involving severe adverse selection problems in the financial markets. From an empirical perspective, Brown et al. (2009) reveal that information sharing is associated with credit that is both more available and less expensive for firms;

this effect is especially pronounced for informationally opaque SMEs¹⁶. In countries with weaker information-sharing mechanisms, lenders may experience difficulties with respect to credit risk measurement, particularly if they are unfamiliar with the loan applicant prior to the loan application. As a consequence, greater opaqueness regarding borrowers' characteristics produces an increased probability of collateral requirements and a higher degree of collateral for any given loan. Therefore, we expect to find negative relationships between information sharing and both the presence of collateral in loans and the collateral to loan ratio.

H3a *Both the likelihood of the presence of collateral and the degree of collateral in SME loan contracts are positively associated with banking concentration*

Boot and Thakor (2000) argue that banks attempt to build closer relationships with their clients in more competitive banking environments. Therefore, banking competition is expected to decrease the collateral requirements. Berlin and Butler (2002) demonstrate that as the competitive pressure in loan markets increases, lenders must relax the contract terms, i.e., lower their expected collateral ratios; thus, loan contracts become less stringent as competition increases. Based on a sample of bank loans in 70 countries, Hainz et al. (2012) indicate that the presence of collateral in loan contracts is more likely in less competitive loan markets. Assuming that a negative association exists between competition and concentration, we expect to find a positive relationship between the concentration of the credit markets and both the presence of collateral in loans and the magnitude of the collateral to loan ratio. We furthermore postulate that because the banking sector is less developed and less competitive in less-developed countries than in developed countries, oligopolistic banks in these less-developed countries may extract rents by frequently requiring collateral and mandating higher collateral to loan ratios.

¹⁶ The authors of this paper use BEEPS data from 2002 and 2005. In particular, data regarding the cost/availability of funds is obtained from the answers of the responding firms to the following question: "Can you tell me how problematic is access to finance (e.g., collateral requirement) or financing not available from banks for the operation and growth of your business?" (1 = major obstacle, 2 = moderate obstacle, 3 = minor obstacle, 4 = no obstacle).

H3b *Both the likelihood of the presence of collateral and the degree of collateral in SME loan contracts are negatively associated with banking concentration*

There is also another group of studies that address a positive association between competition in banking and the presence of collateral (e.g., Besanko and Thakor, 1987a; Voordeckers and Steijvers, 2006). Assuming a negative relationship between competition and concentration, the use of collateral is expected to be less likely in concentrated lending markets. In concentrated banking environments, lenders possess an informational advantage over borrowers; this advantage produces collateral requirements that are less stringent, as predicted by the “lender-based” theory of collateral (Jiménez et al., 2006; 2009). Jiménez et al. (2006; 2009) provide empirical evidence for the negative relationship between the presence of collateral in loan contracts and lender market concentration. By contrast, Berger et al. (2011b; 2011c) demonstrate that lending market concentration, which these researchers use as a control variable, does not have a significant effect on the presence of collateral in loan contracts.

3.2. Model specification and methodology

Using probit and logit models, most of the previously published studies that examine the presence of collateral in loan contracts use a dependent variable that assumes a binary form¹⁷. However, these discrete choice models do not describe the volume of collateral; for example, loan contracts with 1% or 1000% collateral to loan ratios are considered to be the same and are coded identically. Only a few studies have examined collateral to loan ratios, and these investigations primarily utilise tobit models¹⁸. However, tobit is a restrictive model due to its assumptions. First, the maximum likelihood estimation for the tobit model assumes that errors are homoskedastic and possess a normal distribution; if these assumptions are violated, the maximum

¹⁷ Berger and Udell (1995), Degryse and van Cayseele (2000), Jiménez et al. (2009), Menkhoff et al. (2012).

¹⁸ Menkhoff et al. (2006), Peltoniemi (2007).

likelihood estimator becomes inconsistent. Although several modified tobit models exist (e.g., the heteroskedasticity–robust tobit estimator), Ramalho and Vidigal da Silva (2009) argue that none of these modifications produce a single modified tobit model that addresses all of the issues with the tobit approach. Second, the maximum likelihood estimation it assumes that the same data–generating process determines both the binary and the continuous dependent variables, which in this instance are the presence of collateral and the collateral to loan ratio, respectively.

As originally formulated by Cragg (1971), double–hurdle or two–part models generalise the tobit model in a manner that overcomes this restrictive assumption¹⁹. As the name “double–hurdle” suggests, Cragg (1971)’s model is based on the assumption that households make two separate decisions about buying a durable good; in particular, in this model, each household first decides whether to buy a durable good and subsequently determines how much to spend on the purchase of the good in question. Thus, these decisions are determined by different data–generating processes. As explained in Cragg (1971), to observe a positive level of expenditure on a durable good, two separate hurdles must be passed: the first hurdle is the participation decision (i.e., deciding whether to buy the item), and the second hurdle is the consumption decision (i.e., deciding how much to spend on the item). Adopting this assumption to our model, because the incidence of collateral in loan contracts and the collateral to loan ratios stem from two different contracting processes, two separate hurdles must be passed to observe a positive collateral to loan ratio. In contrast to Heckman models, two–part models depend on the assumption of independence between the errors of the two

¹⁹ Goldberger (1964) may be regarded as the first author who addresses the two-part models. However, Cragg (1971) is the first researcher to use the term ‘two-part model’. These models have been extensively used in consumption studies and health economics research, particularly for situations involving cigarette/alcohol consumption (Cragg, 1971; Jones, 1989; Yen and Jensen, 1996; Labeaga, 1999; Newman et al., 2003; Aristei et al., 2008; Madden, 2008). Two-part models are rarely used in empirical finance studies. Dionne et al. (1996) use this model for credit scoring, and Moffatt (2005) employs this model for loan defaults. To the best of our knowledge, two-part models have not yet been implemented in the empirical literature with respect to collateralisation.

equations²⁰. The sample selection model is first and foremost used for wage estimation equations (Heckman, 1979). In these types of applications, the wages of individuals who do not work are not observed, and the population of interest includes not only the workers who are in the labour force but also persons who are out of the labour force. This model allows for the simultaneous estimation of the effects of independent variables on both actual and potential workers.

Another important point regarding the choice between the sample selection and two-part models is the “exclusion restriction”. In most instances, the presence of collateral and the collateral to loan ratios are determined by the same set of variables. In the case of the selection model, it is necessary to use variables that explain the presence of collateral but not the collateral to loan ratio for a loan; these variables are difficult to find.

Menkhoff et al. (2012) and Chakraborty and Hu (2006) use the Heckman selection model to model the presence of collateral in loan contracts for which the selection equation is a loan approval equation. Our paper differs from Menkhoff et al. (2012) and Chakraborty and Hu (2006) in two respects in terms of methodology. First, we are interested in not only the presence of collateralisation in loan contracts but also the degree of this collateralisation. Second, our population of interest are SMEs with loans rather than SMEs without loans because we are interested in actual collateralisation and not in potential, latent collateralisation. Under these circumstances, double-hurdle models become more appropriate for achieving the purposes of our study. We also use a standard likelihood ratio test to compare the performances of the two-part model with the performances of the tobit approach.

In the first part of this study’s model, we use a probit model to explain the presence of collateral in loan contracts, which is expressed by a dummy variable (*COLL1*). The information for this dependent variable is extracted from the following question: “Referring only to this most recent line of credit or loan, what was the approximate value of the collateral required, as a percentage of the value of the loan or line of credit?”. The variable takes the value of one if the firm reported a positive number and

²⁰ Smith (2003) shows that there is little supporting evidence for using models that assume dependence.

zero otherwise. In the second part of the model in this study, we use a truncated regression model to explain the positive values of collateral to loan ratios (*COLL2*).

Table 1
Variable definitions and sources.

Variable	Definition	Source
LHS variables		
Coll1	Dummy=1 if the firm has pledged collateral to obtain an external loan and zero otherwise.	BEEPS
Coll2	The ratio of collateral value to loan size (%), including zeros.	BEEPS
Coll3	The ratio of collateral value to loan size (%) if <i>COLL1</i> =1.	BEEPS
RHS variables		
Borrower characteristics		
Overdue	Dummy=1 if the firm has utility payments that are overdue by more than 90 days and zero otherwise.	BEEPS
Crime	Dummy=1 if the SME has experienced any losses as a result of theft, robbery, vandalism or arson (and zero otherwise).	BEEPS
Age	The number of years that the firm has been operating.	BEEPS
Size	The size of the firm, as measured by the number of full-time employees.	BEEPS
Soleown	Dummy=1 if the firm is owned by a sole owner and zero otherwise.	BEEPS
Femaleown	Dummy=1 if the firm is owned by a sole female owner and zero otherwise.	BEEPS
Quality	Dummy=1 if the firm has an internationally recognised quality certification, such as ISO 9000 or ISO 9002, and zero otherwise.	BEEPS
City	Dummy=1 if the firm is located in the capital or in a city with a population over one million and zero otherwise.	BEEPS
Information sharing		
Prvtbr	The number of individuals or firms in a nation (as a percentage of the adult population of the nation) that are included in a private credit bureau's up-to-date records that track information regarding repayment history, unpaid debts, and outstanding credit .	WB
Pubreg	The number of individuals or firms in a nation (as a percentage of the adult population of the nation) that are included in a public credit registry's up-to-date records that track information regarding repayment history, unpaid debts, and outstanding credit	WB
Lender market characteristics		
Cr	The asset share of the three largest commercial banks within the commercial banking sector of the country as a measure of concentration in the banking sector (%).	Bankscope
Foreign	The asset share of foreign banks in total banking system assets (%).	EBRD
State	The asset share of state-owned banks in total banking system assets (%).	EBRD
Macroeconomic variable		
Lngdppc	The natural logarithm of the GDP per capita in US dollars.	EBRD

This table presents variable definitions and the sources of study data. BEEPS stands for Business Environment and Enterprise Performance Survey, WB stands for the World Bank, and EBRD stands for the European Bank for Reconstruction and Development.

We model these firm-level dependent variables as functions of firm-specific and country-specific variables. To test our hypotheses, we grouped the determinants of the presence of collateral in loan contracts and the collateral to loan ratios for these loan contracts into four categories. The first of these categories refers to the firm characteristic determinants: these variables include two proxies for borrower risk and

allow us to test the first hypothesis of this study. The second category relates to the availability of information on borrowers and permits the testing of this study's second hypothesis. The third category refers to the banking market characteristics. Because the majority of loans are borrowed from banks, we consider banking sector characteristics to be a proxy for lending market characteristics. This group of variables may be used to test the third hypothesis. Finally, the fourth category of determinants includes the *LNGDPPC* as a country-level macroeconomic control variable. The precise definitions and sources of each variable in these four categories are provided in Table 1.

The first group of variables is representative of the firm characteristics and contains two proxies for borrower risk: *OVERDUE* and *CRIME*. *OVERDUE* is a dummy variable that is set equal to one if a firm has utility payments that are overdue by more than 90 days and zero otherwise. *CRIME* is set equal to one if the SME experienced any losses due to crime, theft, and disorder in previous year and is zero otherwise. We expect lenders to be less willing to lend to a firm if that firm has unpaid utility bills and/or if the firm is located in environments that feature intense criminal activity. Accordingly, lenders are more likely to implement more stringent loan conditions for these potentially risky SMEs, including higher collateral requirements. Thus, we expect a positive association between our dependent variables and these two measures of borrower riskiness. The rest of the control variables that we use are as follows. *SIZE* stands for the size of an examined firm and is measured by the number of full-time employees of that firm. *AGE* is the number of years that the firm has been operating. Older firms are more likely to have longer relationship with lenders, as shown by Berger and Udell (1995); thus, these more established firms can obtain loans with better conditions, i.e., lower interest rates and less collateral. Thus, in our model, we expect to observe a negative coefficient for *AGE*. *QUALITY* is a dummy variable that is set equal to one if the firm has an internationally recognised quality certification, such as ISO 9000 or ISO 9002, and zero otherwise. Because higher values of this variable are reflective of higher borrower quality, we expect to find negative coefficients for this variable in our model. *SOLEOWN* is a dummy variable that becomes one if the SME is owned by a sole person. *FEMALEOWN* is a dummy variable that is set equal to one if the SME is a sole

proprietorship that is owned by a female entrepreneur and zero otherwise. Published studies reveal that because women generally form weaker entrepreneurial relationships with bankers due to sexual stereotyping and discrimination, higher interest rates and stricter conditions are likely to apply to loans to women than to men, even if there is no difference in the objective riskiness or the business situation of the male and female borrowers in question (Carter and Rosa, 1998; Alesina et al. 2009; Beck et al. 2011). Thus, we can expect higher collateral requirements for female entrepreneurs. Another body of literature exists that considers women to be better borrowers than men in terms of lower default rates; however, this result is largely attributed to women's difficulties with respect to accessing credit; these difficulties reduce their risk of moral hazard²¹. Finally, due to the existence of transaction (for the borrowers) and enforcement costs (for the bank), SME locations are important for determining the availability and the cost of loans as well as the various terms of the loan contract, such as collateral. *CITY* is a dummy variable that is set equal to one if the firm is located in a national capital or in a city with a population over one million and zero otherwise. We expect loan contract conditions to be less stringent in larger cities because financial centres are primarily located in these cities. Thus, we anticipate finding a negative association between this variable and the dependent variables that we are examining²².

To test for the effects of information sharing among lenders, we use two country-level variables: *PRVTBR* and *PUBREG*. Private credit bureaus in various countries attempt to collect current information regarding repayment history, unpaid debts, and outstanding credit for individuals and firms, and *PRVTBR* represents the number of individuals or firms in a nation (as a percentage of the adult population of the nation) that are included in the up-to-date records of a private credit bureau. Similarly, public credit registries also attempt to gather current information on repayment history, unpaid debts, and credit outstanding for individuals and firms, and *PUBREG* is a measure of public credit registry coverage (as a percentage of the adult population of a nation) that represents the

²¹ See D'Espallier et al. (2011) for a review of the literature regarding the gender effect on default rates in micro-finance institutions.

²² See Jiménez et al. (2009) for a discussion of the effect of location on collateralisation.

number of individuals and firms that are included in the up-to-date records of a public registry. A public registry is a database that is owned by public authorities, such as a nation's central bank or banking supervisory authority, collects information regarding the standing of borrowers in the financial system, and furnishes this information to financial institutions. Because lenders are less strict with borrowers if they possess better information about the borrowers in question, we expect to find negative coefficients for both *PRVTBR* and *PUBREG* in the model.

In the third group of variables, we include banking market characteristics. To test our third hypothesis, we again use country-level variables that provide information about the structure of the banking system. We use *CR*, the share of all commercial bank assets that are owned by the three largest commercial banks, to measure the concentration in the lending market. To control for differences in ownership structure in the lending markets of the examined countries, we use the *FOREIGN* and *STATE* variables. Because foreign banks frequently face difficulties in evaluating subjective information about borrowers, they primarily use objective information and standardised decision techniques in their lending decisions, whereas domestic banks are more apt to use soft information and long-term relationships (Berger and Udell, 1995; Berger et al. 2001; Petersen and Rajan, 2002). As Berger and Udell (2006) indicate, state-owned lenders frequently use government support in the form of subsidies to supply additional credit to SMEs. This credit is generally supplied to satisfy political purposes; as another aspect of providing this credit, state-owned firms are also expected to help borrowing firms by easing the collateral requirements for loans. We use the shares of the total banking system assets that are owned by foreign banks and state-owned banks (expressed in terms of percentages) as measures of the ownership structure in lending markets; we expect a positive coefficient for *FOREIGN* and a negative coefficient for *STATE* to describe the relationship of these two variables to our dependent variables.

Finally, to control for macroeconomic conditions in the examined countries, we use *LNGDPPC*, which represents the natural logarithm of the per capita gross domestic product. As *LNGDPPC* increases, we expect the presence of collateral to decrease due to the possible occurrence of credit expansion and implementation of less stringent loan

conditions, which would produce lower collateral to loan ratios and decreased collateralisation.

4. Data and descriptive statistics

The primary data set that is used in this study is provided by BEEPS, which is a joint project of the European Bank for Reconstruction and Development (EBRD) and the World Bank (WB). The BEEPS is administered throughout 27 transition economies from Eastern Europe and Central Asia (including Turkey) to assess the business environments for private enterprises in the examined nations²³. Surveys were conducted in 2002, 2005, 2007, 2008, and 2009 in which 6 153, 10 421, 1 952, 3 375, and 7 815 firms were surveyed, respectively. Our analysis is based on the pooled cross-section data from these surveys.

We argue that this data set possesses a number of advantages compared with the data sets that are used in previous studies. Most importantly, it enables us to extract valuable information about not only firm characteristics but also the perceptions of the surveyed firms with respect to financial and business environments; this information facilitates our empirical analysis. Moreover, the data include firms in both rural areas and large cities. Thus, these data enable us to analyse diverse firms in a large number of countries. For our final sample of SMEs to be in accordance with both BEEPS definitions and OECD conventions, we define SMEs to be firms that have a maximum of 250 full-time employees and thereby arrive at a total sample of 21,570 SMEs²⁴. Among these 21,570 SMEs, 8,362 SMEs had obtained an external loan, and 6,582 SMEs had agreed to loan

²³ These countries are Albania, Belarus, Georgia, Tajikistan, Turkey, Ukraine, Uzbekistan, Russia, Poland, Romania, Serbia, Kazakhstan, Moldova, Bosnia, Azerbaijan, Macedonia, Armenia, Kyrgyzstan, Estonia, the Czech Republic, Hungary, Latvia, Lithuania, Slovakia, Slovenia, Bulgaria, Croatia, and Montenegro. See BEEPS reports on methodology and observations (<http://www.ebrd.com/pages/research/analysis/surveys/beeps.shtml>) for information regarding the stratification of regions and for additional details related to the sampling process.

²⁴ The definition of enterprise size in the 2005 wave of the BEEPS was as follows: small=2-49 employees, medium=50-249 employees, large=250-9,999 employees.

contracts that included collateral²⁵. The average collateral to loan ratio (for the loan contracts that included collateral) was 146%, with an average standard deviation of nearly 102%²⁶. Of the loan contracts that included collateral (that is, the contracts with $COLL2 > 0$), 80% required a quantity of collateral that was greater than the value of the loan (that is, $COLL2 > 100$).

Our data indicate that collateral was present in loan contracts for 78% of the loans from private commercial banks, whereas state-owned banks and government agencies required collateral for 74% of the loans that they granted. The percentage of loans that required collateral decreased to 53% for loans that were granted by non-bank financial institutions, which include microfinance institutions, credit cooperatives, credit unions, and finance companies²⁷, and this percentage is even lower (44%) for the remaining lenders, which include family/friends, moneylenders, and other types of lenders. Finally, the land and buildings of the borrowing firm are the most-preferred type of collateral, whereas machinery and equipment are a secondary choice for collateral in loan contracts²⁸. Table 2 provides more detailed summary statistics, whereas Table 3 presents the summary statistics at the country level; in this table, countries are sorted in descending order of their average values of $COLL1$. The mean value for the presence of collateral is the lowest in Turkey; in the nation, approximately half of commercial loans

²⁵ This total represents the number of observations that remained after the exclusion of unreliable observations from the sample. To reach a decision about the reliability of an observation, we use the opinions and perceptions of the interviewers regarding the survey responses. In particular, we exclude observations for which the interviewer reported either that the question responses were not truthful or that “*the responses to the questions regarding figures are arbitrary and unreliable numbers*”. In addition, we consider the 5 SMEs that report $COLL2 \geq 2000$ to be outliers and therefore excluded these observations from the analysis.

²⁶ For the 1521 large firms in our sample, 76% of the loans were secured by collateral. Once the collateral is included in the loan contracts, the mean value of the collateral to the loan value (as measured by $COLL3$) was 135%, with a standard deviation of 89%. This comparison implies that the degree of collateral that is required for loans is slightly higher for SMEs than for larger firms.

²⁷ See Table A.2 in the Appendix for the relevant statistics.

²⁸ See Table A.3 in the Appendix.

are secured by collateral. Georgia shows the highest collateralisation, as 95% of the examined loans were secured by collateral. Georgia is also ranked first with respect to the degree of collateral that was required for loans, with an average collateral to loan ratio (as measured by *COLL3*) of 228%. Among the examined countries, Turkey has the lowest mean value of collateral to loan ratio (of 120%).

Table 2

Summary Statistics.

Variable	SMEs					Medium firms					Small firms					Micro firms				
	n.	mean	std. dev.	min	max	n.	mean	std. dev.	Min	max	n.	mean	std. dev.	min	max	n.	mean	std. dev.	min	max
Coll1	8365	0.787	0.410	0	1	2820	0.828	0.378	0	1	3616	0.789	0.408	0	1	1929	0.724	0.447	0	1
Coll2	8365	113.69	97.476	0	1500	2820	114.238	86.04	0	700	3616	115.193	98.06	0	1000	1929	110.08	111.11	0	1500
Coll3	6582	144.49	87.323	1	1500	2334	138.026	75.24	1	700	2852	146.051	87.67	1	1000	1396	152.11	103.27	1	1500
Overdue	7073	0.056	0.230	0	1	2462	0.066	0.248	0	1	3010	0.052	0.222	0	1	1601	0.049	0.217	0	1
Crime	8346	0.257	0.437	0	1	2809	0.311	0.463	0	1	3609	0.248	0.432	0	1	1928	0.197	0.398	0	1
Age	8329	14.35	13.937	0	202	2802	19.043	19.22	1	202	3603	12.664	10.047	0	165	1924	10.650	7.933	0	73
Size	8365	51.04	58.696	1	250	2820	117.084	57.59	50	250	3616	23.966	11.262	10	49	1929	5.230	2.176	1	9
Soleown	8360	0.231	0.422	0	1	2820	0.116	0.321	0	1	3611	0.223	0.416	0	1	1929	0.414	0.493	0	1
Femalown	6211	0.063	0.244	0	1	2010	0.031	0.174	0	1	2759	0.053	0.223	0	1	1442	0.129	0.335	0	1
Quality	8313	0.239	0.426	0	1	2803	0.348	0.476	0	1	3593	0.219	0.413	0	1	1917	0.116	0.321	0	1
City	8365	0.200	0.400	0	1	2820	0.233	0.423	0	1	3616	0.200	0.400	0	1	1929	0.153	0.360	0	1
Pubreg	8365	10.661	14.340	0	57.2	2820	10.638	14.77	0	57.2	3616	10.893	14.189	0	57.2	1929	10.258	13.970	0	57.2
Prvtbr	8365	33.17	31.220	0	100	2820	32.859	31.24	0	100	3616	31.925	30.264	0	100	1929	35.977	32.752	0	100
Cr	7900	64.002	20.916	11	100	2660	61.824	22.497	11	100	3410	64.505	20.601	11	100	1830	66.231	18.716	11	100
State	7467	13.90	17.022	0	77.9	2518	14.899	17.976	0	77.9	3210	13.346	17.186	0	77.9	1739	13.483	15.138	0	77.9
Foreign	7756	54.669	33.283	4.4	99.4	2609	54.834	32.916	4.4	99.4	3356	54.499	33.625	4.4	99.4	1791	54.750	33.190	4.4	99.4
Lngdppc	8096	8.550	0.882	5.272	10.101	2725	8.571	0.897	5.272	10.101	3501	8.535	0.878	5.272	10.101	1870	8.548	0.866	5.272	10.101

The primary data sets that are used are from BEEPS assessments that were conducted in 27 transition economies in Eastern Europe and Central Asia (including Turkey) to assess the business environments of private enterprises. These surveys were administered in 2002, 2005, 2007, 2008 and 2009, and 6153, 10421, 1952, 3375, and 7815 firms, respectively, were surveyed in each of these years. Our analysis is based on the pooled cross-section data from these surveys. We created a subsample by removing observations from firms that were surveyed in more than one year until we obtained a single observation per firm. In particular, we first excluded the firms that did not provide information regarding *COLL2*. If the firm reported values of *COLL2* for two different years, we excluded observations from years with at least one missing explanatory variable and the data from the year 2009. If the observations were complete with all of the explanatory variables provided over the course of more than one year, we arbitrarily excluded the observation from the year 2002. Because few firms were surveyed in multiple years, this subsampling process did not produce dramatic changes in either our empirical results or the descriptive statistics (see Table A.4 in the appendix for the details of the sample for different years).

Table 3

Summary statistics by country.

Country	Statist.	Coll1	Coll2	Coll3	Overdue	Crime	Age	Size	Sole own	Female own	Quality	City	Pubreg	Prvtbr	Cr	State	Foreign	Lngdppc
Georgia	mean	0.95	205.70	216.46	0.03	0.19	12.89	41.32	0.22	0.08	0.18	0.32	0.00	16.40	71.22	0.00	80.61	7.52

	median	1.00	200.00	200.00	0.00	0.00	8.00	20.00	0.00	0.00	0.00	0.00	0.00	16.40	71.00	0.00	90.80	7.98
	std dev.	0.22	125.36	119.16	0.17	0.40	15.71	49.01	0.41	0.28	0.38	0.47	0.00	0.00	2.35	0.00	12.23	0.52
	N	161	161	153	161	161	161	161	161	131	160	161	161	161	161	161	161	161
Kazakhstan	mean	0.91	119.33	131.30	0.02	0.25	9.11	57.94	0.29	0.12	0.16	0.11	0.00	29.90	68.82	0.86	10.43	8.32
	median	1.00	105.00	120.00	0.00	0.00	8.00	34.00	0.00	0.00	0.00	0.00	0.00	29.90	65.00	0.20	7.30	8.24
	std dev.	0.29	87.35	82.60	0.15	0.43	6.22	61.09	0.46	0.32	0.37	0.31	0.00	0.00	5.96	1.21	4.94	0.47
	N	373	373	339	373	372	371	373	373	285	371	373	373	373	373	373	373	373
Hungary	mean	0.90	149.93	166.01	0.03	0.35	14.34	48.53	0.12	0.04	0.35	0.10	0.00	11.40	69.00	6.32	78.93	9.24
	median	1.00	150.00	150.00	0.00	0.00	12.00	24.00	0.00	0.00	0.00	0.00	0.00	11.40	61.00	7.00	82.60	9.30
	std dev.	0.30	89.51	78.72	0.18	0.48	16.31	57.57	0.32	0.18	0.48	0.30	0.00	0.00	15.35	1.21	7.35	0.22
	N	413	413	373	411	413	413	413	413	284	413	413	413	413	413	413	413	413
Moldova	mean	0.90	126.58	141.29	0.03	0.17	11.29	51.61	0.19	0.09	0.07	0.23	0.00	0.00	62.12	16.87	29.48	NA
	median	1.00	140.00	150.00	0.00	0.00	9.00	29.00	0.00	0.00	0.00	0.00	0.00	0.00	65.00	17.60	33.60	NA
	std dev.	0.31	60.70	45.03	0.17	0.37	9.37	59.51	0.40	0.29	0.26	0.42	0.00	0.00	11.82	2.85	9.54	NA
	N	269	269	241	265	269	269	269	269	169	268	269	269	269	269	269	269	0
Albania	mean	0.89	137.92	154.77	0.06	0.15	9.35	34.19	0.31	0.03	0.26	0.12	8.30	0.00	82.06	3.15	93.42	7.94
	median	1.00	140.00	150.00	0.00	0.00	9.00	20.00	0.00	0.00	0.00	0.00	8.30	0.00	84.00	0.00	94.20	8.13
	std dev.	0.31	74.81	60.53	0.24	0.35	5.09	40.83	0.47	0.18	0.44	0.32	0.00	0.00	5.48	3.67	0.86	0.29
	N	248	248	221	120	246	248	248	248	208	244	248	248	248	248	248	248	248
Romania	mean	0.88	128.66	145.88	0.02	0.19	12.66	62.18	0.02	0.02	0.30	0.10	13.00	33.30	64.25	7.15	68.53	8.52
	median	1.00	120.00	130.00	0.00	0.00	11.00	33.00	0.00	0.00	0.00	0.00	13.00	33.30	64.50	7.00	59.20	8.43
	std dev.	0.32	92.31	84.54	0.14	0.39	9.56	65.88	0.14	0.13	0.46	0.30	0.00	0.00	0.97	0.66	12.24	0.40
	N	432	432	381	428	428	429	432	430	307	423	432	432	432	432	432	432	432
FYROM	mean	0.88	143.81	163.26	0.06	0.23	15.52	49.08	0.20	0.01	0.28	0.32	39.40	0.00	77.03	1.50	80.73	8.22
	median	1.00	125.00	167.50	0.00	0.00	13.00	27.00	0.00	0.00	0.00	0.00	39.40	0.00	77.00	1.40	93.30	8.42
	std dev.	0.32	102.64	93.67	0.23	0.42	13.18	52.87	0.40	0.08	0.45	0.47	0.00	0.00	1.07	0.18	19.99	0.33
	N	193	193	170	191	193	191	193	193	158	193	193	193	193	193	193	193	193
Belarus	mean	0.86	109.14	126.88	0.05	0.24	14.75	60.47	0.25	0.16	0.11	0.11	33.50	0.00	83.16	74.55	28.24	8.04
	median	1.00	120.00	130.00	0.00	0.00	10.00	36.50	0.00	0.00	0.00	0.00	33.50	0.00	79.30	75.20	20.00	8.04
	std dev.	0.35	65.71	52.55	0.22	0.43	14.31	62.18	0.43	0.37	0.31	0.31	0.00	0.00	6.75	3.08	15.30	0.57
	N	236	236	203	234	236	233	236	236	140	234	236	236	236	236	236	236	236
Kyrgyz	mean	0.85	139.55	163.76	0.07	0.31	14.61	52.87	0.30	0.14	0.16	0.26	0.00	11.90	86.66	4.55	72.34	6.21
	median	1.00	140.00	150.00	0.00	0.00	9.00	31.00	0.00	0.00	0.00	0.00	0.00	11.90	86.00	4.80	73.60	6.17
	std dev.	0.36	100.07	88.11	0.26	0.46	14.39	61.51	0.46	0.35	0.36	0.44	0.00	0.00	8.17	0.34	1.69	0.36
	N	115	115	98	115	113	115	115	115	70	115	115	115	115	115	115	86	86
Montenegro	mean	0.85	162.44	191.68	0.17	0.19	13.02	41.51	0.58	0.13	0.17	0.24	26.25	1.69	.	2.23	82.04	8.58
	median	1.00	120.00	150.00	0.00	0.00	10.00	21.00	1.00	0.00	0.00	0.00	26.7	0.00	.	0.00	87.10	8.74
	std dev.	0.36	160.71	157.64	0.38	0.39	11.82	53.68	0.50	0.34	0.38	0.43	3.47	13.02	.	5.50	15.90	0.36
	N	59	59	50	58	59	58	59	59	54	58	59	59	59	0	59	59	59
Azerbaijan	mean	0.84	103.69	123.44	0.03	0.08	15.77	48.64	0.45	0.00	0.19	0.36	7.00	0.00	70.75	49.39	7.82	7.82
	median	1.00	100.00	100.00	0.00	0.00	10.50	23.00	0.00	0.00	0.00	0.00	7.00	0.00	69.00	43.40	9.30	8.54
	std dev.	0.37	62.73	47.11	0.17	0.27	15.41	55.35	0.50	0.00	0.39	0.48	0.00	0.00	4.48	6.12	1.54	0.77
	N	75	75	63	66	75	74	75	75	52	74	75	75	75	75	75	75	75
Russia	mean	0.83	114.52	138.61	0.04	0.41	13.51	70.81	0.17	0.06	0.17	0.30	0.00	14.40	18.65	39.20	12.78	8.60
	median	1.00	110.00	130.00	0.00	0.00	9.00	47.00	0.00	0.00	0.00	0.00	0.00	14.40	18.00	39.20	8.30	8.58

	std dev.	0.38	85.73	74.52	0.20	0.49	17.00	69.32	0.37	0.24	0.38	0.46	0.00	0.00	9.01	0.00	5.17	0.53
	N	541	541	447	540	537	540	541	541	355	533	541	541	541	541	252	541	541
Ukraine	mean	0.83	139.91	169.34	0.02	0.27	13.93	56.62	0.26	0.12	0.13	0.22	0.00	10.10	41.90	9.86	29.74	7.64
	median	1.00	145.00	170.00	0.00	0.00	9.00	30.00	0.00	0.00	0.00	0.00	0.00	10.10	41.00	9.40	21.30	7.52
	std dev.	0.38	101.13	85.95	0.15	0.45	15.14	62.48	0.44	0.33	0.34	0.41	0.00	0.00	6.65	1.29	15.73	0.53
	N	420	420	347	419	420	413	420	417	285	419	420	420	420	420	420	420	420
Croatia	mean	0.82	106.31	130.34	0.10	0.21	17.65	46.66	0.38	0.07	0.26	0.05	0.00	81.20	59.10	4.25	90.70	9.36
	median	1.00	100.00	100.00	0.00	0.00	14.00	22.00	0.00	0.00	0.00	0.00	0.00	81.20	58.00	4.70	90.40	9.49
	std dev.	0.39	92.45	85.69	0.30	0.41	16.15	55.70	0.49	0.26	0.44	0.21	0.00	0.00	2.41	0.64	0.41	0.25
	N	499	499	407	178	498	499	499	499	413	493	499	499	499	499	499	499	499
Bulgaria	mean	0.81	118.12	145.07	0.01	0.23	12.35	51.47	0.21	0.06	0.31	0.13	37.00	13.10	55.97	2.09	81.42	8.53
	median	1.00	130.00	140.00	0.00	0.00	11.00	29.00	0.00	0.00	0.00	0.00	37.00	13.10	52.00	2.10	82.30	8.62
	std dev.	0.39	78.92	61.11	0.12	0.42	9.49	54.95	0.41	0.23	0.46	0.34	0.00	0.00	16.24	0.18	2.77	0.26
	N	506	506	412	150	506	503	506	506	459	504	506	506	506	506	506	506	506
Estonia	mean	0.80	101.45	126.18	0.02	0.51	14.93	54.51	0.06	0.00	0.23	0.29	0.00	22.40	92.16	0.00	98.55	9.25
	median	1.00	100.00	120.00	0.00	1.00	12.00	24.00	0.00	0.00	0.00	0.00	0.00	22.40	87.00	0.00	98.30	9.51
	std dev.	0.40	79.66	69.01	0.12	0.50	17.22	60.61	0.24	0.00	0.42	0.45	0.00	0.00	5.32	0.00	0.55	0.35
	N	199	199	160	197	198	199	199	199	137	199	199	199	199	199	199	199	199
Czech Republic	mean	0.80	99.30	124.75	0.18	0.50	12.10	49.32	0.28	0.07	0.30	0.16	4.90	73.20	73.79	NA	NA	9.44
	median	1.00	100.00	100.00	0.00	0.50	11.00	25.00	0.00	0.00	0.00	0.00	4.90	73.20	63.00	NA	NA	9.41
	std dev.	0.40	91.80	86.06	0.38	0.50	8.65	59.29	0.45	0.26	0.46	0.36	0.00	0.00	14.80	NA	NA	0.41
	N	250	250	199	243	250	247	250	250	157	250	250	250	250	250	0	0	250
Latvia	mean	0.79	102.87	129.87	0.04	0.42	12.99	61.00	0.15	0.07	0.19	0.35	57.20	0.00	50.68	11.58	62.60	9.02
	median	1.00	100.00	100.00	0.00	0.00	11.00	21.00	0.00	0.00	0.00	0.00	57.20	0.00	47.00	17.10	69.30	9.34
	std dev.	0.41	103.36	99.88	0.21	0.50	12.34	68.62	0.36	0.26	0.39	0.48	0.00	0.00	4.39	6.42	8.35	0.42
	N	178	178	141	178	178	177	178	178	134	177	178	178	178	178	178	178	178
Armenia	mean	0.79	119.34	151.83	0.04	0.11	12.40	34.71	0.43	0.03	0.15	0.38	16.90	38.30	59.87	0.00	55.18	7.48
	median	1.00	130.00	150.00	0.00	0.00	8.00	17.00	0.00	0.00	0.00	0.00	16.90	38.30	68.00	0.00	48.70	7.32
	std dev.	0.41	99.41	87.34	0.19	0.31	13.00	44.56	0.50	0.16	0.36	0.49	0.00	0.00	14.56	0.00	7.09	0.37
	N	243	243	191	243	243	243	243	243	218	243	243	243	243	243	243	243	243
Lithuania	mean	0.78	104.18	132.80	0.05	0.39	13.47	60.06	0.20	0.07	0.20	0.19	20.00	67.80	79.90	0.00	91.42	9.00
	median	1.00	100.00	100.00	0.00	0.00	11.00	32.50	0.00	0.00	0.00	0.00	20.00	67.80	80.50	0.00	91.50	9.13
	std dev.	0.41	122.54	123.86	0.22	0.49	12.18	61.97	0.40	0.26	0.40	0.40	0.00	0.00	1.31	0.00	0.32	0.38
	N	232	232	182	232	232	232	232	232	168	228	232	232	232	232	232	232	232
Uzbekistan	mean	0.78	97.70	124.62	0.07	0.05	15.57	57.17	0.29	0.12	0.09	0.19	4.50	3.30	85.48	67.60	4.40	6.29
	median	1.00	120.00	120.00	0.00	0.00	9.00	38.50	0.00	0.00	0.00	0.00	4.50	3.30	83.00	67.60	4.40	6.34
	std dev.	0.41	61.21	37.50	0.25	0.22	17.18	59.74	0.46	0.32	0.29	0.39	0.00	0.00	5.83	0.00	0.00	0.43
	N	162	162	127	162	161	162	162	162	78	162	162	162	162	162	59	59	162
Bosnia	mean	0.78	135.09	172.79	0.09	0.23	18.25	55.25	0.37	0.10	0.27	0.34	30.20	47.20	71.87	2.29	90.75	8.17
	median	1.00	112.00	150.00	0.00	0.00	12.00	31.00	0.00	0.00	0.00	0.00	30.20	47.20	50.00	3.60	90.90	8.05
	std dev.	0.41	110.51	95.35	0.29	0.42	17.83	61.19	0.48	0.30	0.44	0.47	0.00	0.00	22.93	1.49	5.07	0.44
	N	275	275	215	267	273	273	275	275	199	275	275	275	275	275	275	275	275
Slovakia	mean	0.77	105.14	136.06	0.17	0.40	12.31	49.76	0.20	0.07	0.26	0.09	2.20	44.50	78.38	1.06	94.82	9.38
	median	1.00	100.00	120.00	0.00	0.00	11.00	21.50	0.00	0.00	0.00	0.00	2.20	44.50	81.00	1.10	96.70	9.35

	std dev.	0.42	85.23	71.97	0.37	0.49	9.45	57.03	0.40	0.26	0.44	0.29	0.00	0.00	5.98	0.15	2.72	0.34
	N	176	176	136	174	176	176	176	176	124	176	176	176	176	176	176	176	176
Tajikistan	mean	0.75	110.39	146.83	0.09	0.12	11.59	46.64	0.27	0.06	0.14	0.22	0.00	0.00	NA	10.91	7.59	6.16
	median	1.00	120.00	150.00	0.00	0.00	6.00	26.00	0.00	0.00	0.00	0.00	0.00	0.00	NA	9.70	8.90	6.68
	std dev.	0.43	90.40	74.13	0.29	0.32	12.69	53.99	0.45	0.24	0.35	0.42	0.00	0.00	NA	1.26	1.36	0.59
	N	137	137	103	137	137	135	137	137	102	137	137	137	137	0	66	66	137
Poland	mean	0.73	105.81	144.78	0.02	0.28	17.19	45.94	0.39	0.14	0.17	0.04	0.00	91.70	64.24	21.67	73.03	8.92
	median	1.00	120.00	130.00	0.00	0.00	13.00	20.00	0.00	0.00	0.00	0.00	0.00	91.70	55.00	21.50	74.30	8.98
	std dev.	0.44	84.51	64.21	0.15	0.45	15.77	59.07	0.49	0.35	0.38	0.19	0.00	0.00	12.98	0.22	1.35	0.27
	N	587	587	429	586	587	586	587	587	345	585	587	587	587	587	587	587	587
Serbia	mean	0.72	112.53	155.81	0.09	0.34	19.63	59.01	0.35	0.06	0.20	0.29	0.00	100.00	NA	23.77	58.55	8.39
	median	1.00	100.00	120.00	0.00	0.00	13.00	32.50	0.00	0.00	0.00	0.00	0.00	100.00	NA	23.90	66.00	8.68
	std dev.	0.45	105.07	92.36	0.29	0.47	19.60	63.06	0.48	0.23	0.40	0.45	0.00	0.00	NA	0.22	12.52	0.37
	N	270	270	195	266	270	269	270	270	215	267	270	270	270	0	114	114	270
Slovenia	mean	0.55	71.38	130.50	0.13	0.28	16.96	35.62	0.20	0.03	0.27	0.18	2.70	0.00	60.65	14.24	24.91	9.79
	median	1.00	50.00	100.00	0.00	0.00	13.00	14.00	0.00	0.00	0.00	0.00	2.70	0.00	56.00	12.60	22.60	9.81
	std dev.	0.50	88.94	82.09	0.33	0.45	16.68	47.56	0.40	0.17	0.44	0.39	0.00	0.00	9.25	2.19	4.18	0.34
	N	309	309	169	306	309	309	309	309	199	309	309	309	309	309	309	309	309
Turkey	mean	0.53	61.69	115.65	0.06	0.11	16.19	39.80	0.05	0.01	0.45	0.35	18.30	42.20	70.74	31.88	11.31	9.05
	median	1.00	20.00	100.00	0.00	0.00	14.00	20.00	0.00	0.00	0.00	0.00	18.30	42.20	96.00	33.10	6.30	8.87
	std dev.	0.50	112.06	131.58	0.24	0.31	10.65	49.13	0.21	0.10	0.50	0.48	0.00	0.00	26.96	1.30	5.34	0.19
	N	808	808	431	374	807	805	808	808	766	804	808	808	808	808	808	808	808
Total	mean	0.79	113.69	144.49	0.06	0.26	14.34	51.04	0.23	0.06	0.24	0.20	10.66	33.17	64.00	13.90	54.67	8.55
	median	1.00	100.00	130.00	0.00	0.00	11.00	26.00	0.00	0.00	0.00	0.00	2.70	22.40	64.00	7.00	63.60	8.69
	std dev.	0.41	97.48	87.32	0.23	0.44	13.94	58.70	0.42	0.24	0.43	0.40	14.34	31.22	20.92	17.02	33.28	0.88
	N	8365	8365	6582	7073	8346	8329	8365	8360	6211	8313	8365	8365	8365	7900	7467	7756	8096

This table reports summary statistics for the variables by country. The listed countries are ranked in descending order according to the mean value of *COLL1*. The primary data sets used are BEEPS assessments that were conducted to assess the business environments of private enterprises. The surveys were conducted in 2002, 2005, 2007, 2008 and 2009, and 6 153, 10 421, 1 952, 3 375, and 7 815 firms, respectively, were surveyed in each of these years. Our analysis is based on pooled cross-section data from these surveys. We created a subsample by dropping the observations of firms that were surveyed in more than one year until we had a single observation per firm. In particular, we first excluded the firms that do not report values for *COLL2*. If the firm reported *COLL2* values for multiple years, we excluded the observation from the year for which at least one of the explanatory variables was missing and the data from year 2009. If the observations were complete with all explanatory variables for more than one year, we arbitrarily excluded the observation from the year 2002. Because few firms were surveyed in multiple years, this subsampling process did not yield dramatic changes in either our empirical results or the descriptive statistics.

Finally, Table 4 presents the basic summary statistics for collateralisation in different country groups. This table reveals no major differences among the examined country groups with respect to the mean values of collateralisation on loans that are extended to SMEs. We observe that compared with non-EU countries, the EU countries in our sample have lower collateralisation with respect to both the presence of collateral and collateral to loan ratio²⁹. In all of the assessed sub-groups of countries, we observe that among the sizes of firms that are considered to be SMEs, micro firms demonstrate the lowest mean value for the presence of collateral (*COLL1*), and the mean value for the presence of collateral is lower for small firms than for medium firms. By contrast, if collateral is included in the loan contracts (that is, if *COLL1*=1), higher collateral to loan ratios (*COLL3*) are observed as firm size decreases (from medium to small to micro-sized enterprises).

²⁹ This gap between EU and non-EU countries grows if we consider the candidate countries of Croatia and Turkey. The 2005 wave of the BEEPS was implemented in several other countries, including Germany. In the 2005 BEEPS results for Germany, 90% of the 793 loans that were extended to SMEs were secured by collateral, and the average collateral to loan ratio for these loans was 127%, with a 37.2% standard deviation. This standard deviation for *COLL3* is lower than the standard deviation for any of the countries in our sample.

Table 4
Collateralisation in different country groups.

Region	Var.	SMEs					Medium firms					Small firms					Micro firms				
		n.	mean	std. dev.	min	max	n.	mean	std. dev.	min	max	n.	mean	std. dev.	min	max	n.	mean	std. dev.	min	max
EU	Coll1	2405	0.76	0.43	0	1	833	0.84	0.36	0	1	1010	0.74	0.44	0	1	562	0.66	0.47	0	1
	Coll2	2405	102.19	89.15	0	1000	833	108.30	72.35	0	700	1010	101.62	92.08	0	1000	562	94.16	104.52	0	1000
	Coll3	1822	134.89	77.97	1	1000	703	128.32	60.26	1	700	749	137.04	81.11	2	1000	370	143.03	97.98	3	1000
NON-EU	Coll1	5960	0.80	0.40	0	1	1987	0.82	0.38	0	1	2606	0.81	0.39	0	1	1367	0.75	0.43	0	1
	Coll2	5960	118.33	100.28	0	1500	1987	116.73	91.08	0	600	2606	120.45	99.81	0	1000	1367	116.62	113.10	0	1500
	Coll3	4760	148.16	90.39	1	1500	1631	142.21	80.50	1	600	2103	149.26	89.69	1	1000	1026	155.38	104.97	1	1500
CIS	Coll1	2463	0.84	0.37	0	1	912	0.86	0.35	0	1	1099	0.84	0.36	0	1	452	0.79	0.41	0	1
	Coll2	2463	125.00	93.77	0	1000	912	124.22	92.22	0	600	1099	125.64	92.69	0	1000	452	125.03	99.52	0	600
	Coll3	2071	148.66	83.31	1	1000	785	144.31	83.53	1	600	928	148.79	82.03	2	1000	358	157.86	85.53	1	600
CEE	Coll1	5094	0.80	0.40	0	1	1702	0.85	0.36	0	1	2155	0.80	0.40	0	1	1237	0.73	0.44	0	1
	Coll2	5094	116.47	94.15	0	1000	1702	117.69	81.50	0	700	2155	119.26	96.43	0	1000	1237	109.94	105.47	0	1000
	Coll3	4080	145.42	82.81	1	1000	1445	138.62	70.15	1	700	1734	148.22	85.22	1	1000	901	150.94	95.30	2	1000
Total	Coll1	8365	0.79	0.41	0	1	2820	0.83	0.38	0	1	3616	0.79	0.41	0	1	1929	0.72	0.45	0	1
	Coll2	8365	113.69	97.48	0	1500	2820	114.24	86.04	0	700	3616	115.19	98.07	0	1000	1929	110.08	111.11	0	1500
	Coll3	6582	144.49	87.32	1	1500	2334	138.03	75.24	1	700	2852	146.05	87.67	1	1000	1396	152.11	103.27	1	1500

This table presents the basic summary statistics for collateralisation among different country groups.

5. Estimation results

Most of the previous studies on SMEs evaluate all SMEs as a single group of firms and do not distinguish between micro, small and medium firms. However, the determinants of collateral requirements for these groups of firms may differ. In accordance with the BEEPS classifications, we define medium firms as firms that have less than 250 and more than 49 full-time employees and small firms as firms that have less than 50 and more than 9 full-time employees. In addition, we distinguish between small and micro firms by defining micro firms as firms that have less than 10 full-time employees. Using these classifications, we perform not only regressions for the full sample of SMEs but also separate regressions for small, medium, and micro-sized firms.

Table 5 reports the estimation results. For all of the examined groups of firms, we first provide the tobit result with the dependent variable of *COLL2*, whereas the remaining two columns report the estimations of the two-part model. In the first part of the two-part model, we provide the probit model estimation results to estimate the probability of the presence of collateral in loan contracts; in this assessment, *COLL1* is the dependent variable³⁰. In the second part we present the truncated regression results for *COLL3*. The average variance inflation factor for the dependent variables is calculated as 1.29, which indicates the absence of multicollinearity. As we perform a standard likelihood ratio test to assess the applicability of the two-part model against the tobit approach, we note that the tobit model is too restrictive due to its assumptions³¹.

³⁰ In addition, we conducted logit models, and the results of these models were similar to the findings that have already been presented.

³¹ The likelihood ratio statistic is calculated as $LR = -2[\text{LTobit} - (\text{LProbit} + \text{LTRUN})] \sim \chi_k^2$, where *LTobit* is the likelihood of the tobit model; *LProbit* is the likelihood of the probit model; *LTRUN* is the likelihood of the truncated regression model; and *k* is the number of independent variables in the equations. The formulation of the null hypothesis indicates that the tobit model is an appropriate modelling strategy to explain zero collateralisation; this null hypothesis is rejected in our regressions.

With respect to the first hypothesis, the positive and significant coefficient estimates for *CRIME* with respect to *COLL1* provide a degree of support. We note that the presence of collateral is more likely for SMEs that have experienced losses due to theft, robbery, vandalism or arson compared with other types of SMEs. However, this effect is not valid for micro enterprises, and the truncated regression results indicate that *CRIME* does not play a role in determining the degree of collateral in loan contracts that are extended to SMEs. *OVERDUE* has no significant impact on either the presence of collateral or the collateral to loan ratio for SMEs.

With respect to firm-level control variables, *AGE* affects *COLL1* negatively for the total sample of SMEs and medium firms; this result is in accordance with our predictions that loan contracts for older firms are less likely to include collateral. By contrast, we are unable to observe this effect for small firms because *AGE* and *COLL3* are positively related. Our estimation results generally yield positive coefficient estimates for the effect of *SIZE* on *COLL1*. However, this relationship becomes negative if the collateral to loan ratio (*COLL3*) is regarded as the dependent variable. This finding can be explained by the fact that smaller SMEs often lack collateralisable assets and therefore apply for loans that do not require collateral, such as loans from informal creditors or from microfinance institutions. If smaller SMEs obtain a collateralised loan, the collateral to loan ratio becomes higher as the firm size decreases. By contrast, micro-sized firms have insignificant coefficient estimates for *SIZE*.

Examining the ownership structure of SMEs, we note that the presence of collateral in loan contracts is less likely for SMEs that are established as sole proprietorships than for SMEs that are corporations. We only observe the existence of a significant effect for the control variable *FEMALEOWN* in loan contracts that are extended to medium firms. One possible explanation for this negative relationship may be the fact that as discussed in previous literature, female borrowers are more disciplined than male borrowers with respect to repaying their loans. The effect of *QUALITY* is significantly negative only for medium firms, indicating that medium firms with quality certifications are less likely to be asked for collateral in their loan applications. However, these firms do not receive

loans with more favourable terms in terms of collateral, as demonstrated by the fact that the effect of *QUALITY* is insignificant in the truncated regression.

Finally, compared with SMEs that are located in smaller cities, SMEs that are located in the capital and/or large cities are less likely to obtain loans that require collateral and also benefit from lower collateral to loan ratios. However, this effect is not significant for micro firms. In accordance with our expectations, this result demonstrates that the collateral requirements for SMEs are less stringent in the capital and in large cities with a population of over one million. This result can be explained by the fact that financial centres are mostly located in these cities; thus, it is easier to switch to other lenders and search for loans that do not require collateral if the loan terms that are offered by one lender become stricter.

Table 5 - Estimation results.

Variables	SMEs			Medium firms			Small firms			Micro firms		
	Tobit	Two-part model		Tobit	Two-part model		Tobit	Two-part model		Tobit	Two-part model	
		Probit	Trunc. reg.		Probit	Trunc. reg.		Probit	Trunc. reg.		Probit	Trunc. reg.
		Coll2	Coll1		Coll3	Coll2		Coll1	Coll3		Coll2	Coll1
Overdue	-0.270 (8.792)	0.120 (0.122)	-13.410 (11.300)	-11.910 (11.750)	0.051 (0.219)	-20.270 (15.050)	5.276 (13.760)	0.079 (0.173)	-0.237 (17.910)	1.000 (21.860)	0.204 (0.278)	-29.490 (25.720)
Crime	8.137* (3.849)	0.147** (0.055)	1.301 (4.557)	12.16* (5.615)	0.192* (0.100)	7.413 (6.314)	9.841 (5.973)	0.171* (0.086)	1.992 (7.378)	-7.592 (10.67)	-0.053 (0.113)	-5.813 (11.84)
Age	0.016 (0.136)	-0.00432* (0.002)	0.406** (0.150)	-0.274* (0.152)	-0.007** (0.002)	0.103 (0.154)	0.652* (0.318)	0.002 (0.004)	0.921* (0.376)	1.114* (0.566)	0.002 (0.006)	1.772** (0.611)
Size	0.080** (0.031)	0.003*** (0.000)	-0.079* (0.041)	0.041 (0.049)	0.001 (0.001)	0.019 (0.055)	0.180 (0.224)	0.008* (0.003)	-0.485 (0.296)	0.050 (2.056)	0.009 (0.022)	-1.200 (2.277)
Soleown	-2.335 (5.201)	-0.163* (0.066)	10.650 (5.471)	5.353 (10.690)	-0.154 (0.167)	14.150 (10.460)	-1.228 (7.751)	-0.175* (0.100)	13.020 (8.577)	-2.174 (10.380)	-0.057 (0.110)	3.477 (11.380)
Femaleown	-7.552 (7.887)	0.027 (0.104)	-15.380* (8.428)	-20.450 (16.080)	0.185 (0.285)	-40.33* (18.430)	6.423 (12.530)	0.243 (0.180)	-10.47 (14.35)	-8.473 (13.41)	-0.092 (0.147)	-3.672 (12.93)
Quality	-3.084 (4.269)	-0.038 (0.057)	-3.887 (5.346)	-10.550 (5.684)	-0.223* (0.092)	-3.240 (6.556)	5.822 (6.649)	0.077 (0.088)	1.771 (8.609)	-9.045 (16.55)	-0.088 (0.162)	-3.664 (20.64)
City	-24.16*** (4.718)	-0.243*** (0.057)	-20.29** (6.334)	-30.82*** (5.926)	-0.311** (0.096)	-26.77*** (7.095)	-16.73* (7.316)	-0.205* (0.086)	-10.220 (10.110)	-29.0* (15.06)	-0.240* (0.129)	-24.65 (22.16)
Pubreg	-0.478*** (0.137)	-0.006*** (0.002)	-0.285* (0.167)	-0.622** (0.193)	-0.0138*** (0.003)	-0.141 (0.205)	-0.377* (0.206)	-0.004 (0.003)	-0.348 (0.253)	-0.395 (0.361)	-0.003 (0.003)	-0.258 (0.463)
Prvtbr	-0.483*** (0.073)	-0.005*** (0.001)	-0.349*** (0.086)	-0.434*** (0.110)	-0.007*** (0.002)	-0.190 (0.118)	-0.356** (0.115)	-0.003* (0.001)	-0.294* (0.141)	-0.707*** (0.171)	-0.004** (0.002)	-0.608** (0.220)
Cr	-0.180* (0.093)	-0.002 (0.001)	-0.141 (0.117)	-0.328** (0.123)	-0.003 (0.002)	-0.337* (0.147)	-0.090 (0.145)	0.000 (0.002)	-0.080 (0.183)	-0.064 (0.323)	-0.004 (0.003)	0.542 (0.412)
State	-0.137 (0.107)	0.002 (0.002)	-0.361** (0.136)	0.049 (0.160)	0.003 (0.003)	-0.113 (0.180)	-0.184 (0.163)	0.002 (0.002)	-0.467* (0.236)	-0.515 (0.321)	-0.002 (0.004)	-0.860* (0.410)
Foreign	0.643*** (0.075)	0.005*** (0.001)	0.629*** (0.096)	0.692*** (0.117)	0.009*** (0.002)	0.526*** (0.136)	0.671*** (0.116)	0.00570*** (0.001)	0.655*** (0.153)	0.526*** (0.186)	0.002 (0.002)	0.651** (0.231)
Lngdppc	-38.32*** (2.912)	-0.334*** (0.043)	-34.80*** (3.441)	-38.24*** (5.436)	-0.241* (0.098)	-43.19*** (6.120)	-42.75*** (4.346)	-0.437*** (0.063)	-35.52*** (5.619)	-34.90*** (6.001)	-0.268*** (0.070)	-26.76*** (6.371)
Constant	436.6*** (25.300)	3.804*** (0.379)	416.2*** (28.580)	455.9*** (48.140)	3.388*** (0.850)	504.0*** (53.310)	450.1*** (37.630)	4.345*** (0.573)	410.2*** (44.630)	400.0*** (57.660)	3.340*** (0.659)	306.5*** (66.7)
n.	4035	4035	3244	1355	1355	1149	1764	1764	1417	916	916	678
log likelihood	-20632.8	-1885.8	-18694.9	-7045	-527.1	-6491.1	-9037.2	-820.2	-8202.1	-4481.2	-505.6	-3960.9

This table presents the tobit, probit and truncated regressions of coll2, coll1, and coll3, respectively, on each of the other examined variables. Due to a lack of observations, data from Serbia, Montenegro, Moldova, Tajikistan, and Uzbekistan are excluded from these regressions. All of the presented regressions include statistically significant constant terms, except for the last equation. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Analysing the estimation results for the effects of the firm-level variables, we observe that these variables do not have a great deal of explanatory power for determining collateralisation. These insignificant results for the examined firm-level explanatory variables can be attributed to the characteristics of less-developed economies³². Lenders are more likely to experience difficulties in assessing the available information regarding borrower firms in these countries. Reports about firms in these countries can be unreliable due to the weaknesses of the legal, informational, and institutional infrastructures of these developing nations. This problem may be more severe for informationally opaque SMEs. Thus, firm characteristics might be less important than the market conditions for determining the collateral characteristics of commercial loans. The positive and significant coefficient estimates of *CRIME* and *CITY* provide a degree of support for this inference.

With respect to the second hypothesis, the coefficient estimates for *PRVTBR* and *PUBREG* are negative and significant for most of the model specifications, as expected. Information sharing reduces informational asymmetries and eventually reduces adverse selection problems by improving the information that banks possess about credit applicants. This situation makes information sharing more important for SMEs than for larger firms because banks refrain from lending to informationally opaque SMEs. In countries where banks can exchange information on the riskiness of borrowers, banks choose to lend to safer SMEs. Our results indicate that as the percentage of individuals or firms listed by private credit bureaus and public credit registries increases in a country, both the probability of the presence of collateral and the collateral to loan ratio decrease for loans. This finding is consistent with the results of Brown et al. (2009), who find a negative association between information sharing and the ease of obtaining external financing. Thus, in countries where lenders possess better information about the repayment history and unpaid debts of borrowers through public and private credit

³² We created additional firm-specific control variables to verify our results. In particular, we used dummy variables to test the effects of being an innovative or exporting firm; however, we did not observe significant effects from these factors.

bureaus, both the probability of the presence of collateral and the degree of this collateral decrease, particularly for financially opaque SMEs.

With respect to the third hypothesis, we find evidence indicating that banking concentration has a negative impact on the degree of collateral for SMEs, confirming hypothesis *H3b*. This negative relationship is attributed to the lender-based theory of collateral, which presumes that in more concentrated lending markets, lenders have an informational advantage due to their more lengthy borrower-lender relationships. Accordingly, concentrated markets are associated with less stringent collateral requirements. Our findings for medium firms confirm the results of Jiménez et al. (2006 and 2009). However, this effect is not significant in all model specifications, and this relationship appears to be valid only for medium firms; moreover, these results are not particularly robust, as demonstrated by our subsequent robustness assessments.

With respect to the asset share of foreign banks in the total banking system assets, the positive and significant coefficients of *FOREIGN* indicate that the likelihood of collateral and the degree of this collateral is higher in countries with a greater share of foreign banks. This result can be explained by the fact that foreign banks engage in the intensive use of objective information and standardised decision techniques in their lending decisions because they experience difficulties in accurately evaluating subjective information about borrowers. We find that *STATE* only has a significant effect of reducing the collateral to loan ratios. The effect of *STATE* is higher for micro-sized firms than for small firms, and this effect vanishes for medium firms. This result indicates that lower collateral to loan ratios exist in countries with higher shares of state banks; this effect is particularly evident for small and micro firms.

With respect to country-level control variables, our estimation results demonstrate a negative and statistically significant association between *LNGDPPC* and collateralisation. This significant result reveals that improvements in macroeconomic conditions help ease loan contract terms by relaxing collateral requirements.

5.1. Robustness checks

In a first round of robustness checks, we changed the definitions of the borrower risk proxies. We first used a categorical variable instead of *CRIME* to account for the effect of risk that arises from the location of the SME. This variable was set equal to 0 if crime, theft and disorder are no obstacle to the current operations of the firm, 1 if these factors are a minor obstacle, =2 if they are a moderate obstacle, =3 if they are a major obstacle, or =4 if they are a very severe obstacle. Second, we replaced the utility arrears with tax arrears. Although there were fewer available observations for these variables, our results remained unchanged in these analyses.

In the second round of robustness checks, we used additional control variables. First, we added dummy variables for various lender types: (1) private commercial banks; (2) state-owned banks or government agencies; (3) non-bank financial institutions, including microfinance institutions, credit cooperatives, credit unions, or finance companies; and (4) other lenders³³. Because only 4,194 firms answered the survey question about lender type, the inclusion of lender type as a consideration reduces the number of observations across all of the examined groups of firms by more than half. Nevertheless, the coefficient estimates for the remaining variables remain similar and do not lose statistical significance. If we use the private commercial banks as the base group for all other groups, all of the other lender groups yield negative coefficient estimates for small and medium enterprises. These results can be interpreted as evidence that compared with privately owned banks, other groups of lenders help SMEs by reducing collateral requirements and thereby easing loan conditions. However, we do not observe significant coefficient estimates for the effect of borrowing from state-owned banks. Thus, borrowing from the third and fourth groups of lenders has a negative effect on collateralisation for small and medium enterprises. The remaining coefficient estimates except for *CR* remained the same in these model estimations; however, under these conditions, the little evidence that exists to support a negative

³³ See Table A.2 in the Appendix for information regarding the presence of collateral in the loans that were extended by different types of lenders.

relationship between bank concentration and collateralisation in our baseline results became insignificant.

Second, we consider the effect of the legal environment by examining an index from the Doing Business project of the World Bank that measures the strength of legal rights in a nation. This index ranges from 0 to 10, with higher scores indicating that collateral and bankruptcy laws protect the rights of borrowers and lenders and facilitate lending; thus, better laws expand access to credit. For the countries in our sample, the mean value for this variable is 6.15 (the median is 6), and the standard deviation is 2.02. This variable assumes its highest value for Montenegro (an average value of 9.95) and its lowest value for Uzbekistan (an average value of 2). Because this variable was highly correlated with the *FOREIGN* and *STATE* control variables, we run separate regressions for this variable to avoid multicollinearity³⁴. Our previous estimation results remained unchanged. The coefficient estimates for the legal rights index do not produce significant results for the presence of collateral, as measured by *COLL1*; however, this index has a statistically significant positive effect on the degree of collateral in loan contracts, as measured by *COLL3*. As argued by Brown et al. (2009), better legal protection makes loan contracts easier to enforce and facilitates the issuance of a larger number of loan contracts. This legal protection may cause the lender to require higher collateral to loan ratios.

To control for the effect of legal origin, we used a set of dummy variables for the origin of the legal system of each examined nation (French, German, or Socialist)³⁵. However, these dummy variables yield insignificant coefficient estimates in all specifications. Thus, we excluded legal origin dummy variables from the regressions. This finding

³⁴ See Table A.5 in the Appendix for pairwise correlation coefficients.

³⁵ This type of consideration was in accordance with the approach of La Porta et al. (1997), a study that addresses the legal origins of countries as a source of differences in financial sectors and firm structures among countries. The countries in our sample feature three different legal origins: French, German, and socialist. Turkey, Romania, Lithuania, and Albania are the countries that adopted French laws. Bosnia, Bulgaria, the Czech Republic, Croatia, the FYROM, Hungary, Latvia, Montenegro, Poland, Serbia, Slovakia, and Slovakia are the countries that adopted German laws, whereas the remaining nations that were examined adopted socialist laws.

confirms the results of Pistor et al. (2000), who reveal that better shareholder laws and creditor rights cannot solve the problems of obtaining external financing. Many years are required for these laws to generate detectable effects.

Finally, our sample consists of both EU and non-EU countries, and all of the EU countries that we examine are post-communist. We first perform separate regressions based on the 1,422 SMEs that answered the survey questions about collateralisation for these post-communist EU countries. In these regressions, *OVERDUE* gains a certain degree of significance, whereas all of the other coefficient estimates except *LNGDPPC* decrease in significance. In all of these estimations, female ownership (*FEMALEOWN*) is found to have a negative but statistically insignificant association with collateralisation. In regressions based on the 2,613 SMEs from non-EU countries, we observe a positive association between female ownership and the presence of collateral for the small enterprises from non-EU countries. In the non-EU countries of our sample, the coefficient estimates for *CR* become positive for the presence of a collateral regression (*COLLI*) for the small-sized firms that were surveyed, whereas these coefficient estimates remain negative for medium firms.

In our estimates of different sets of regressions for the CEE and CIS countries, we obtain similar results, except for the effects of *CR* and *FEMALEOWN*. The coefficient estimates for *CR* become positive for small and micro-sized firms in CIS countries; by contrast, we observe a negative coefficient for *CR* for small and micro-sized firms in CEE nations. A stronger negative effect of *FEMALEOWN* on collateralisation is observed for the CEE countries than for the CIS countries.

6. Conclusion

The objective of our paper is to investigate the determinants of collateral requirements on loans extended to SMEs in transition countries through the examination of firm-specific, lender market-specific and country-specific variables. Using BEEPS, we evaluate extensive information not only by assessing borrowers themselves but also by incorporating the perceptions of these borrowers with respect to their local business

environment. In contrast to previous empirical research on collateral, we not only focus on the presence of collateral in loan contracts but also on the degree of collateral for these contracts. Thus, from a methodological point of view, we contribute to the literature by examining the determinants of the degree of collateral for loans. Our analysis assesses both borrower characteristics, which have typically been the major focus of previous investigations, and the country-specific factors that affect collateral requirements. Our results indicate that country-specific variables (*hypothesis 2* and *hypothesis 3*) rather are more important than firm-specific variables (*hypothesis 1*) for determining both the presence and the degree of collateral in loan contracts of SMEs in less-developed countries. We find that in countries in which lenders have better information about borrowers' repayment history and unpaid debts through public and private credit bureaus, both the probability for the presence of collateral and the degree of that collateral decrease in loan contracts. Thus, collateral requirements serve as a tool for resolving the problem of asymmetric information about the borrower's quality. In this study, we also reveal evidence for the negative relationship between banking concentration and the degree of collateral. In contrast to previous studies that evaluate all SMEs as a single group of firms, we distinguish between small, medium, and micro enterprises. We present evidence that the determinants of collateral requirements differ for businesses of distinct sizes.

Our study helps remedy the scarcity of empirical evidence for less-developed and transition economies and therefore yields important policy implications for SMEs, financial institutions and policy makers. Because collateral requirements depend more on each country's information asymmetry than on borrower risk, to improve the abilities of SMEs to access finance it appears to be crucial to improve the process of collecting information about the borrower, both in terms of quality (how the risk is evaluated) and in terms of the affordability/credibility of this information (who performs the analysis). In this context, lending activity may benefit from entities that are dedicated to the information collecting process, such as mutual guarantee societies (MGSs). MGSs can play an important role as principal interlocutors for enterprises in improving access to credit; by entering long-term relationships with banks, MGSs enable banks to acquire

reliable information. MGSs also offer guarantees that are effective in mitigating the risks of banks because they are compliant with Basel II guidelines. Moreover, MGSs could help maximise the capacity to leverage public resources. From a macro perspective, the introduction of a method to evaluate risk-based collateral requirements, which can be implemented in the presence of better and shared information, raises interesting policy questions regarding the allocation planning of public resources to enterprises. Within the context of the current economic and financial environment, the public sector must be able to offer targeted and effective resources to enterprises. By improving the risk analysis and the information sharing level of a country, MGSs can help ensure that scarce public resources are used more effectively by providing an indication of the adequate level of guarantees for various enterprises.

7. Acknowledgements

We would like to thank the participants in the 2012 ADEIMF Annual Conference, the 4th International IFABS Conference, and the 7th Portuguese Finance Network Conference for their comments on the earlier versions of this paper. We gratefully acknowledge receiving financial support from ADEIMF. Any errors are ours.

8. Appendix

Table A.1

Why do firms not apply for new loans?

Main reason for not applying for a new loan	# of SMEs	Percentage
No need for a loan – the firm has sufficient capital	6,300	69.65
Interest rates are not favourable	1,086	12.01
Application procedures for loans or lines of credit are complex	496	5.48
Collateral requirements are too high	435	4.81
Did not think that the loan would be approved	177	1.96
The size or maturity times of available loans are insufficient	99	1.09
It is necessary to make informal payments to obtain bank loans	62	0.69
Other	256	2.83
Don't know	134	1.48
Total	9,045	100

The data above represent the author's calculations using BEEPS data.

Table A.2

The collateral requirements of SMEs across financial institutions.

Type of firm	Variable	Private commercial banks	State-owned banks or government agencies	Non-bank financial institutions	Other	Total
SMEs	coll1=0	765	158	79	28	1,030
	coll1=1	2,598	454	90	22	3,164
	total	3,363	612	169	50	4,194
Medium	coll1=0	208	50	17	7	282
	coll1=1	1,044	189	24	5	1,262
	total	1,252	239	41	12	1,544
Small	coll1=0	372	73	41	15	501
	coll1=1	1,164	182	38	8	1,392
	total	1,536	255	79	23	1,893
Micro	coll1=0	185	35	21	6	247
	coll1=1	390	83	28	9	510
	total	575	118	49	15	757

The data above represent the author's calculations using BEEPS data. Non-bank financial institutions include microfinance institutions, credit cooperatives, credit unions, or finance companies.

Table A.3

Forms of collateral in loans that are granted to SMEs.

	a	b	c	d	e
a. Land and buildings owned by the borrowing firm	3,771				
b. Machinery and equipment, including movables	727	1,732			
c. Accounts receivable and inventories	306	261	650		
d. Personal assets (e.g., houses) of an owner of the SME.	410	262	159	1,165	
e. Other forms of collateral	152	141	101	113	889

This table presents the number of collateral types that were required. The intersection indicates that firms are asked to provide both forms of collaterals. These numbers are in accordance with Niinimäki (2009), indicating that real estate is the most common and dominant form of collateral across the examined countries. The table values reflect the author's calculations using BEEPS data.

Table A.4

The data sample for the different survey years.

Country	Year of survey					Total
	2002	2005	2007	2008	2009	
Albania	34	72	128	0	14	248
Belarus	20	128	0	0	95	243
Georgia	14	23	0	0	38	75
Tajikistan	71	90	0	75	0	236
Turkey	53	86	0	0	136	275
Ukraine	26	67	356	0	57	506
Uzbekistan	53	95	320	0	31	499
Russia	74	89	0	0	87	250
Poland	40	57	0	0	102	199
Romania	29	26	0	0	138	193
Serbia	28	49	0	84	0	161
Kazakhstan	72	260	0	0	81	413
Moldova	56	189	0	0	128	373
Bosnia	31	55	0	0	29	115
Azerbaijan	35	41	0	0	102	178
FYROM	46	70	0	0	116	232
Armenia	60	124	0	0	85	269
Kyrgyz	5	6	0	0	48	59
Estonia	175	302	0	0	110	587
Czech Republic	54	216	0	0	162	432
Hungary	141	148	0	0	252	541
Latvia	30	83	0	0	156	269
Lithuania	35	68	0	0	73	176
Slovakia	90	83	0	0	136	309
Slovenia	32	34	0	71	0	137
Bulgaria	0	430	0	378	0	808
Croatia	78	199	0	143	0	420
Montenegro	59	63	0	40	0	162
Total	1,441	3,153	804	791	2,176	8,365

Table A.5

Pairwise correlation coefficients.

	Coll1	Coll2	Coll3	Overdue	Crime	Age	Size	Sole own	Female own	Quality	City	Pubreg	Prvtbr	Cr	State	Foreign
Overdue	0.01	-0.02	-0.03	1												
Crime	0.07	0.03	-0.01	0.06	1											
Age	-0.02	0.01	0.02	0.08	0.02	1										
Size	0.08	0.01	-0.05	0.02	0.10	0.27	1									
Soleown	-0.01	0.01	0.02	-0.01	-0.03	-0.11	-0.21	1								
Femaleown	-0.01	0.01	0.02	-0.02	-0.01	-0.06	-0.10	0.46	1							
Quality	-0.02	-0.04	-0.03	0.02	0.00	0.09	0.21	-0.14	-0.08	1						
City	-0.05	-0.07	-0.05	-0.02	0.01	0.04	0.08	-0.13	-0.07	0.09	1					
Pubreg	-0.03	-0.02	-0.01	0.00	-0.04	-0.01	0.00	-0.05	-0.03	0.06	0.12	1				
Prvtbr	-0.07	-0.06	-0.03	0.03	0.04	0.10	-0.01	0.10	0.03	0.03	-0.03	-0.25	1			
Cr	-0.05	-0.02	0.02	0.03	-0.04	0.01	-0.08	-0.02	-0.03	0.10	-0.16	0.11	0.09	1		
State	-0.09	-0.12	-0.09	-0.01	-0.04	0.05	0.03	-0.06	-0.01	0.00	0.07	0.07	-0.06	-0.03	1	
Foreign	0.11	0.11	0.06	0.00	0.05	0.03	0.00	0.05	0.01	0.02	-0.04	0.15	0.29	0.25	-0.56	1
Lngdppc	-0.07	-0.11	-0.09	0.01	0.08	0.08	0.02	-0.13	-0.07	0.14	0.11	-0.01	0.33	-0.06	-0.02	0.20

9. References

- Aghion, P., Bolton, P., 1992. An incomplete contracts approach to financial contracting. *Review of Economic Studies* 59, 473–493.
- Alesina, A., Lotti, F., Mistrulli, E., 2009. Do Women Pay More for Credit? Evidence from Italy. Working Paper, Harvard University.
- Arstei, D., Perali, F., Pieroni, L., 2008. Cohort, age and time effects in alcohol consumption by Italian households: A double-hurdle approach. *Empirical Economics* 35, 29–61.
- Baas, T., Schrooten, M., 2006. Relationship Banking and SMEs: A Theoretical Analysis. *Small Business Economics* 27, 127–137.
- Beck, T., Behr, P., Madestam, A., 2011. Sex and Credit: Is There a Gender Bias in Microfinance? Working paper, Tilburg University.
- Beck, T., Demirguc-Kunt, A., Laeven, L., Maksimovic, V., 2006. The determinants of financing obstacles. *Journal of International Money and Finance* 25, 932–952.
- Benmelech, E., Bergman, N.K., 2011. Bankruptcy and the Collateral Channel. *The Journal of Finance* 66, 337–378.
- Berger, A.N., Udell, G.F., 1990. Collateral, Loan Quality, and Bank Risk. *Journal of Monetary Economics* 25, 21–42.
- Berger, A.N., Udell, G.F., 1995. Relationship lending and lines of credit in small firm finance. *Journal of Business* 68, 351–381.
- Berger, A.N., Udell, G.F., 1998. The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle. *Journal of Banking and Finance* 22, 613–673.
- Berger, A.N., Udell, G.F., 2006. A more complete conceptual framework for SME finance. *Journal of Banking and Finance* 30, 2945–2966.
- Berger, A.N., Klapper, L.F., Udell, G.F., 2001. The ability of banks to lend to informationally opaque small businesses. *Journal of Banking and Finance* 25, 2127–2167.
- Berger, A.N., Frame, W.S., Ioannidou, V., 2011a. Tests of ex ante versus ex post theories of collateral using private and public information. *Journal of Financial Economics* 100, 85–97.
- Berger, A.N., Espinosa-Vega, M.A., Frame, W.S., Miller, N.H., 2011b. Why do borrowers pledge collateral? New empirical evidence on the role of asymmetric information. *Journal of Financial Intermediation* 20, 55–70.
- Berger, A.N., Cerqueiro, G., Penas, M.F., 2011c. Does debtor protection really protect debtors? Evidence from the small business credit market. *Journal of Banking and Finance* 35, 1843–1857.
- Berglöf, E., von Thadden, E.L., 1994. Short-Term Versus Long-Term Interests: Capital Structure with Multiple Investors. *Quarterly Journal of Economics* 109, 1055–1084.
- Berlin, M., Butler, A.W., 2002. Collateral and Competition. Working paper, Federal Reserve Bank of Philadelphia.
- Besanko, D., Thakor, A.V., 1987a. Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets. *International Economic Review* 28, 671–89.
- Bester, H., 1987. The role of collateral in credit markets with imperfect information. *European Economic Review* 31, 887–899.

- Boot, A.W.A., 2000. Relationship banking: What do we know? *Journal of Financial Intermediation* 9, 7-25.
- Boot, A.W.A., Thakor, A.V., 1994. Moral hazard and secured lending in an infinitely repeated credit market game. *International Economic Review* 35, 899–920.
- Boot, A.W.A., Thakor, A.V., 2000. Can relationship banking survive competition? *The Journal of Finance* 55, 679–713.
- Boot, A.W.A., Thakor, A.V., Udell, G.F., 1991. Secured lending and default risk: Equilibrium analysis, policy implications and empirical results. *The Economic Journal* 101, 458–72.
- Brown, M., Jappelli, T., Pagano, M., 2009. Information sharing and credit: Firm-level evidence from transition countries. *Journal of Financial Intermediation* 18, 151–172.
- Brick, I.E., Palia, D., 2007. Evidence of jointness in the terms of relationship lending. *Journal of Financial Intermediation* 16, 452–476.
- Caballero, R.J., Krishnamurthy, A., 2001. International and domestic collateral constraints in a model of emerging market crises. *Journal of Monetary Economics* 48, 513-548.
- Carter, S., Rosa, P., 1998. The financing of male- and female-owned businesses. *Entrepreneurship and Regional Development* 10, 225–242.
- Cerqueiro, G., Degryse, H., Ongena, S., 2011. Rules versus discretion in loan rate setting. *Journal of Financial Intermediation* 20, 503-529.
- Chakraborty, A., Hu, C.X., 2006. Lending relationships in line-of-credit and nonline-of-credit loans: Evidence from collateral use in small business. *Journal of Financial Intermediation* 15, 86–107.
- Chalupka, R., Kopecsni, J., 2009. Modeling Bank Loan LGD of Corporate and SME Segments: A Case Study. *Finance a úver – Czech Journal of Economics and Finance* 59, 360–382.
- Chan, Y.S., Kanatas, G., 1985. Asymmetric valuations and the role of collateral in loan agreements. *Journal of Money, Credit and Banking* 17, 84–95.
- Chan, Y.S., Thakor, A.V., 1987. Collateral and Competitive Equilibria with Moral Hazard and Private Information. *The Journal of Finance* 42, 345–63.
- Chen, Y., 2006. Collateral, loan guarantees, and the lenders' incentives to resolve financial distress. *The Quarterly Review of Economics and Finance* 46, 1–15.
- Coco, G., 1999. Collateral, heterogeneity in risk attitude and the credit market equilibrium. *European Economic Review* 43, 559–574.
- Cragg, J., 1971. Some statistical models for limited dependent variables with application to the demand for durable goods. *Econometrica* 39, 829-844.
- Cressy, R., Toivanen, O., 2001. Is there adverse selection in the credit market? *Venture Capital* 3, 215–238.
- Degryse, H., Van Cayseele, P., 2000. Relationship lending within a bank-based system: Evidence from European small business data. *Journal of Financial Intermediation* 9, 90–109.
- D'Espallier, B., Guérin, I., Mersland, R., 2011. Women and Repayment in Microfinance: A Global Analysis. *World Development* 39, 758-772.
- Dionne, G., Artis, M., Guillen, M., 1996. Count data models for a credit scoring system. *Journal of Empirical Finance* 3, 303-325.

- Feder, G., Tongroj, O., Tejaswi, R., 1988. Collateral, guaranties and rural credit in developing countries: Evidence from Asia. *Agricultural Economics* 2, 231-245.
- Gelos, G., Werner, A.M., 2002. Financial Liberalization, Credit Constraints, and Collateral: Investment in the Mexican Manufacturing Sector. *Journal of Development Economics* 67, 1-27.
- Godlewski, C.J., Weill, L., 2011. Does Collateral Help Mitigate Adverse Selection? A Cross-Country Analysis. *Journal of Financial Services Research* 40, 49-78.
- Goldberger, A.S., 1964. *Econometric Theory*. John Wiley, New York.
- Gonas, J., Highfield, M.J., Mullineaux, D.J., 2004. When are commercial loans secured. *The Financial Review* 39, 79-99.
- Gorton, G., Kahn, J., 2000. The Design of Bank Loan Contracts. *Review of Financial Studies* 13, 331-364.
- Grunert, J., Weber, M., 2009. Recovery rates of commercial lending: Empirical evidence for German companies. *Journal of Banking and Finance* 33, 505-513.
- Hainz, C., 2003. Bank Competition and Credit Markets in Transition Economies. *Journal of Comparative Economics* 31, 223-245.
- Hainz, C., Weill, L., Godlewski, C.J., 2012. Bank competition and collateral: Theory and evidence. *Journal of Financial Services Research*, forthcoming.
- Harhoff, D., Körting, T., 1998. Lending relationships in Germany – Empirical evidence from survey data. *Journal of Banking and Finance* 22, 1317-1353.
- Heckman, J., 1979. Sample selection bias as a specification error. *Econometrica* 47, 53-161.
- Hernández-Cánovas, G., Martínez-Solano, P., 2006. Banking relationships: Effects on debt terms for small Spanish firms. *Journal of Small Business Management* 44, 315-333.
- Holmstrom, B., Tirole, J., 1997. Financial Intermediation, Loanable Funds, and the Real Sector. *Quarterly Journal of Economics* 112, 663-91.
- Hui, C.H., Lo, C.F., Wong, T.C., Man, P.K., 2006. Measuring provisions for collateralised retail lending. *Journal of Economics and Business* 58, 343-361.
- Inderst, R., Mueller, H.M., 2007. A lender-based theory of collateral. *Journal of Financial Economics* 84, 826-859
- Jiménez, G., Salas, V., Saurina, J., 2006. Determinants of collateral. *Journal of Financial Economics* 81, 255 – 281.
- Jiménez, G., Salas, V., Saurina, J., 2009. Organizational distance and use of collateral for business loans. *Journal of Banking and Finance* 33, 234-243.
- Jiménez, G., Salas, V., Saurina, J., 2011. The Effects of Formal and Informal Contracting in Credit Availability. *Journal of Money, Credit and Banking* 43, pp.109-132.
- Jiménez, G., Saurina, J., 2004. Collateral, type of lender and relationship banking as determinants of credit risk. *Journal of Banking and Finance* 28, 2191-212.
- Jones, A.M., 1989. A double-hurdle model of cigarette consumption. *Journal of Applied Econometrics* 4, 23-39.
- Kiyotaki, N., Moore, J., 1997. Credit cycles. *Journal of Political Economy* 105, 211-248.
- Krishnamurthy, A., 2003. Collateral constraints and the amplification mechanism. *Journal of Economic Theory* 111, 277-292.

- Labeaga, J.H.M., 1999. A double-hurdle rational addiction model with heterogeneity: Estimating the demand for tobacco. *Journal of Econometrics* 93, 49–72.
- La Porta, R., López-de-Silanes, F., Shleifer, A., Vishny, R., 1997. Legal Determinants of External Finance. *The Journal of Finance* 52, 1131–1150.
- Leeth, J.D., Scott, J.A., 1989. The incidence of secured debt: Evidence from the small business community. *Journal of Financial and Quantitative Analysis* 24, 379–394.
- Longhofer, S.D., Santos, J.A.C., 2000. The Importance of Bank Seniority for Relationship Lending. *Journal of Financial Intermediation* 9, 57–89.
- Machauer, A., Weber, M., 1998. Bank behavior based on internal credit ratings of borrowers. *Journal of Banking and Finance* 22, 1355–1383.
- Madden, D., 2008. Sample selection versus two-part models revisited: The case of female smoking and drinking. *Journal of Health Economics* 27, 300–307.
- Manove, M., Padilla, J., Pagano, M., 2001. Collateral Versus Project Screening: A model of lazy Banks. *RAND Journal of Economics* 32, 726–744.
- Mattesini, F., 1990. Screening in the Credit Market: The Role of Collateral. *European Journal of Political Economy* 6, 1–22.
- Menkhoff, L., Neuberger, D., Rungruxsirivorn, O., 2012. Collateral and its substitutes in emerging markets' lending. *Journal of Banking and Finance* 36, 817–834.
- Menkhoff, L., Neuberger, D., Suwanaporn, C., 2006. Collateral-based lending in emerging markets: Evidence from Thailand. *Journal of Banking and Finance* 30, 1–21.
- Moffatt, P.G., 2005. Hurdle Models of Loan Default. *The Journal of the Operational Research Society* 56, 1063–1071.
- Newman, C., Henchion, M., Matthews, A., 2003. A double-hurdle model of Irish household expenditure on prepared meals. *Applied Economics* 35, 1053–1061.
- Niinimäki, J.-P., 2009. Does collateral fuel moral hazard in banking? *Journal of Banking and Finance* 33, 514–521.
- Niinimäki, J.-P., 2011. Nominal and true cost of loan collateral. *Journal of Banking and Finance* 35, 2782–2790.
- Ono, A., Uesugi, I., 2009. Role of Collateral and Personal Guarantees in Relationship Lending: Evidence from Japan's Loan Market. *Journal of Money, Credit and Banking* 41, 936–960.
- Pagano, M., Jappelli, T., 1993. Information sharing in credit markets. *The Journal of Finance* 43, 1693–1718.
- Park, C., 2000. Monitoring and Structure of Debt Contracts. *The Journal of Finance* 55, 2157–95.
- Petersen, M.A., Rajan, R.G., 1995. The Effect of Credit Market Competition on Lending Relationships. *The Quarterly Journal of Economics* 110, 407–443.
- Petersen, M.A., Rajan, R.G., 2002. Does Distance Still Matter? The Information Revolution in Small Business Lending. *The Journal of Finance* 57, 2533–2570.
- Peltoniemi, J., 2007. Collateral Requirements and Relationship Banking: Empirical Evidence from Unique Finnish Credit-files. *The Finnish Journal of Business Economics* 11, 393–414.
- Pistor, K., Raiser, M., Gelfer, S., 2000. Law and finance in transition countries. *Economics of Transition* 8, 325–368.
- Ramalho, J.J.S., Vidigal da Silva, J., 2009. A two-part fractional regression model for the financial leverage decisions of micro, small, medium and large. *Quantitative Finance* 9, 621–636.

- Rajan, R.G., Winton, A., 1995. Covenants and Collateral as Incentives to Monitor. *The Journal of Finance* 50, 1113–1146.
- Repullo, R., Suarez, J., 1998. Monitoring, Liquidation, and Security Design. *Review of Financial Studies* 11, 163–187.
- Sharpe, S., 1990. Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationship. *The Journal of Finance* 45, 1069–1089.
- Smith, M.D., 2003. On dependency in Double-Hurdle models. *Statistical Papers* 44, 581-595.
- Stiglitz, J.E., Weiss, A., 1981. Credit Rationing in Markets with Imperfect Information. *The American Economic Review* 71, 393-410.
- Steijvers, T., Voordeckers, W., 2009. Collateral and credit rationing: A review of recent empirical studies as a guide for future research. *Journal of Economic Surveys* 23, 924–946.
- Steijvers, T., Voordeckers, W., 2011. Collateral and Credit Rationing: A Review of Recent Empirical Studies as a Guide for Future Research. In: Sayer, S. (Eds.), *Issues in Finance: Credit, Crises and Policies*. Wiley-Blackwell, Oxford.
- Uchida, H., 2011. What Do Banks Evaluate When They Screen Borrowers? Soft Information, Hard Information and Collateral. *Journal of Financial Services Research* 40, 29–48.
- Voordeckers, W., Steijvers, T., 2006. Business collateral and personal commitments in SME lending. *Journal of Banking and Finance* 30, 3067–3086.
- Yen, S.T., Jensen, H.H., 1996. Determinants of household expenditures on alcohol. *Journal of Consumer Affairs* 30, 48–67.

Previously published “CEFİN Working Papers”

- 33 *Is it money or brains? The determinants of intra-family decision power*, by Graziella Bertocchi, Marianna Brunetti, Costanza Torricelli (June 2012)
- 32 *Is financial fragility a matter of illiquidity? An appraisal for Italian households*, by Marianna Brunetti, Elena Giarda, Costanza Torricelli (June 2012)
- 31 *Attitudes, personality factors and household debt decisions: A study of consumer credit*, by Stefano Cosma and Francesco Pattarin (February 2012)
- 30 *Corridor implied volatility and the variance risk premium in the Italian market*, by Silvia Muzzioli (November 2011)
- 29 *Internal Corporate Governance and the Financial Crisis: Lessons for Banks, Regulators and Supervisors*, by Elisabetta Gualandri, Aldo Stanziale, and Enzo Mangone (November 2011)
- 28 *Are defined contribution pension schemes socially sustainable? A conceptual map from a macroprudential perspective*, by Giuseppe Marotta (October 2011)
- 27 *Basel 3, Pillar 2: the role of banks' internal governance and control function*, by Elisabetta Gualandri (September 2011)
- 26 *Underpricing, wealth loss for pre-existing shareholders and the cost of going public: the role of private equity backing in Italian IPOs*, by Riccardo Ferretti and Antonio Meles (April 2011)
- 25 *Modelling credit risk for innovative firms: the role of innovation measures*, by Pederzoli C., Thoma G., Torricelli C. (March 2011)
- 24 *Market Reaction to Second-Hand News: Attention Grabbing or Information Dissemination?*, by Cervellati E.M., Ferretti R., Pattitoni P. (January 2011)
- 23 *Towards a volatility index for the Italian stock market*, by Muzzioli S. (September 2010)
- 22 *A parsimonious default prediction model for Italian SMEs*, by Pederzoli C., Torricelli C. (June 2010)
- 21 *Average Internal Rate of Return and investment decisions: a new perspective*, by Magni C.A. (February 2010)
- 20 *The skew pattern of implied volatility in the DAX index options market*, by Muzzioli S. (December 2009)
- 19 *Accounting and economic measures: An integrated theory of capital budgeting*, by Magni C.A. (December 2009)
- 18 *Exclusions of US-holders in cross-border takeover bids and the principle of equality in tender offers*, by Mucciarelli F. (May 2009).
- 17 *Models for household portfolios and life-cycle allocations in the presence of labour income and longevity risk*, by Torricelli C. (March 2009)
- 16 *Differential evolution of combinatorial search for constrained index tracking*, by Paterlini S, Krink T, Mitnik S. (March 2009)
- 15 *Optimization heuristics for determining internal rating grading scales*, by Paterlini S, Lyraa M, Pahaa J, Winker P. (March 2009)
- 14 *The impact of bank concentration on financial distress: the case of the European banking system*, by Fiordelisi F, Cipollini A. (February 2009)
- 13 *Financial crisis and new dimensions of liquidity risk: rethinking prudential regulation and supervision*, by Landi A, Gualandri E, Venturelli V. (January 2009)

- 12 *Lending interest rate pass-through in the euro area: a data-driven tale*, by Marotta G. (October 2008)
- 11 *Option based forecast of volatility: an empirical study in the Dax index options market*, Muzzioli S. (May 2008)
- 10 *Lending interest rate pass-through in the euro area*, by Marotta G. (March 2008)
- 9 *Indebtedness, macroeconomic conditions and banks' losses: evidence from Italy*, by Torricelli C, Castellani S, Pederzoli C. (January 2008)
- 8 *Is public information really public? The role of newspapers*, Ferretti R, Pattarin F. (January 2008)
- 7 *Differential evolution of multi-objective portfolio optimization*, by Paterlini S, Krink T. (January 2008)
- 6 *Assessing and measuring the equity gap and the equity*, by Gualandri E, Venturelli V. (January 2008)
- 5 *Model risk e tecniche per il controllo dei market parameter*, Torricelli C, Bonollo M, Morandi D, Pederzoli C. (October 2007)
- 4 *The relations between implied and realised volatility, are call options more informative than put options? Evidence from the Dax index options market*, by Muzzioli S. (October 2007)
- 3 *The maximum LG-likelihood method: an application to extreme quantile estimation in finance*, by Ferrari D., Paterlini S. (June 2007)
- 2 *Default risk: Poisson mixture and the business cycle*, by Pederzoli C. (June 2007)
- 1 *Population ageing, household portfolios and financial asset returns: a survey of the literature*, by Brunetti M. (May 2007)