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Essays on Banking Credit Acquisition: Evidences from SMEs operating in Adverse Context

Collateralization, Mutual Guarantees and Borrowing Discouragement

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Extended Abstract

This thesis consists in four papers addressing the difficulties of Small and Medium-sized Enterprises (SMEs) when accessing banking finance in a context of high informational asymmetries , during a period of financial crisis and adjustments of the banking capital ratios. A central characteristic of SMEs is their dependence on bank credit for external financing (Degryse and Van Cayseele, 2000). Asymmetric information and agency costs, however, underlie the inadequate financing of these firms. Previous studies show that, due to the lack of information on individual borrowers, banks issue restrictive loan term contracts to reduce their default exposure. Banks can cause the interest rate to become inefficiently high such that worthy firms are driven out of the credit market (Stiglitz and Weiss, 1981). Alternatively, firms with negative net present value projects could obtain financial support in the credit market by taking advantage of cross-subsidization of borrowers with worthy projects (Mankiw, 1986; De Meza and Webb, 1987). In both cases, the reason for market failure is that banks are unable to assess the actual riskiness of SMEs and are forced to offer the same contract to them with a different probability of success. Hence, to overcome screening errors, lenders may reject part of a firm´s loan request (i.e., type I rationing) or simply turn down the credit (i.e., type II rationing) (Steijvers and Voordeckers, 2009a).

Recent studies show that when borrowers' wealth is large enough, banks may bypass informational asymmetries by offering a menu of contracts with collateral requirements which, acting as a sorting device, mitigates the screening errors and the credit rationing for good firms. In this case, risky borrowers will be self-selected by choosing contracts with high repayment (i.e., high interest rates) and low collateral, while safe borrowers will choose contracts with high collateral and low repayment (Han et al., 2009a). Thus, in the design of loan term contracts, collateral assumes a key role as a risk management instrument (Bonfim, 2005). Its role, however, has been little studied in the field of entrepreneurial finance and has been validated, particularly, in the context of a market-based system that gives to SMEs a wider range of funding sources (La Porta et al., 1998). Furthermore, it seems entirely plausible that the role of collateral differs within developed and less developed countries (Menkhoff et al., 2012), surrounded by different levels of informational asymmetries (Hainz, 2003; Beck et al., 2006; Menkhoff et al., 2006), and that their efficiency depends on its nature (i.e., business versus personal collateral – Mann, 1997b).

The features of collateral also depend on the characteristics of the individual loan and the firm (Berger and Udell, 1998; Columba et al., 2010) as well as the legal procedures for loan recovery (Zecchini and Ventura, 2009). If SMEs are unable to post collateral while they have a short credit history, meet less rigorous reporting requirements and the availability of public information is scarce (Columba et al., 2010) or if the legal system is inadequate to protect creditor rights (Zecchini and Ventura, 2009), their access to bank credit would remain restricted especially during economic downturns, with negative effects on industry dynamics,

competitiveness and growth (Beck and Demirgüc- Kunt, 2006). In this context, in almost half of countries around the world several types of loan guarantee funds have been created to help SMEs to gain easier access to the credit market (Green, 2003; Gonzàles et al., 2006; Beck et al., 2010; Cowling, 2010; Honohan, 2010). The importance of mutual guarantee schemes (MGS) is destined to further increase in the light of the Basel II and III Capital Accords which state that the guarantees of such institutions can, if granted in compliance with some requirements, allow banks to mitigate credit risk with small business lending, and thus, save regulatory capital (SPGM, 2007; Cardone-Riportella et al. 2008). In the recent years, the allocation of mutual guarantees gained a momentum, especially in Organization for Economic Co-operation and Development (OECD) countries. Since the onset of the crisis in the international financial sector, MGS have been the privileged instrument to extend credit for SMEs without compromising the capital requirements of banks (Uesugi et al, 2010). However, the question whether third-party guarantee is an effective instrument to promote lending to SMEs is a controversial issue in both academic and policy literature (Cowling, 2010; Honohan, 2010; Boschi et al., 2014).

Traditionally, practitioners and policy makers have been concentrating much of their attention in those firms that apply for bank credit and specifically on the credit rationing problem, marginalizing those firms which do not apply for loans, even when they need external financing. These firms are the so-called "discouraged borrowers" (Cavalluzzo et al., 2002). Although the theoretical model of Kon and Storey (2003) for "discouragement" is, in principle, applicable to both developed and less developed economies, it is expected that discouragement is higher in less developed countries due to lower business traceability (e.g., Chakravarty and Xiang, 2013; Brown et al., 2011; Cole and Dietrich, 2012). Empirical literature on the discouragement problem in less developed countries is, however, limited providing a fertile ground for the study of the causes for the existence of discouraged borrowers.

Based on this theoretical and empirical framework, this thesis critically approaches underexplored dimensions of banking lending activity targeted to SMEs financing, such as: the collateralization policy; the role of mutual guarantees; and the discouraged demand for credit. In the first chapter we examine the simultaneous impact of observed characteristics and private information on SMEs´ loan contracts, using data from a major commercial bank operating in Portugal, gathered between January 2007 and December 2010. Using a multiperiod setting, this paper provides the first analysis of the sorting by signalling and self-selection (SBSS) model in a bank-based system. Furthermore, this chapter provides empirical evidence of the effect of macroeconomic conditions on loan contracts during credit crunch and recession periods. Using 12,666 credit approvals, the main results show that borrowers with good credit scores and a high probability of success as they are unlikely to default, are more willing to pledge collateral in return for lower interest rate premium (IRP). In an interactive and sequential event, we confirm that lenders tailor the specific terms of the contract, based on the observable characteristics, increasing both collateral requirements and IRP, for observed risky borrowers, in line with Han et al (2009a)´s SBSS model. However, we reject the positive effect of loan

size, predicted by the SBSS model, in terms of loan price negotiation. We argue that loan size decreases the probability of collateralization and the loan interest rates, suggesting that larger loans increase the potential payoff for banks and are assigned to borrowers with good observable characteristics. As loan maturity increases, in contrast, the lender is more likely to demand collateralization and IRP, especially if the borrower is bad or unobservably good, in line with moral hazard arguments (Jensen and Meckling, 1976; Boot et al., 1991). This paper shows that our findings are robust when we predict the degree of collateralization offered by the borrower, adding strength to the SBSS model and contributing to overcome its empirical gaps underlined by Lambrecht (2009).

The second chapter scrutinizes the role of mutual guarantees in Portuguese bank lending activity. Using data provided by the same bank, covering 11,181 loans granted to SMEs between January 2008 and December 2010, this paper provides the first appraisal of Portuguese MGS in response to the financial crisis. We examine the characteristics of firms benefiting from mutual guaranteed loans and analyzes the impact of mutual guarantees in loan pricing as well as on the ex-post performance of borrowers. The findings provide a comprehensive insight confirming the value of mutual guarantees to improve Portuguese banking loan activity, especially for good SMEs operating in a stressful context, reducing the costs of borrowing and improving the ex post default of borrowers. Thus, we suggest that mutual guarantees could be used to raise the loan´s recovery rate allowing banks to meet their commitments with banking regulation and supervision in the context of financial crisis. We also argue that these effects are especially noticeable by combining third-party guarantees and collateral.

The third chapter extends the empirical evidences on the determinants of the collateral in loan contract terms in countries characterized by low informational traceability and low creditor protection. It uses the fourth-round database of the Business Environment and Enterprise Performance Survey (BEEPS) carried out between 2007 and 2009, covering 3,403 ultimately banking credit approvals for SMEs, operating in Eastern European and Central Asia less developed countries. This paper examines the incidence of business and personal collateral and its level reporting first-hand evidence regarding the impact of the recently reformed credit environment on collateral requirements. The findings endorse the importance in producing and sharing private information between lenders to reduce informational asymmetries and consequently the need to provide collateral to receive a loan. Moreover, we find that market concentration increases banks´ lazy-behavior by asking for collateral not to mitigate observable risk but to reduce screening efforts. We also prove that reforms around the depth of information-sharing instruments by public credit registries only have practical effects mitigating credit constraints and reducing the collateral requirements when coupled with public reforms on its coverage. In addition, this chapter shows that business and personal collateral have distinctive values addressing moral hazard and adverse selection problems, especially relevant in the context under study, advising caution on the practitioners' extrapolations when modeling the determinants of bank loans collateralization.

The fourth chapter examines the conditions that favor the existence of discouraged borrowers, using data provided by the fourth-round of the BEEPS. This paper selects 6,307 loan seekers, among which 2,207 SMEs are typed as discouraged borrowers and 4,280 are classified as loan applicants. We prove that whereas the firm´s opaqueness, demographic issues and distance between borrower and lender better explains the discouragement by tough loan price and/or loan application procedures, the firm´s risk and the banking concentration explains the incidence of discouraged borrowers by fear of rationing. Nonetheless, we argue that in a higher concentrated banking system, those firms with a closer and more intensive relationship with the bank are more likely discouraged to apply for a loan than distant borrowers. This is reasonable if we assume that these firms are more likely to rely on banks as their primordial source of finance, getting locked by the superior bargaining power of the credit provider in a context of low competition (Sharpe, 1991; Detragiache et al. 2000). In turn, this bargaining power may discourage the business to apply for new loans. The innovator status, the legal protection of borrowers and lenders in a default event and the coverage of information sharing instruments help to explain the discouragement in a transversal way.

Keywords: SME, Entrepreneurship signaling, Private information, Collateral, Personal collateral; Business collateral, Level of personal and business collateral, Public mutual credit guarantees; Financial crisis, Bank capital ratios, Asymmetric Information; Ex-post default; Less developed countries; Discouraged borrowers; Self-selection

JEL classification: C35; D82, G14; G15; G18, G21, G30, H12, O16

Resumo Alargado

Esta tese é composta por quatro artigos que abordam as dificuldades enfrentadas pelas Pequenas e Médias Empresas (PMEs) no acesso ao financiamento bancário num contexto de elevada assimetria de informação e/ou reduzida rastreabilidade de informação, durante um período de crise financeira e de ajustamentos nos rácios de capital do sector bancário. Uma das características centrais das PMEs é a sua dependência do crédito bancário no que diz respeito ao seu financiamento externo (Degryse e Van Cayseele, 2000), sendo frequentemente atribuídas as suas fragilidades no acesso a fontes externas de capital, maioritariamente dívida bancária, à assimetria de informação e aos custos de agência. A literatura evidencia que, devido à falta de informação sobre os mutuários, os bancos emitem contratos de empréstimo com cláusulas restritivas para reduzir a sua exposição ao risco e ao incumprimento. Os bancos tendem a exigir, por exemplo, taxas de juro tão elevadas que afastam empresas sustentáveis e saudáveis do mercado de crédito (Stiglitz e Weiss, 1981). Em alternativa, as empresas com projetos de valor atual líquido (VAL) negativo poderão obter apoio financeiro, no mercado de crédito bancário, aproveitando a subsidiação cruzada dos mutuários com projetos viáveis (Mankiw, 1986; De Meza e Webb, 1987). Em ambos os casos, a origem destas imperfeições de mercado reside na incapacidade dos bancos avaliarem corretamente o grau de risco efetivo das PMEs, e dos seus projetos, sendo forçados a oferecer o mesmo contrato para empresas com probabilidade de sucesso distintas. Assim, com o objetivo de mitigar os erros na triagem dos diferentes projetos, os credores podem ser levados a racionar o montante dos empréstimos a conceder a essas empresas (i.e., racionamento de tipo I) ou simplesmente a rejeitar o pedido de crédito (i.e., racionamento de tipo II) (Steijvers e Voordeckers, 2009a).

Estudos recentes sugerem que quando a qualidade dos mutuários é elevada (isto é, quando apresentam bons *ratings*), os bancos podem superar a assimetria de informação oferecendo um menu de contratos que prevê a prestação de garantias bancárias que agem como um dispositivo de triagem, mitigando os erros de "screening" e, consequentemente, o racionamento do crédito para as empresas rentáveis. Neste caso, os mutuários com risco elevado optam por escolher contratos com taxas de juro mais elevadas e garantias bancárias mais reduzidas, enquanto que os mutuários com maior qualidade creditícia optam por contratos mais exigentes do ponto de vista dos requisitos ao nível das garantias bancárias em troca de taxas de juro mais baixas (Han et al., 2009a). Assim, na negociação dos contratos de empréstimos bancários, as garantias bancárias assumem um papel fundamental como um instrumento de sinalização e gestão de riscos (Bonfim, 2005). O seu papel, no entanto, tem sido pouco estudado no contexto das finanças empresariais e foi validado, em particular, no contexto "*market-based system*" que oferece às PMEs uma ampla gama de fontes de financiamento (La Porta et al., 1998). Além disso, assume-se como plausível o argumento de que o papel das garantias bancárias varia entre países desenvolvidos e países menos desenvolvidos, em função dos diferentes níveis de assimetria de informação que se colocam à

atividade bancária (Hainz, 2003; Menkhoff et al, 2012; Beck et al, 2006; Menkhoff et al., 2006). Simultaneamente, reconhece-se que a eficiência das garantias bancárias depende da natureza dos ativos usados para garantir o empréstimo, o que pressupõe uma análise cuidada e singular sobre o valor intrínseco das garantias bancárias reais *versus* garantias pessoais (Mann, 1997).

As características das garantias bancárias dependem igualmente das características individuais do empréstimo e da própria empresa (Berger e Udell, 1998; Columba et al, 2010), bem como do enquadramento legal em caso de incumprimento (Zecchini e Ventura, 2009). Se as PMEs forem incapazes de prestar garantias bancárias, se estas apresentarem um curto historial de crédito, se adotarem políticas de reporte de informação financeira pouco rigorosas e se a informação pública sobre si mesmas for reduzida (Columba et al., 2010), ou mesmo se o sistema legal for insuficiente para proteger os direitos dos credores (Zecchini e Ventura, 2009), o seu acesso ao crédito bancário permanecerá restrito, especialmente em períodos de recessão económica, com efeitos negativos sobre a dinâmica da economia, a sua competitividade e crescimento (Beck e Demirgüc- Kunt, 2006). Neste contexto, em quase metade dos países em todo o mundo, vários tipos de fundos de garantia mútua foram criados com o objetivo de facilitar o acesso ao crédito bancário por parte das PMEs (Green, 2003; Gonzàles et al., 2006; Beck et al., 2010; Cowling, 2010; Honohan, 2010). A importância das garantias mútuas é cada vez mais relevante devido aos Acordos de Capital de Basileia II e III, na medida em que estas permitem, se concedidas em conformidade com alguns requisitos, mitigar a exposição ao risco de crédito associado aos empréstimos concedidos às PMEs, de tal forma que podem promover a atividade de concessão de crédito garantindo em simultâneo o cumprimento dos rácios regulamentares de capital (SPGM, 2007; Cardone-Riportella et al., 2008). Com efeito, nos últimos anos, a atribuição de garantias mútuas ganhou um novo impulso, especialmente nos países que compõem a Organização para a Cooperação Económica e para o Desenvolvimento (OECD),uma vez que, no âmbito da crise no setor financeiro internacional, estas têm sido o instrumento privilegiado para estender o crédito às PMEs sem comprometer os requisitos de capital dos bancos (Uesugi et al, 2010). Não obstante, a eficiência das garantias mútuas prestadas por uma terceira entidade enquanto instrumento promotor da concessão de empréstimos às PMEs é ainda uma questão controversa na literatura política e académica (Cowling, 2010; Honohan, 2010; Boschi et al,2014).

Tradicionalmente, os académicos e os decisores políticos têm vindo a concentrar grande parte da sua atenção nas empresas que solicitam empréstimos bancários e, especificamente, no problema do racionamento de crédito, marginalizando as empresas que não apresentam pedidos de crédito bancário, mesmo quando admitem necessitar de algum tipo de empréstimo. Estas empresas são designadas de "mutuários desencorajados" ("*Discouraged borrowers*") (Cavalluzzo et al., 2002; Kon and Storey, 2003). Apesar da base teórica de Kon e Storey (2003) para o "desencorajamento" ser, em princípio, aplicável a economias desenvolvidas e a economias em desenvolvimento, existem evidências empíricas que sugerem que o problema do desencorajamento de crédito é maior em países menos desenvolvidos (por exemplo, Chakravarty e Xiang, 2013; Brown et al, 2011; Cole e Dietrich, 2012). No entanto, a literatura

empírica sobre este problema nos países menos desenvolvidos é ainda limitada oferecendo um terreno fértil no que diz respeito ao entendimento sobre a existência deste tipo de mutuários.

Com base no enquadramento teórico e empírico, esta tese aborda, de forma crítica, algumas dimensões pouco exploradas sobre a atividade de crédito bancário especificamente direcionada ao financiamento das PMEs, tais como: a política de garantias bancárias (reais e pessoais); o papel de garantias mútuas e o desencorajamento da procura de crédito bancário. Com efeito, no primeiro capítulo desta tese examinamos o impacto simultâneo das características observadas e da informação privada sobre os termos do contrato de crédito bancário das PMEs, usando dados recolhidos entre janeiro de 2007 e dezembro de 2010 sobre a atividade bancária de um grande banco comercial a operar em Portugal. Usando uma configuração de dados multi-período, este capítulo fornece a primeira abordagem ao modelo "*Sorting by Signalling and Self-Selection*" (SBSS) num contexto de "*Bank-based System*". Para além disso, fornece evidências empíricas sobre o efeito das condições macroeconómicas sobre os termos dos contratos de crédito bancário durante o período de crise financeira e de recessão económica. Usando 12,666 pedidos de crédito aprovados, os principais resultados mostram que os mutuários com um bom *rating* estão mais dispostos a oferecer garantias bancárias em troca de uma redução percentual das taxas de juro, sabendo que têm uma elevada probabilidade de sucesso, não sendo, por isso, suscetíveis de entrar em incumprimento. Num processo interativo e sequencial, os resultados confirmam que os credores adequam os termos específicos do contrato de crédito em função das características observadas, aumentando quer os requisitos de garantias bancárias quer a taxa de juro para mutuários com maior risco observado, de acordo com o modelo SBSS proposto por Han et al (2009a). No entanto, rejeitamos a relação positiva entre o montante do empréstimo, prevista neste modelo, e o preço do crédito negociado. Neste capítulo, argumentamos que o montante do empréstimo diminui a probabilidade de prestar garantias bancárias reduzindo igualmente as taxas de juro exigidas para a obtenção do empréstimo, o que sugere que os empréstimos de maior montante aumentam o retorno potencial para os bancos e são atribuídos a mutuários com melhor qualidade creditícia. Em contrapartida, à medida que a maturidade dos empréstimos aumenta, torna-se cada vez mais provável que o credor exija garantias bancárias e taxas de juro mais elevadas, especialmente se o credor possui informações públicas negativas acerca do mutuário ou se a qualidade do mutuário do crédito não é observável, com o objetivo de reduzir o risco moral - *"moral hazard"* - e os riscos inerentes à substituição de ativos no período subsequente à concessão de crédito ("*ex-post shifting behavior*") (Jensen and Meckling, 1976; Boot et al., 1991).Este capítulo mostra que estes resultados são robustos quando analisado o rácio de cobertura das garantias bancárias, reforçando as conclusões do modelo SBSS e contribuindo para ultrapassar as suas limitações empíricas sublinhadas, de resto, por Lambrecht (2009).

O segundo capítulo analisa o papel das garantias mútuas na atividade de crédito bancário Português. Usando dados fornecidos pelo mesmo banco, cobrindo 11,181 empréstimos concedidos às PMEs entre janeiro de 2008 e dezembro de 2010, este artigo fornece a primeira avaliação do sistema de garantias mútuas português em resposta à crise financeira. O estudo

examina as características das empresas que beneficiaram de empréstimos garantidos por uma terceira entidade e analisa o impacto das garantias mútuas no preço dos empréstimos, bem como sobre o desempenho futuro dos mutuários. Os resultados fornecem uma visão abrangente confirmando o valor destas garantias na melhoria da atividade de concessão de crédito dos bancos em Portugal, especialmente para as PMEs com boa classificação de risco e que operam em contexto de "*stress financeiro" (*nomeadamente por pressões ao nível de liquidez*)*, reduzindo os custos dos empréstimos, bem como o rácio de empresas em incumprimento no período pós-concessão de crédito. Assim, sugerimos que as garantias mútuas sejam usadas para aumentar a taxa de recuperação dos empréstimos permitindo que os bancos cumpram os seus compromissos com a regulação e supervisão bancária num contexto de crise financeira. Argumentamos ainda que os efeitos positivos das garantias mútuas sobre a atividade bancária são potenciados através da combinação entre estas e as garantias bancárias (pessoais).

Com base nos dados recolhidos do quarto questionário do "*Business Environment and Enterprise Performance Survey"* (BEEPS), realizado entre 2007 e 2009, abrangendo 3,403 pedidos de crédito aprovados para as PMEs que operam em países menos desenvolvidos da Europa de Leste e na Ásia Central, no terceiro capítulo estendemos as evidências empíricas sobre os determinantes das garantias bancárias examinando simultaneamente os determinantes das garantias bancárias reais e pessoais. Controlando a cobertura das garantias bancárias prestadas, este capítulo fornece resultados únicos sobre o impacto do ambiente de crédito recentemente sujeito a um conjunto de reformas (por exemplo, ao nível dos centros públicos e privados de recolha e partilha de informação - DBR, 2010). Concluímos que as empresas jovens usam as garantias pessoais como sinal da sua capacidade creditícia e de compromisso para aceder ao crédito bancário. Este efeito de sinalização é alcançado através da prestação de ativos pessoais como garantia do empréstimo bancário. Os resultados reforçam ainda a importância em recolher e partilhar informações privadas sobre os mutuários entre credores, reduzindo deste modo a necessidade de prestar garantias bancárias. Sugerem também que o aumento da concentração bancária promove um comportamento ocioso dos bancos, que se traduz num aumento das exigências de garantias pessoais, não para mitigar o risco, mas sim para reduzir os custos de "screening" e monotorização do risco. Os resultados indicam ainda que reformas relativamente à "profundidade" dos instrumentos de partilha de informação por parte de registos públicos de crédito apenas têm efeitos práticos sobre a atenuação de restrições de crédito e redução das exigências de garantias bancárias quando acompanhadas de reformas públicas sobre a sua cobertura. Este estudo revela ainda várias diferenças entre os determinantes: da incidência de garantias bancárias; do tipo de ativos usados para garantir a obtenção de crédito e do valor da(s) própria(s) garantia(s) prestada(s).

O quarto capítulo examina as condições que justificam a existência de mutuários desencorajados *("discouraged borrowers"*), usando dados fornecidos pelo quarto questionário do BEEPS. Este artigo seleciona 6,307 PMEs com assumida necessidade de crédito, de entre as quais 2,207 PMEs são classificadas como "*discouraged borrowers"*, e 4,280 como empresas que solicitaram empréstimos bancários. Com base nos dados recolhidos, verificamos que: enquanto

a rastreabilidade sobre a qualidade das empresas, as questões demográficas e a distância entre devedor e credor explicam o problema do desencorajamento baseado numa perceção negativa sobre o preço do crédito ou sobre a complexidade dos procedimentos para obtenção do empréstimo; o risco das PMEs e a concentração do mercado bancário explicam a existência de problemas de desencorajamento motivado pelo medo de racionamento do crédito. No entanto, os resultados demonstram que num sistema bancário mais concentrado, as empresas com uma relação mais estreita e intensa com o banco (*main bank*) têm uma tendência maior em "cair" em situação de desencorajamento comparativamente a mutuários mais distantes do seu credor. Estes resultados sugerem que essas empresas, que têm os bancos como principal fonte de financiamento, ficam reféns do poder informacional superior dos seus credores conferindo-lhes uma posição privilegiada numa situação de mudança de credor (i.e.,*"superior bargaining power effect"*) (Sharpe, 1991; Detragiache et al., 2000). Por sua vez, esta posição privilegiada pode desencorajar a empresa a solicitar novos empréstimos para evitar os *"switching costs"*. A capacidade de inovação, a proteção legal dos mutuários e dos credores num cenário de incumprimento, bem como a cobertura pública/privada por registos de crédito da informação sobre as empresas, ajudam a explicar o desencorajamento de crédito de uma forma transversal.

Palavras-Chave: **Keywords**: PMEs, sinalização, finanças empresariais, informação privada, Garantias bancárias, Garantias bancárias pessoais; Garantias bancárias reais, Nível de garantias bancárias pessoais e reais; Países menos desenvolvidos, Garantias mútuas públicas, , Crise Financeira, Rácios de capital bancário, garantias bancárias, Incumprimento; Mutuários desencorajados

Classificação JEL: C35; D82, G14; G15; G18, G21, G30, H12, O1

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List of Acronyms

2SLS – Two stage least squares
ABCCS - Association of British Chambers of Commerce Survey
AEL – Applied Economic Letters
AO – Angola
ARG – Argentina
AS – Adverse Selection
AT – Austria
AUS – Australia
BBS – Bank-based sytem
BC – Business Collateral
BD – Bangladesh
BdP – Banco de Portugal
BEEPS - Business Environment and Enterprise Performance Survey
BEL – Belgium
BG – Bulgaria
BOL – Bolivia
BRA – Brazil
CAM –Cameroon
CEO – Chief Executive Officer
CH – Switzerland
CI – Ivory Coast
CIR – Credit Register of the Bank of Spain
CIRC – Central de Información de Riesgos Credicticios
CL – Chile
CN – China
CO – Colombia
CR – Continuation ratio
CRC – Portuguese Central Credit Register
CRP – Continuation ratio probit
CRT – Croatia
CSMAR – China Securities Markets and Accounting Research Database
CZ – Czech Republic
DBR – Doing Business Report
DK – Denmark
EBRD - European Bank for Reconstruction and Development
EC – Ecuador
ECB - European Central Bank
EECA – Eastern Europe and Central Asia developing countries
EGY – Egypt
EOSMEs – Economic Observatory of SMEs
EU – European Union
FBR – Family Business Review
FCT - Portuguese Foundation for Science and Technology
FID – Financial Information Database
FIN – Finland
FR – The Financial Review
FRA – France
FRBoCCB - Federal Reserve Bank of Chicago Commercial Bank
GDP – Gross domestic product
GER – Germany
GFDD - Global Financial Development Database
GH – Ghana
GR – Greece
GT – Guatemala
HCD - Holding Company Database
HKG – Hong-Kong
HU – Hungary
IDN – Indonesia
IL – Israel
INBAM - International Network of Business and Management Journals conference
IND – India
IR – Iran
IRE – Ireland
IRP – Interest rate Premium
ISIC – International Standard Industrial Classification
ISR – Israel
IT – Italy
IV – Instrumental variable
JAM – Jamaica
JBF – Journal of Banking and Finance
JBFA – Journal of Business Finance and Accounting
JEBO –Journal of Economic Behaviour and Organization
JEF – Journal of Entrepreneurial Finance
JFE – Journal of Financial Economics;
JFI – Journal of Financial Intermediation
JFQA – Journal of Financial and Quantitative Analysis
JFSR – Journal Finance Services Research
JJIE – Journal of the Japanese and International Economies
JMCB – Journal of Money, Credit and Banking
JP – Japan
JSBM – Journal of Small Business Management
KAZ – Kazakhstan
KR – South Korea
LKA – Sri Lanka

LPC- Loan Pricing Corporation DealScan database
LT – Lithuania
MA – Morocco
Max - Maximum
MBS – Market-based system
MEX – Mexico
MH – Moral Hazard
Min. - Minimum
MY – Malaysia
NECE - Research Unit in Business Sciences
NL – Netherland
NO – Norway
NSSBF – National Survey of Small Business Finance
NZ – New Zealand
Obs - Observations
OECD – Organisation for Economic Co-operation and Development
OLS – Ordinary least squares
OM – Oman
PAN – Panama
PC – Personal Collateral
PE – Peru
PG – Papua New Guinea
PH – Philippines
PK – Pakistan
PL – Poland
PT – Portugal
QJE – The Quarterly Journal of Economics
R&D – Research and Development
RENT - Research in Entrepreneurship and Small Business conference
ROU – Romania
RU – Russia
SA – South Arabia
SABE – Sistema de Análisis de Balances Españoles
SABI – Iberian Balance sheet Analysis System
SBE – Small Business Economics
SBOR - Sorting by observed risk
SBPI - Sorting by private information
SBSS - Sorting by signaling and self-selection
SE – Sweden
SFE –Survey of the Financial Environment
SG – Singapore
SI – Slovenia
SK – Slovakia
SMBC - Seventeen Mexican Banks Circa
SMEF –Survey on Small and Medium-sized Enterprises Finance
SMEs – Small and medium-sized enterprises
SNFIB – Survey of the National Federation of Independent Business
SP – Spain
SSBCS – Survey of Small Business Credit Scoring
SSMGF – Survey of Small and Medium-sized German Firms
STBL – Federal Reserve's Survey of Terms of Bank Lending
Std. dev. – Standard Deviation
TJF – The Journal of Finance
TLD- Thailand
TR – Turkey
TUN- Tunisia
TW –Taiwan
UK – United Kingdom
US – United States
USD – United States Dollars
VC – Venture Capital: An International Journal of Entrepreneurial Finance
VE – Venezuela
VN – Vietnam
WBDI – World Bank Data Indicators
WBES - World Business Environment Survey
WSEAS – WSEAS Transactions on Business and Economics
ZA–South Africa

CHAPTER 1

The role of collateral in the credit acquisition process: Empirical evidence from SME lending

Abstract

We test the simultaneous impact of observed characteristics and private information on debt term contracts in a multiperiod setting, using a data set of 12,666 credit approvals by one major Portuguese commercial bank during 2007–2010. The main results show that borrowers with good credit scores that know they have a high probability of success and are unlikely to default are more willing to pledge collateral in return for lower interest rate premium (IRP). Furthermore, lenders tailor the specific terms of the contract, increasing both collateral requirements and IRP from observed risk, for borrowers operating in riskier industries and with less credit availability. The results are robust to controls for joint debt terms negotiation and the degree of collateralization offered by the borrower.

***Keywords**: SME, entrepreneurship signaling, private information, collateral*
JEL classification: D82, G21, G30

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Resumo

Este artigo testa o impacto simultâneo das características observadas e da informação privada nos contratos dívida bancária num contexto multi-período, utilizando uma base de dados que cobre informação sobre 12,666 créditos aprovados, entre 2007- e 2010, por um grande banco comercial Português. Os principais resultados mostram que os mutuários com um bom *score* de crédito, aqueles que sabem que têm uma alta probabilidade de sucesso e os que não tendem a entrar em incumprimento estão mais dispostos a prestar garantias bancárias em troca de uma menor taxa de juro. Além disso, os resultados demonstram que os credores adequam os termos específicos do contrato, aumentando ambos os requisitos de garantias bancárias e a taxa de juro com base no risco observado, nomeadamente nos empréstimos concedidos a mutuários que operam em indústrias de maior risco e com menor disponibilidade de crédito. Os resultados são robustos quando controlado o montante das garantias bancárias no estudo da relação conjunta dos termos da crédito.

Palavras-Chave: *PMEs,* sinalização, finanças empresariais*, informação privada, garantias bancárias*

Classificação *JEL*: D82, G21, G3

1.1. Introduction

A central characteristic of small and medium-sized enterprises (SMEs) is their dependence on bank credit for external financing (Degryse and Van Cayseele, 2000). Asymmetric information and agency costs underlie the inadequate financing of SMEs; therefore, banks issue restrictive loan term contracts to reduce their default exposure. Thus, in the design of loan term contracts, collateral assumes a key role as a risk management instrument, especially for SME lending (Bonfim, 2005).

To analyze the role of collateral in debt term contracts, Han et al. (2009) propose a "sorting by signaling and self-selection" (SBSS) model that emphasizes two unique views on how collateral can mitigate credit risk better than sorting by observed risk (SBOR) (e.g., Berger and Udell, 1990) or sorting by private information (SBPI) (e.g., Bester, 1985). In the SBOR model, borrowers' risk types are observable, so lenders require collateral and higher interest rate premium (IRP) on the basis of borrowers' observed characteristics (demand-side argument). In the SBPI model, good borrowers instead offer collateral as a reliable signal of their low risk, and in return, they expect a loan contract with lower IRP (supply-side argument). Combining features of these existing paradigms, the SBSS model introduces borrowers' observable characteristics (i.e., SBOR) to design an incentive-compatible menu of loan contracts that works as a self-regulating mechanism (i.e., SBPI). With this model, both demand- and supply-side factors guide the design of loan contracts negotiated with banks.

In testing the simultaneous impacts of observed characteristics and private information on debt term contracts, we extend Han et al.'s (2009) model in three ways. First, because loan term contracts (i.e., collateral and IRP) are jointly determined (Brick and Palia 2007), we test the signaling value of collateral and consider the determinants of IRP, with the assumption that they can be determined endogenously, as predicted by the SBSS model (Godlewski and Weill, 2011). Second, our analysis spans a multiperiod setting, which allows us to control for the survivor bias effect, that is, by including not only surviving firms but also default firms. Third, unlike previous studies, our unique data set permits us to conduct the analysis with a continuous variable for collateral; thus, we test the SBSS model by controlling for not just whether collateral was provided but also the amount pledged. These extensions in turn lead to three main contributions to extant literature.

First, though some empirical studies examine the role of collateral in mitigating informational asymmetries in loan contracts (e.g., Berger et al., 2011; Jimenez et al., 2006; Menkhoff et al., 2006; Voordeckers and Steijvers, 2006), few explore the interdependencies of collateral and IRP. Those that do generally use U.S. data (e.g., Brick and Palia, 2007; Han et al., 2009), which reflect market-based financial systems (La Porta et al., 1998). The current study instead analyses the role of collateral in loans granted to SMEs in Portugal, a country characterized by a bank-based system and an economy dominated by SMEs. This issue is particularly relevant considering the structural differences in the size and importance of U.S. and EU banking sectors relative to their respective overall financial sectors (Schildbach and Wenzel, 2013). Specifically, in the United States, financial firms other than banks have grown

more quickly in recent decades, such that the so-called shadow banking system overtook the traditional banking system in size by the 1990s. In Europe, most financing still moves through traditional credit institutions, so even though the economies are roughly comparable in size, the EU's banking sector has more than four times as many total bank assets as the U.S. sector, which has important repercussions for how SMEs find external funding.. European banks' relatively limited capacity to provide credit to private and public sectors thus determines the economy's overall financial strength far more in Europe than in the United States, where actors other than banks are equally relevant.[1] In Portugal, this issue is critical: It suffers the third worst credit conditions within the European Union (Gaspar, 2012).

In addition, the effect of creditor protection on bank lending to small businesses is largely unexplored, despite the fact that small businesses constitute a crucial sector of virtually all economies (Banco de Portugal 2013). The differences in Portuguese and U.S. bankruptcy codes are best viewed from the perspective of super-priority financing, automatic stays, and the legislation goals in general; in the United States, both liquidation (Chapter 7) and reorganization (Chapter 11) are legal under bankruptcy code, and thus, the country is characterized as debtor friendly. In contrast, Portugal's 2004 bankruptcy code not only moves away from debtor protection but also explicitly emphasizes the liquidation of firms over their rescue and recovery. As part of this protection of creditors' rights, Portugal's legislation does not allow for automatic stays from creditors, whereas under U.S. legislation, Chapter 11 allows firms in reorganization to postpone all repayments of capital and interest until reorganization is complete as a way of preserving the company as an operating concern. Finally, super-priority financing under the Portuguese system only occurs if an insolvency plan expressly provisions for it or if the firm has any collateral assets free to bank this potential claim; in contrast, under the U.S. system, firms can use super-priority financing without such limitations.

Second, our sample covers 2007–2010, so we provide empirical evidence of the effect of macroeconomic conditions on loan term contracts during credit crunch and recession periods. We control for this effect by balancing the number and amount of loans granted before and after the 2008 financial crisis and using a censored model to predict the determinants of the amount of collateral required (Lambrecht, 2009).

Third, to the best of our knowledge, we are the first authors to focus on the Portuguese loan market. According a survey conducted by the European Central Bank (ECB), SME access to finance in the euro area has remained broadly unchanged; however, substantial cross-country differences are evident, and in general, financing is more difficult for SMEs than for large

[1] The differences between the U.S. and EU banking markets grew after the financial crisis. Previously, both U.S. and European banks reported profits; currently, only U.S. banks do so, while their European peers struggle to stay above this line consistently. In addition, U.S. lending is growing, and loan loss provisions have returned to 2007 levels. In contrast, loan growth remains weak in Europe, and loan loss provisions remain elevated. European banks' greater need to raise capital ratios and stronger deleveraging and shrinking has put them at a competitive disadvantage compared with their U.S. counterparts (Schildbach and Wenzel, 2013).

companies (ECB 2015). Using 12,666 credit approvals by one of the largest commercial banks in Portugal, we show that risky borrowers must provide collateral and pay higher IRP to obtain a loan, in line with the SBOR (demand-side) model. Sharing private information between lenders and borrowers also exerts an impact, such that borrowers with good credit scores, which know they have a high probability of success, are more willing to pledge collateral in return for lower IRP, in line with the SBPI (supply side) model. The results are robust when we control for joint debt term negotiation and the degree of collateralization pledged by the borrower. Thus, SBSS sheds more light on entrepreneurial debt contracts in Portugal, due the high incidence of collateral at origin of the contract (i.e., the moral hazard [MH] effect).

The next section provides an overview of the role of collateral in mitigating agency costs. In Section 1.3, we describe the data, variables, and method; section 1.4 reports the discussions of the results. Section 1.5 shows several robustness tests. Finally, section 1.6 concludes with some implications and avenues for further research.

1.2. The role of collateral in debt term contracts: An overview

Bank loans are the most widely used form of SME financing (Berger and Udell, 1995), though these exchange relationships often suffer from market imperfections, such as information asymmetries. Information asymmetries occur because the lenders lack reliable information about the default risk of the applicants. The mostly unlisted SMEs also tend to lack audited financial statements, so they have difficulty signaling their quality to financial institutions. Such information asymmetries can be so severe that they eventually lead to credit rationing.

The aim of using collateral in the credit acquisition process is to reduce banks' exposure to loss and thereby mitigate credit rationing for SMEs (Stiglitz and Weiss, 1981). Yet the question of why some loans occur without collateral, while other loans require securitization, continues to plague scholars (Steijvers et al. 2010). Several theories suggest collateral is an information asymmetry–reducing instrument, whether because it provides an incentive that reduces MH problems or because it serves as a screening device that resolves the adverse selection (AS) problem. Consistent with MH theory, empirical studies generally indicate a positive relation between collateral and borrowers' risk (e.g., Jiménez et al. 2006). Thus, banks sort borrowers on the basis of information they have about credit quality (SBOR) and then charge riskier borrowers higher interest rates premium and demand collateralized loans from them. Screening models instead consider the effects of asymmetric information on the relation between risk and collateral (cf. Stiglitz and Weiss, 1981). As Bester (1985) shows, if borrowers' riskiness is hidden information, a bank can use collateral as a screening device to distinguish between high- and low-risk borrowers and thus mitigate its AS problem. Borrowers with a low probability of bankruptcy are more inclined to accept higher collateral requirements if doing so reduces their interest rate premium, compared with SMEs with a high probability of failure. Therefore, the various contracts provide a self-selection mechanism to separate borrowers with different risk profiles, implying that collateral and interest rate premium act as substitutes

(Besanko and Thakor, 1987; Bester, 1985). Accordingly, a lender offers each borrower a set of incentive-compatible contracts, and collateral serves as a mechanism to reveal the borrower's private information about its ex ante risk preference (SBPI)[2].

1.2.1. SBSS

The SBSS model derives from entrepreneurial rather than corporate finance models, which Han et al. (2009) justify with three rationales. First, following Bolton Committee (1971) they assume that a small business is owned and managed by the same individual; thus, the personal characteristics and wealth of SME owner-managers have a stronger influence on firm performance than in large companies (e.g., Tirole, 2010). Because the owner's personal wealth cannot be separated entirely from the assets of the business, it frequently serves as a means to access bank loans (Ang et al. 1995); thus, the availability of collateral is mainly determined by the business owner's personal wealth. Second, the downside risk associated with loan defaults due to business closures is much higher among SMEs than for mature, large firms (e.g., Hart and Oulton, 1999). Third, rating agencies and the financial press seldom monitor SMEs, so information asymmetries are more significant. For example, in comparison with large firms very little information about small firms and their owners is in the public domain. Thus, collecting information is more costly for this group of firms, particularly in proportion to the amount borrowed (Ang 1991)[3]. Taking these features in account, Han et al. combine features of the SBOR paradigm and the SBPI paradigm to present the SBSS model[4].

The borrower's risk type is private information and unknown to the lender. Whereas Bester (1985) draws all borrowers from the same distribution, Han et al. (2009) suggest that, on the basis of observable characteristics, borrowers can represent two possible distributions: good and bad. The SBSS model assumes a one-period setting and perfect competition in the lending market, such that in equilibrium, by offering two different contracts to any given borrower, the lender can separate good borrowers from bad ones. That is, a low (high) interest and high (low) collateral contract is preferable to good (bad) borrowers. Then the specific terms of the contract (i.e., precise IRP and collateral requirements) can be tailored according

[2] For reviews of theoretical models and empirical studies on the use of collateral, see Coco (2000) and Steijvers and Voordeckers (2009a), respectively.

[3] Here in after, we use the terms "small business" and "business owner" interchangeably, in line with the entrepreneurial literature.

[4] Han et al.'s (2009) use of the signaling concept differs from that of Bester (1985). According to Han et al., signaling is the process by which a lender makes a lending decision by collecting information from an "observable signal" transferred by a borrower. In contrast, Bester uses signaling as a mechanism by which a borrower discloses his or her unobservable quality to the lender by pledging collateral on loans. However, Lambrecht (2009) notes that Han et al.'s use of the term "signaling" (2009) is confused because in information economics this concept refers to (usually costly) action undertaken by an agent to credibly reveal information about his or her type. Therefore, he suggests that Han et al should more accurately call their model "sorting by characteristics and self-selection" (Lambrecht, 2009, p. 457).

to the borrower's observable characteristics. In this sense, the SBSS captures two important features of bank lending: (1) Banks offer an array of standardized loan products from which customers may choose, and (2) the specific terms of any particular loan can be modified in accordance with the borrower's creditworthiness.

1.2.2. Research hypotheses and empirical implications

The SBSS model suggests three specific hypotheses. The first is consistent with screening models, in which borrowers that are unlikely to undergo bankruptcy are more inclined to accept higher collateral requirements to reduce their IRP than are those with a high probability of bankruptcy, because their risk of losing their collateral is low (Chan and Kanatas, 1985). Therefore, collateral and IRP act as substitutes (Bester, 1985). To categorize borrower types (private information), Han et al. (2009) use ex post profits at the time of the loan decision and predict:

> ***H1**: Less risky borrowers choose a contract with more collateral and a lower interest rate premium, whereas risky borrowers choose a contract with less collateral and a higher interest rate premium.*

The next two hypotheses derive from Han et al.'s (2009, p. 431) corollaries 1 and 2, respectively. That is, larger loans should go to less risky borrowers with low probabilities of default, such that larger loans also should increase the likelihood of an exchange of collateral for lower IRP. Furthermore, borrowers that transmit low risk signals obtain better contract terms (i.e., lower collateral requirements and/or low IRP). Such observable signals reflect the characteristics of the business (e.g., profitability, total liabilities, total assets) and the owner (e.g., age, experience, court judgment history). Thus,

> ***H2**: Loan size relates positively to the amount of collateral and negatively to interest rates premium.*

> ***H3**: Borrowers who transfer low risk signals obtain lower interest rates premium and/or put up lower collateral.*

1.3. Data, variables, and method

1.3.1. Data and information environment

We use data from a major commercial bank operating in Portugal, gathered between January 2007 and December 2010.[5] These data represent the Portuguese banking environment reasonably well, in that they represent a long-term credit decision period and cover most of this bank's credit portfolio for various geographical regions; thus, we do not expect regional

[5] We guaranteed this bank confidentiality and anonymity for it and its customers.

biases in credit policy. Interviews with account managers also revealed that the bank maintains a single general credit policy, according to which account managers may approve credit requests below certain threshold on their own; if the credit request surpasses this threshold, the decision occurs at a central bank level. The degree of market concentration, measured by the Herfindahl-Hirschman index, was 1303, indicating a moderately concentrated market (APB 2012, pp. 29, 63)[6].

In Portugal, SMEs represent 99.6% of businesses and create 75.2% of private employment and 56.4% of trade (Banco de Portugal, 2013). Accordingly, the data set is large, including 12,666 loans to SMEs. We define SMEs in line with the European Commission (2003/361/EC), as well as the Basel II agreement, as firms with fewer than 250 employees and annual business volumes less than €50 million or assets that do not exceed €43 million. Most of the loans were issued in 2009 (34.65%) and 2010 (38.47%), rather than 2007 (10.45%) or 2008 (16.43%). Previous research reveals that loan terms can differ as a function of the type of business operation (Berger and Udell, 1998), so we sought to focus on financial loans[7] and excluded unincorporated business, for which the assets are not separate from the owner's (such businesses usually are classified as households).

1.3.2. Variables

1.3.2.1. Dependent variables

In line with the SBSS model, we aim to examine the simultaneous impacts of observed characteristics and private information on debt term contracts. Thus, the dependent variables are collateral, collateralization, and IRP. *Collateral* is a dummy variable, equal to 1 if the firm posts collateral and 0 otherwise. *Collateralization* reflects the collateralized percentage of the loan granted, according the bank's internal evaluation. Finally, *IRP* is the interest rate premium percentage beyond the indexer (i.e., Euribor 12 months) that the bank charges.

1.3.2.2. Independent variables

According to the SBSS model, the key determinants of loan contract terms are observable signals transmitted by borrowers to the lender and the borrower's credit quality, which is private information. Empirically, we use two variables to measure observed risk: industry risk and credit availability. *Industry risk* is the ratio of the default loans to total loans

[6] Values of this ratio below 1000 suggest little bank concentration; values between 1000 and 1800 indicate moderate concentration, and values greater than 1800 imply a highly concentrated market.

7 We exclude loans that are mainly transaction driven (e.g., mortgages, equipment loans, motor vehicle loans, loans based on the purchase of fixed assets) because they are typically granted on a (business) collateral basis; in asset-based lending of this type (Steijvers and Voordeckers 2009b; Berger and Udell, 2002), it is frequently mandatory to provide the assets funded by the loan as collateral independently of the observable or private borrower´s information. Thus, including these loans in the sample would likely skew the global results.

granted, by average industry. Because information regarding the characteristics of the firms and their owners is scarce in our data set, we also include *credit availability*, or the difference between the loan credit available throughout the financial system and the loan amount approved for the firm[8]. For a given loan size, reduced credit availability indicates relative financial distress. Han et al. (2009) instead employ industry risk, industry profitability, and owner experience in the business.

Tests of the SBPI paradigm require insight into the private information about borrower credit quality, which the lender does not know precisely at the time it grants the loan. We use the *credit score* defined by the lender at the time it grants the loan. This score combines data about the personal credit history of the small business owner with firm financial data. In response to the Basel II Accord, banks often compute minimum capital requirements using an internal ratings–based approach. Therefore, we include four dummy credit score variables: *Credit Score AAA:BB* equals 1 if the score is classified as AAA to BB; *Credit Score BB-* equals 1 if the loan is classified with an internal credit score of BB-; *Credit Score B+:B-* equals 1 if the loan is classified with an internal credit score of B+ to B-; and *Credit Score CCC:C* equals 1 if the loan is classified with an internal credit score of CCC to C. Each variable equals 0 otherwise.

To assess the borrower's private information, we use ex post default, a variable that takes a value of 1 if the borrower did not have any loan in default at the time the loan was granted but then defaults after obtaining the loan (Jiménez et al., 2006). In this sense, it supports a test of SBSS in a multiperiod setting. Han et al. (2009) employ an ex post profitability index on equity return, which restricts their analysis to a one-period setting.

Regarding the loan characteristics, we introduce *LoanSize* (measured in euros) and *LoanMaturity* (number of months between loan origination and maturity) variables. To isolate borrower risk from transaction effects (because large firms tend to have large loans and thus are more likely to supply collateral), we also use loan size bands: *LoanSize1q* takes a value of 1 if the loan is less than €25,000 [≤1st quartile (Q)]; *LoanSize2q* equals 1 if the loan is greater than €25,000 but less than €50,000 (]1stQ;2ndQ]); *LoanSize3q* assumes the value of 1 if the loan size is above €50,000 but less than €200,000 (]2ndQ;3rdQ]); and *LoanSize4q* is 1 if the loan is greater than €200,000 (>3thQ). Each variable equals 0 otherwise. Because the sample period includes the global financial crisis of 2008–2009, we use *GDPpc* to proxy for economic development (Beck et al., 2006). The dummy variable *Financial stability* also takes a value of 1 if the loan was granted before the international crisis (i.e., before 2008).

In the SBSS model, collateral and IRP are jointly determined, so we rely on an instrumental probit estimator to determine the probability of collateralization. The instrumental variable (IV) for the IRP is the Euribor rate at 12 months (i.e., a variable that

[8] Portuguese law mandates that all institutions report monthly to the Banco de Portugal all loans above 50 euros. This information is maintained in the Central Credit Register (CRC). Thus, when granting a new loan, a bank can observe the total amount borrowed from other banks, as well as if the applicant has any credit overdue.

affects the price of the credit but not collateralization), the variable *Euribor*. The choice of this IV relates to evidence that the adjustments made in the financial market by the Euribor rate (inversely) influenced the mean of the IRP on banks' loan portfolios. To assess IRP, we use a two stage least squares (2SLS) estimator. For the collateral we use *Project finance* (i.e., a dummy variable that equals 1 if the loan was granted to finance a project and 0 otherwise; e.g., Godlewski and Weill, 2011). We use this variable because the loan risk evaluation is a function of the cash flow generated by the project alone rather than by the wealth of the borrower (Yescombe, 2002). Because the probability of repayment for a loan depends on its purpose, we can assume that the loan purpose influences the lender's requirement for collateral (Godlewski and Weill, 2011). Table 1.1. contains all the variable definitions as well the descriptive statistics. Appendix 1.1. contains descriptive statistics by subsample.

Table 1.1. Variables definition and descriptive statistics

This table present variables definition and descriptive statistics. *Industry risk* is calculated using the ratio of the default loans to total loans granted, by average industry. C*redit availability is* or the difference between the loan credit available throughout the financial system and the loan amount approved for the firm, and the *Ex-post default* variable is based on information available in the Central Credit Register. *Credit Scores* are the internal scores assigned by the risk department of the bank to the loan applicant.

Variable	Definition	Obs.	Mean	Std. dev.	Min.	Max.
Dependent variables						
Collateral	Equals 1 if borrower has pledged collateral (0,1)	12,666	0.753	0.432	0	1
IRP	Difference between the contractual interest rate for the loan and the prime rate	12,666	2.889	1.172	0.5	13.78
Collateralization[9]	Collateralized percentage of the loan granted according the internal evaluation of the bank	12,666	0.663	0.422	0	1
Observable Characteristics						
Industry risk	Ratio of the default loans divided by total loan granted by industry	12,666	4.454	1.862	0.05	7.075
Credit availability	Difference between credit available in the entire financial system for the firm and loan amount approved by the bank to the firm (€)	12,666	1,700,295.00	8,513,603.00	0	185,000,000.00
Private Information						
Credit Score AAA:BB	Equals 1 if the loan is classified with an internal credit score of AAA to BB (0, 1)	12,666	0.515	0.500	0	1
Credit Score BB-	Equals 1 if the loan is classified with an internal credit score of BB- (0,1)	12,666	0.190	0.393	0	1
Credit Score B+:B-	Equals 1 if the loan is classified with an internal credit score of B+ to B- (0, 1)	12,666	0.256	0.437	0	1
Credit Score CCC:C	Equals 1 if the loan is classified with an internal credit score of CCC to C (0,1)	12,666	0.040	0.193	0	1
Ex-post default	Equals 1 if borrower did not default previously but defaulted after the loan was granted (0,1)	12,666	0.189	0.391	0	1

[9] Regarding the collateralization statistics, if we consider the sample with collateral provided (i.e., Collateral = 1), hence the mean of collateralization is 0.882, the median = 1, the standard deviation = 0.203.

Table 1.1. Variable definitions and descriptive statistics (Continuation)

GDP is available in the World Bank Indicators. *Euribor* is based in information available in the European Money Markets Institute.

Variable	Definition	Obs.	Mean	Std. dev.	Min.	Max.
Loan Characteristics						
LoanSize	Loan amount measured in euros	12,666	315,413.10	1,696,316	5,000	67,000,000
LoanMaturity	Number of months between loan origination and maturity	12,666	44.048	29.530	1	336
LoanSize1Q	Equals 1 if loan size is less than €25,000€ (≤1st quartile (Q)) (0,1)	12,666	0.349	0.477	0	1
LoanSize2Q	Equals 1 if loan size is between €25,000€ and €50,000(]2nd Q; 3rd Q]) (0,1)	12,666	0.232	0.422	0	1
LoanSize3Q	Equals 1 if loan size is between €50,000 and €200,000 (]3rd Q;4th Q]) (0,1)	12,666	0.196	0.397	0	1
LoanSize4Q	Equals 1 if loan size is more than €200,000 (>3th Q) (0,1)	12,666	0.223	0.416	0	1
Macroeconomic Conditions						
GDPpc	Gross domestic product per capita, in euros (constant price)	12,666	17,421.1	210.714	17,186.06	17,742.67
Financial Stability	Equals 1 if the loan is granted before the international crisis (before 2008) (0,1)	12,666	0.105	0.306	0	1
Interaction effects						
INTER1	Ln (LoanSize+1) * Ex post default	12,666	2.088	4.389	0	17.569
INTER2	LoanSize 1Q * Ex post default	12,666	0.058	0.234	0	1
INTER3	LoanSize 2Q * Ex post default	12,666	0.047	0.212	0	1
INTER4	LoanSize 3Q * Ex post default	12,666	0.042	0.202	0	1
INTER5	LoanSize 4Q* Ex post default	12,666	0.039	0.195	0	1
Instrumental Variables						
Project finance	Equals 1 if loan is to finance a project (0,1)	12,666	0.085	0.280	0	1
Euribor	Euribor at 12 months	12,666	2.585	1.119	1.251	4.124

1.3.3. Method

To test the SBSS model, we examine the role of both observable signals transmitted by the borrower to the lender[10] and private information. A consensus across screening models (Bester, 1985) and self-selection models (Han et al., 2009) is that IRP and collateral act as substitutes in the presence of informational asymmetries. Therefore, both loan price terms are jointly determined, which may promote endogenous problems caused by the correlation between endogenous variables and the error term. If endogeneity prevails, a probit (ordinary least squares [OLS]) model for collateral (IRP) will provide biased results. Accordingly, we employ a simultaneous equation method to estimate the separate impacts of the collateral and the loan interest rates premium (e.g., Brick and Palia, 2007).

To test for endogeneity, we follow Rivers and Vuong (1988) and Wooldridge's (2010) method, relying on the IV approach: First, we regressed all possible endogenous variables on all independent and control variables, including IVs, to obtain the reduced form of the residuals. Then, the OLS regression expands to the IRP and probit regression to Collateral on all exogenous variables, including the residuals obtained in the first step. If the residual t-statistics are not statistically significant, the results do not reject the null hypothesis; that is, the contract terms are exogenous. If we find evidence of endogeneity, we perform the Durbin (1954) and Wu-Hausman (Wu, 1974; Hausman, 1978) tests - Ho: Collateral (IRP) is exogenous. If these tests show that one (or both) contract terms are endogenous, we next check the validity of the IVs (by regressing the instrumented variable on IVs) and replace the OLS (Probit) model with a 2SLS (Instrumental Probit) model for IRP (Collateral). To conduct these tests, we use two IVs: the Euribor rate at 12 months for IRP and Project Finance for Collateral.

We conducted postestimation tests to determine validity of estimations and instruments: (1) Durbin and Wu-Hausman tests expand to Wooldridge's (1995) robust score test and robust regression-based test (see Baum, 2006); (2) The F-test, Cragg test, and Stock and Yogo (2005) test are conducted for weak identification ($H_{0:}$ IVs are weak; i.e., Corr (x, z) = 0). The simultaneous equation system is as follows:

$$\text{Collateral}_i=\alpha_i+\beta_1\widehat{\text{IRP}}_i+\beta_2\text{Industry Risk}_i+\beta_3\text{Credit Availability}_i+\beta_4\text{Credit score (AAA:BB)}_i+$$
$$\beta_5\text{Credit score (BB-)}_i+\beta_6\text{Credit score(B+:B-)}_i+\beta_7\text{Credit Score(CCCC:C}_i)$$
$$+\beta_8\text{Ex-PostDefault}_i+\beta_9\text{Loan Size}_i+\beta_{10}\text{Loan Maturity}_i+\beta_{11}W_i+\varepsilon_i \quad \text{(Eq.1)}$$

$$\text{IRP}_i=\alpha_i+\beta_1\widehat{\text{Collateral}}_i+\beta_2\text{Industry Risk}_i+\beta_3\text{Credit Availability}_i+\beta_4\text{Credit score (AAA:BB)}_i$$
$$+\beta_5\text{Credit score (BB-)}_i+\beta_6\text{Credit score(B+:B-)}_i+\beta_7\text{Credit Score(CCCC:C}_i)$$

[10] Because Portuguese financial institutions must report data to the CRC, they can also consult information about current and prospective borrowers. Therefore, no financial institutions grant credit to any borrower that, at the time of loan negotiation, has any credit overdue or has defaulted in the six months previous according the reports of the CRC.

$$+\beta_8 \text{Ex-PostDefault}_i+\beta_9 \text{Loan Size}_i+\beta_{10} \text{Loan Maturity}_i+\beta_{11} W_i+\varepsilon_i \quad \text{(Eq.2)}$$

where $\widehat{IRP}_i$ and $\widehat{Collateral}_i$ are the fitted values obtained in the first step; W_i is the vector of control variables, and ε_i is the error term uncorrelated with the endogenous and instrumental variable.

Han et al. (2009) developed their model based on the amount of collateral pledged by the borrower. However, empirically most studies employ a binary variable, which implies that the model can only tested indirectly. To overcome this data limitation, our unique data set allows us to use both: Collateral as a binary variable and Collateralization as a continuous variable measured by the collateral-to-loan ratio (%). To examine these issues, we regress *Collateralization* in the same set of explanatory variables used in eq. (1). When the variable *Collateralization* contains a cluster of zeros (which might lead OLS estimators to provide biased and inconsistent estimators; Menkhoff et al., 2006), we rely on the censored regression model (Tobit), which is an extension of the probit model (e.g., Elsas and Krahenen, 2000; Lehman and Neuberger, 2001; Hanley, 2002; Menkhoff et al., 2006). With this method (for censored samples[11]), the regressand (*collateral-to-loan ratio*) divides the firms in two groups: one consisting of firms about which we have information on the regressor as well the regressand and another consisting of firms about which we have information on only the regressor and not the regressand[12].

To validate the potential endogeneity between *IRP* and *Collateralization*, we follow the steps described for eq. (2) and (3). If we do not accept the exogeneity between these variables, we must use an instrumental Tobit estimator:

$$\text{Collateralization}_i=\alpha_i+\beta_1 \widehat{IRP}_i+\beta_2 \text{Industry Risk}_i+\beta_3 \text{Credit Availability}_i+\beta_4 \text{Credit score (AAA:BB)}_i$$
$$+\beta_5 \text{Credit score (BB-)}_i+\beta_6 \text{Credit score(B+:B-)}_i+\beta_7 \text{Credit Score(CCCC:C}_i)$$
$$+\beta_8 \text{Ex-PostDefault}_i+\beta_9 \text{Loan Size}_i+\beta_{10} \text{Loan Maturity}_i+\beta_{11} W_i+\varepsilon_i \quad \text{(Eq.3)}$$

[11] For an extensive overview on censored samples, see Gujarati (2010) and Green (2003).

[12] Hanedar et al. (2014) argue that the Tobit could be restrictive if the data-generating process determines both the binary and continuous dependent variables. Therefore, if the bank assumes that the first decision is to require (or not require) collateral on a loan contract and then decides the amount of collateral, using a two-part model (as a truncated regression model) seems more appropriate theoretically than using a single Tobit model. Nonetheless, because in this study we aim to examine the level of *Collateralization* in the context of SBSS theoretical predictions rather than to analyze the collateralization steps, we may assume that the cluster of zeros represent a corner solution and not a cluster that should be dropped for our analysis solution (for an overview about corner-solution motivations, see Baum 2006, p. 262).

where $\widehat{IRP}_i$ is the fitted value of the loan interest rate premium percentage obtained in the first step; W_i is the vector of control variables, and ε_i is the error term uncorrelated with endogenous and instrumental variable.

1.4. Empirical results

1.4.1. Descriptive statistics and univariate tests

Descriptive statistics (Table 1.1.) show that 75.3% of loans were collateralized. To compare these values with the United States, Han et al. (2009) and Brick and Palia (2007) report values of 63.07% and 57.2%, respectively. The sample firms paid a mean rate of 2.889% in IRP. The collateralization ratio is 66.3%, across all loans granted by the lender. For only those firms that provide collateral, this ratio increases to 88.2% of the loan amount. Appendix 1.1 reports the descriptive statistics by *Collateral*, *IRP* median, and *Collateralization* median subsamples.

Table 1.2 contains the results of the univariate tests for Collateral, IRP, and Collateralization variables. For the collateral variable, the results indicate that firms that provide collateral paid lower IRPs (2.723% versus 3.390%; $p < .01$). This result is confirmed by the IRP mean variable, which shows that firms that provide collateral paid an IRP lower than the median (62% versus 89.8%; $p < .01$). For the variable *Collateralization*, the association is positive; that is, a higher ratio of collateralization implies a higher IRP (2.775% versus 2.602%; $p < .01$). In addition, firms that provide collateral and are given an IRP above the mean tend to belong to riskier industries (collateral: 4.570 versus 4.104; IRP: 4.581 versus 4.314). However, when we control for the amount of collateral pledged, we observe an opposite result: Firms that pledged more collateral belong to less risky industries (4.394 versus 4.979; $p < .01$). The findings also show that credit is readily available for firms that pay higher IRPs and have a low incidence of collateral. Nonetheless, the results show a positive relation between credit availability and collateralization ratio. These results only partially support H3, which posits that lenders require more collateral (and higher IRP) from borrowers that transfer bad signals.

Univariate tests also confirm that collateralized loans tend to give firms with higher credit scores (Credit Score AAA:BB) an IRP below the median (collateral: 52.9% versus 47.1%; $p < .01$; IRP: 45.8% versus 57.7%; $p < .01$). Nonetheless, the findings also show that, after the decision to provide collateral is made, those firms provide a lower collateral-to-loan ratio (51.3% versus 56.7%; $p < .01$). Furthermore, those firms that have pledged collateral and paid IRP below the median are less likely to be in *ex post* default (collateral: 16.3% versus 26.3%, $p < .01$; IRP: 15.9% versus 21.3%; $p<.01$).

Table 1.2. Univariate Tests (nonparametric)

This table presents univariate tests for independent variables. *Wilcoxon-Mann-Whitney* test is conducted for continuous variable on mean; a z-test applied to binary variables at the median. H0: mean (y = 0) = mean (y = 1). DIFF = mean (y = 1) – mean (y = 0). Median (IRP) = 2.625; Median (Collateralization) = 1. Univariate test by Collateralization applied for the subsample of SMEs that provided collateral (i.e., SMEs reporting "Collateral = 1")

*** *p*. < .01. ** *p*. < .05. * *p*. < .1

	Mean			Mean			Mean		
	Collateral=0 (N=3,140)	Collateral=1 (N=9,526)	Diff.	IRP < Median (N=6,035)	IRP ≥ Median (N=6,631)	Diff.	Collateralization < Median (N=2,853)	Collateralization ≥ Median (N=6,673)	Diff.
IRP	3.390	2.723	-0.667***				2.602	2.775	0.173***
Collateral				0.898	0.620	-0.278***			
Observable characteristics									
Industry risk	4.104	4.570	0.466***	4.314	4.581	0.267***	4.979	4.394	-0.585***
Credit availability	3,317,916	1,167,088	-2,150,827***	1,309,208	2,056,232	747,024***	944,452	1,262,275	317,823
Private Information									
Credit Score AAA:BB	0.471	0.529	0.058***	0.577	0.458	-0.119***	0.567	0.513	- 0.055***
Credit Score BB-	0.213	0.183	-0.030***	0.173	0.206	0.033***	0.177	0.185	0.008
Credit Score B+:B-	0.274	0.251	-0.023***	0.221	0.289	0.068***	0.236	0.257	0.021**
Credit Score CCC:C	0.041	0.038	-0.003	0.029	0.047	0.018***	0.020	0.045	0.025***
Ex post default	0.263	0.163	-0.100***	0.159	0.213	0.054***	0.111	0.185	0.074***
Loan Characteristics									
LoanSize	504,839.2	252,973.7	-251,865.6***	292,238	336,505.2	44,267.2***	291,759.1	236,391.2	-55,367.96
LoanMaturity	29.290	48.914	19.628***	45.426	42.793	-2.633	49.508	48.659	-0.849

However, table 1.2 shows a positive relation between ex post default likelihood and collateral-to-loan ratio (18.5% versus 11.1%; $p < .01$). These results only partially support H1, which posits that less risky borrowers choose a contract with collateral in return for lower IRP. When we look for the collateral-to-loan ratio, we find that less (more) risky borrowers with collateralized loans provide a lower (higher) amount of collateral. In contrast to Han et al. (2009), we find that collateralized loans and loans granted with lower interest rate premium in our sample tended to belong to firms that received less credit (i.e., lower LoanSize, $p < .01$), so we must reject H2 (we examine this finding further in the context of SBSS model). However, in summary, the univariate tests confirm that collateralized loans are associated with higher maturities ($p < .01$).

The correlation matrix reveals a negative correlation ($p < .01$) of collateral (and collateralization) with IRP. Both private information and observed signals influence the loan price terms. Moreover, the correlation values for the independent variables are less than .5, which indicates that multicollinearity was not a problem (Gujarati and Porter, 2010), as confirmed by the variance inflation factors (these results are available upon request)).

1.4.2. Validity of IVs

To establish a benchmark to evaluate simultaneous equation system results, Appendix 1.2. (Appendix 1.3.) reports the single probit estimator (OLS estimator) for *Collateral* (*IRP*) on all exogenous variables, including the possibility of an *IRP (Collateral)* endogenous variable, plus the residuals of IRP (*Collateral)* obtained in the first step. For all single estimations, the residual t-statistics (of *IRP* and *Collateral*) indicate significance ($p < .01$), rejecting the null hypothesis that the contract terms are exogenous. The significance of Durbin and Wu-Hausman tests ($p < .01$) confirms that both *IRP* and *Collateral* are endogenous. Thus, the simultaneous equation system may provide more consistent results. The right-hand column [i.e., right-hand specification] of Appendix 1.2. (Appendix 1.3.) checks the validity of *Project Finance (Euribor)* as an IV of *Collateral (IRP)*.The results report coefficients statistically significant at 1%, indicating that they are good IVs (Ono and Uesugi, 2009).

Although loan size and loan maturity are potentially endogenous, the number of endogenous variables the model can handle is constrained by the difficulties of conceiving of instruments for loan maturity and loan size that would not also be related to *Loan Interest Rate Premium* and/or *Collateral* variables (Brick and Palia, 2007). To address this difficulty in our data set, we rely on Brick and Palia's (2007) suggestion; that is, the results do not change significantly when the *LoanMaturity* and *LoanSize* are moved into and out of the test of the SBSS model.

1.4.1. Probability of collateralization

The SBSS model tests feature of the full sample, including companies that default after obtaining the loan, so we use an additional variable to measure asymmetric information between the lender and the borrower, namely, ex post default. Therefore, the discussion of

the empirical results focuses on this model, as shown in table 1.3. The results in the first specification of table 1.3 present the basic model, the second specification controls for the macroeconomic variables, and other three models control for transaction effects with loan size (LoanSize1q, LoanSize3q, LoanSize4q; specification [3]; Ln(LoanSize+1) and INTER1; specification [4]) and loan size dummies and their interactions (INTER2, INTER4, and INTER 5; specification [5]) with ex post default, the key determinant of the SBSS model.

The results confirm the SBOR model: higher IRP is associated with a higher probability of collateralization ($p < .01$), and borrowers that belong to less risky industries or are less financially distressed ($p < .01$) benefit from a low incidence of collateral. These results are consistent with Han et al. (2009), who show that lenders more often request collateral from firms that report past delinquency episodes, and thus provide observable signals that they are bad. Furthermore, because Portugal has low credit protection (e.g., Bonfim et al. 2012) at the time of loan origination, collateral requirements will directly reflect a bank's ability to realize assets upon default. As a consequence, banks' adjustments can reduce, but not fully eliminate, the effect of the bankruptcy code on default outcomes.

Regarding credit score variables, the results indicate a positive coefficient ($p < .01$) of the highest credit score category included in the model (i.e., *Credit Score AAA:BB*), in line with the SBPI model. When we include ex post default, we uncover negative coefficients ($p < .01$) in all specifications, as predicted by SBSS. In other words, borrowers of good quality - information that is known only imperfectly by the lender before the loan contract—provide collateral to signal their creditworthiness (Bester, 1985). In exchange, they benefit from lower IRP, in support of H1. Moreover, ex post defaulted firms opt not to provide collateral, to reduce the risk that they must surrender their assets to the lender in the event they default. These results provide empirical support for the SBSS model and H1 and H3. However, the positive coefficients ($p < .1$) for INTER1 (specification [4]) and INTER5 (specification [5]) reveal that for nonobserved low-risk borrowers, the lender requests more collateral to grant large amounts of credit, as predicted by the SBOR model (demand-side collateral). Han et al. (2009) report a positive coefficient for interactions of loan size and the high loan size band with the profit variable (proxy for nonobserved low-risk borrowers), but their results are not statistically significant.

Consistent with univariate tests, the coefficients of Ln(LoanSize+1), loan size3Q, and loan size4Q are negative and statistically significant ($p < .01$), which contradicts H2. Apparently, larger loans are assigned to observably good borrowers. Moreover, long-term loans tend to be collateralized more than short-term loans. These combined results indicate that the specific terms of any particular loan can be modified to reflect the borrower's actual creditworthiness, as predicted by the SBSS model. The results remain unchanged for the other variables (i.e., GDPpc+1 and financial stability; $p < .01$). For example, for periods of recession and after the international financial crisis, collateralization requests increased.

1.4.2. Interest rate premium

Unlike Han et al. (2009), we adopt the method employed by Godlewski and Weill (2011) such that our analysis includes the incidence of collateralization as key variable to explain the level of IRP charged by the lender (for the results from the test of the SBSS model for IRP, see Table 1.4). On the basis of the Durbin and Wu-Hausman exogeneity results (i.e., both collateral and IRP are endogenous), we rely on 2SLS to confirm the influences of both supply - and demand-side factors on IRP (Brick and Palia 2007).

Table 1.4 shows the results: the first specification tests the basic model, the second specification controls for the macroeconomic variables, and the last three specifications control for transaction effects between loan size (i.e., LoanSize1q, LoanSize3q, and LoanSize4q), loan size dummies, and the interactions with the ex post default variable (i.e., INTER1, INTER2, INTER4, and INTER5).

We find a negative coefficient for the collateral variable in all IRP specifications (p < .01), which contradicts the findings reported in Table 1.3 but matches the adverse selection hypothesis (Godlewski and Weill, 2011; Arouri et al, 2014). Overall, collateral appears to represent an important informative device prior to the negotiation of the IRP. At the moment borrowers offer collateral, the lender interprets it as a commitment gesture that the lender weights when it negotiates the IRP. Subsequently, borrowers benefit from a discounted interest rate premium. Furthermore, the positive (negative) coefficient of Industry Risk (Credit Availability) (p < .01) confirms that lenders weight observable information about the borrower to determine the interest rate offered, requiring higher IRP from observed riskier borrowers, in line with H3. The negative (positive) coefficient of the Credit Score AAA:BB (Credit Score CCC:C) variable confirms that borrowers with high (low) credit scores may choose contracts with more (less) collateral and lower (higher) IRP, in line with H1. The positive coefficient for ex post default (p < .05 in specification [2] and [3]) confirms that unobservable high-risk borrowers choose contracts with no collateral in exchange for a higher IRP, as predicted by H1. Thus, these results emphasize the role of private information in reducing IRP for good borrowers. Han et al. (2009) report that larger and older firms with experienced owners exchange collateral for lower interest rate premium. The negative coefficient of Ln(LoanSize+1), LoanSize3Q, and LoanSize4Q (p < .01) rejects H2 and suggests that larger loans are assigned to observably good borrowers. Nevertheless, the positive coefficient of Ln(LoanMaturity+1) (p < .01) suggests that as the maturity of the loan increases, borrowers pay higher IRP to receive these long-term loans, reflecting MH considerations. The results for the variables GDPpc+1 and financial stability (p < .01) confirm previous results; that is, during recession periods, banks also charge more collateral as well as a high IRP on loans granted.

Table 1.3. -Simultaneous System Estimations for *Collateral* - SBSS model

This table reports the IV Probit estimations for *Collateral* based on the SBSS model, including proxies for both observable characteristics and private information. The fitted values of the instrumented variable *IRP* was obtained from the first step equation using *Euribor* as the IV. Standard errors are reported between brackets.*** $p < .01$. ** $p < .05$. * $p < .1$

Second stage - IV Probit Regression
Dependent variable: *Collateral;* Instrumented variable: *IRP;* IV: *Euribor*

	(1)	(2)	(3)	(4)	(5)
IRP *(fitted values)*	0.195***	0.167***	0.163***	0.166***	0.161***
	(0.041)	(0.043)	(0.043)	(0.043)	(0.043)
Observed Characteristics					
Industry risk	0.068***	0.037***	0.039***	0.037***	0.040***
	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)
Ln(Credit availability+1)	-0.040***	-0.038***	-0.048***	-0.038***	-0.048***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Private Information					
Credit Score AAA:BB	0.134***	0.137***	0.138***	0.137***	0.138***
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Credit Score BB-	0.055	0.052	0.053	0.052	0.053
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
Credit Score CCC:C	-0.052	-0.028	-0.025	-0.032	-0.031
	(0.071)	(0.072)	(0.072)	(0.072)	(0.072)
Ex post default	-0.117***	-0.084**	-0.078**	-0.536**	-0.132**
	(0.034)	(0.035)	(0.035)	(0.259)	(0.067)
Other Variables					
Ln(LoanSize+1)	-0.085***	-0.081***		-0.089***	
	(0.012)	(0.012)		(0.013)	
Ln(LoanMaturity+1)	0.693***	0.679***	0.666***	0.677***	0.665***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
LoanSize1q			-0.012		-0.014
			(0.037)		(0.041)
LoanSize3q			-0.171***		-0.188***
			(0.040)		(0.046)
LoanSize4q			-0.227***		-0.262***
			(0.045)		(0.050)
INTER1				0.040*	
				(0.023)	
INTER2					-0.004
					(0.088)
INTER4					0.068
					(0.095)
INTER5					0.172*
					(0.096)
Ln(GDPpc+1)		-7.191***	-6.614***	-7.165***	-6.552***
		(1.333)	(1.344)	(1.334)	(1.346)
Financial stability		-0.194***	-0.197***	-0.196***	-0.199***
		(0.049)	(0.049)	(0.049)	(0.049)
Constant	-1.202***	69.248***	62.947***	69.093***	62.367***
	(0.190)	(13.024)	(13.137)	(13.031)	(13.154)
Observations	12,666	12,666	12,666	12,666	12,666
Wald chi squared	3,179.69	3,178.30	3,163.19	3,174.47	3,160.02
Prob. > Chi2	0.000	0.000	0.000	0.000	0.000
Log likelihood	-24,230.75	-24,191.67	-24,191.43	-24,190.02	-24,185.01

Table 1.4 -Simultaneous System Estimations for *IRP* - SBSS model

This table reports the 2SLS estimations for *IRP* based on SBSS model, including proxies for both observable characteristics and private information. The fitted values of the instrumented variable *Collateral* were obtained from the first step equation using Project Finance as IV. Standard errors are reported between brackets. *** $p < .01$. ** $p < .05$. * $p < .1$

Second stage – 2SLS
Dependent variable: *IRP;* Instrumented variable: *Collateral;* IV: *Project Finance*

	(1)	(2)	(3)	(4)	(5)
Collateral *(fitted values)*	-3.839***	-4.340***	-4.669***	-4.392***	-4.788***
	(0.633)	(0.803)	(0.906)	(0.818)	(0.937)
Observed Characteristics					
Industry risk	0.140***	0.113***	0.120***	0.114***	0.122***
	(0.016)	(0.014)	(0.015)	(0.014)	(0.016)
Ln(Credit availability+1)	-0.084***	-0.086***	-0.097***	-0.086***	-0.099***
	(0.011)	(0.012)	(0.015)	(0.012)	(0.015)
Private Information					
Credit Score AAA:BB	-0.208***	-0.187***	-0.175***	-0.186***	-0.170***
	(0.038)	(0.043)	(0.046)	(0.044)	(0.048)
Credit Score BB-	0.013	0.015	0.020	0.015	0.020
	(0.044)	(0.047)	(0.050)	(0.048)	(0.051)
Credit Score CCC:C	0.264***	0.287***	0.291***	0.281***	0.279***
	(0.078)	(0.084)	(0.089)	(0.085)	(0.091)
Ex post default	0.051	0.081*	0.086*	-0.593*	-0.079
	(0.042)	(0.044)	(0.046)	(0.350)	(0.091)
Other Variables					
Ln(LoanSize+1)	-0.127***	-0.136***		-0.149***	
	(0.025)	(0.028)		(0.031)	
Ln(LoanMaturity+1)	0.716***	0.808***	0.871***	0.818***	0.896***
	(0.152)	(0.188)	(0.208)	(0.191)	(0.215)
LoanSize1q			0.003		-0.012
			(0.044)		(0.050)
LoanSize3q			-0.263***		-0.342***
			(0.074)		(0.085)
LoanSize4q			-0.460***		-0.533***
			(0.096)		(0.109)
INTER1				0.060*	
				(0.031)	
INTER2					0.054
					(0.113)
INTER4					0.342***
					(0.127)
INTER5					0.338**
					(0.134)
Ln(GDPpc+1)		-5.286**	-4.986*	-5.379**	-5.100*
		(2.476)	(2.576)	(2.508)	(2.639)
Financial stability		-0.418***	-0.447***	-0.424***	-0.458***
		(0.083)	(0.091)	(0.085)	(0.094)
Constant	5.147***	57.089**	52.907**	58.140**	54.074**
	(0.231)	(24.393)	(25.216)	(24.726)	(25.834)
Observations	12666	12666	12666	12666	12666
F stat	54.41	38.81	29.71	35.00	23.49
Prob > F stat	0.000	0.000	0.000	0.000	0.000

1.5. Robustness Tests

Han et al.'s (2009) model depends on the amount of collateral the borrower provides, which they test using a binary variable that could bias the results (Hanley, 2002). For example, a niche market exists for low-quality borrowers that cannot provide collateral, so lenders in that market may not demand collateral but instead charge an extremely high IRP, knowing that only the worst quality borrowers will opt for this type of loan (Lambrecht, 2009). In addition, the role of collateral and the level of collateral provided may not represent identical screening devices for SMEs (Menkhoff et al. 2006). To examine these issues in depth, we re-estimated our model using a collateralization variable that indicates the collateralized percentage of loans granted, according to the bank's internal evaluation. Because this variable contains a cluster of zeros, we apply a Tobit model as an extension of a censored regression model (Hanley, 2002). Table 1.5 presents the results for a SBSS model with a collateralized subsample, using a censored Tobit approach. The Durbin and Wu-Hausman tests confirm that IRP is endogenously determined in the Collateralization model. Thus, we use an instrumental Tobit estimator: Euribor is the IV[13]. In so doing, we obtain four insights.

First, in contrast to the results provided in the table 1.3, this table shows a (negative) nonsignificant relation between IRP and collateralization. This result might suggest that when the bank has made the decision to require collateral, the negotiation of the ratio of collateral is independent of the IRP charged. Accordingly, this evidence suggests that banks use the decision to require collateral rather than the negotiation of collateral-to-loan ratio to signal their commitment and manage credit risk (e.g., Hanedar et al 2014, p. 117). Second, lenders require a greater degree of collateralization from borrowers operating in high-risk industries and a lesser degree for firms that are less financially distressed (Ln(credit availability+1)), in line with H3. Third, the positive coefficient of *Credit Score AAA:BB* ($p < .05$ or $p < .1$) supports H1. Fourth, *Ex post default* exhibits a statistically significant (negative) effect ($p < .05$) in specification [4]) only when we include the variable INTER1 in the model. These results suggest that when the bank decides it is necessary to collateralize the loan, the value of private information in collateral-to-loan ratio negotiation decreases. The other results are unchanged compared with our previous findings.

Overall, observable characteristics appear to offer the most important determinants of the degree of collateralization. The provision of collateral thus is regarded as a signal. When collateral has been provided, private information has a smaller impact on negotiations of debt

[13] Appendix 1.4 establishes a benchmark to evaluate simultaneous equation system results, reporting the single Tobit estimator for *Collateralization* on all exogenous variables, including the possibility of an *IRP* endogenous variable, plus the residuals of *IRP* obtained in the first step. For all single estimations, the residual t-statistics (of *IRP* and *Collateral*) indicate significance ($p < .01$), rejecting the null hypothesis that the contract terms are exogenous. The significance of Durbin and Wu-Hausman tests ($p < .01$) confirms that both *IRP* and *Collateral* are endogenous.

term contracts, confirming that the role of collateral and the level of collateral provided do not represent identical screening devices for SMEs (Menkhoff et al. 2006). Regarding loan characteristics, our results confirm that more credit reduces the degree of collateralization, whereas this degree increases with loan maturity as a means to mitigate MH problems, in contrast with H2. We also acknowledge that these findings could suggest that lenders increase their screening and monitoring of larger loans, using instruments other than price, and they consider increased credit offers viable opportunities for increased payoffs. Moreover, the results for the INTER5 variables ($p < .05$) indicate that for nonobserved high-quality borrowers, lenders require high collateralization ratios before they will grant high amounts of credit.

We also performed postestimations for IV estimators (i.e., *Collateral*, *IRP*, and *Collateralization*). Wooldridge's (1995) robust scores and robust regression-based calculations confirm that *Collateral* and *IRP* as well as *Collateralization* and *IRP* are endogenously determined ($p < .01$) in line with the Durbin and Wu-Hausman tests. The F-statistic for the significance of IVs (statistically significant at 1% in all specifications) is higher than 10, confirming that the IVs are not weak (Stock and Yogo, 2002). Stock and Yogo (2005) tests also reject the null hypothesis of weak IVs (for a 10% rejection rate) as we confirm that the Cragg and Donald (1993) Minimum Eigenvalue Statistics are higher than the critical value obtained by the 2SLS Wald test[14].

[14] These results are reported in the appendix 1.5.

Table 1.5 -Simultaneous System Estimations for *Collateralization* - SBSS model

This table reports the IV Tobit estimations for *Collateralization*, left censored for the null value of the dependent variable) based on SBSS model, including proxies for both observable characteristics and private information. The fitted values of the instrumented variable *IRP* were obtained from the first step equation using *Euribor* as instrumental variable. Standard errors are reported between brackets. *** $p < .01$. ** $p < .05$. * $p < .1$

Second stage - IV Tobit Regression
Dependent variable: *Collateralization;* Instrumented variable: *IRP;* IV: *Euribor*

	(1)	(2)	(3)	(4)	(5)
IRP *(fitted values)*	-0.004	-0.008	-0.007	-0.009	-0.008
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Observed Characteristics					
Industry risk	0.016***	0.005*	0.006**	0.005*	0.006**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Ln(Credit availability+1)	-0.014***	-0.013***	-0.019***	-0.013***	-0.019***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Private Information					
Credit Score AAA:BB	0.022*	0.024**	0.026**	0.024**	0.026**
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Credit Score BB-	0.013	0.012	0.012	0.012	0.012
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Credit Score CCC:C	0.020	0.029	0.032	0.027	0.030
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Ex post default	-0.002	0.012	0.013	-0.197**	-0.007
	(0.012)	(0.012)	(0.012)	(0.094)	(0.023)
Other Variables					
Ln(LoanSize+1)	-0.059***	-0.056***		-0.059***	
	(0.004)	(0.004)		(0.005)	
Ln(LoanMaturity+1)	0.305***	0.297***	0.291***	0.296***	0.290***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)
LoanSize1q			-0.021*		0.022*
			(0.012)		(0.013)
LoanSize3q			-0.069***		-0.052***
			(0.014)		(0.015)
LoanSize4q			-0.171***		-0.161***
			(0.015)		(0.016)
INTER1				0.019**	
				(0.008)	
INTER2					-0.002
					(0.030)
INTER4					0.026
					(0.033)
INTER5					0.069**
					(0.033)
Ln(GDPpc+1)		-2.993***	-2.777***	-2.981***	-2.765***
		(0.458)	(0.463)	(0.458)	(0.464)
Financial stability		-0.075***	-0.079***	-0.076***	-0.079***
		(0.018)	(0.018)	(0.018)	(0.018)
Constant	0.264***	29.544***	26.950***	29.467***	26.814***
	(0.074)	(4.463)	(4.517)	(4.461)	(4.518)
Observations	12,666	12,666	12,666	12,666	12,666
Left-censored obs.	3,140	3,140	3,140	3,140	3,140
Wald chi squared	3,505.49	3,605.70	3,574.25	3,611.76	3,581.09
Prob > chi squared	0.000	0.000	0.000	0.000	0.000
Log likelihood	-28,231.14	-28,178.18	-28,186.79	-28,175.66	-28,180.27

1.6. Concluding remarks

Contractual relationships between lenders and borrowers are characterized by agency costs due to AS and MH problems. In the presence of asymmetric information, a lender offers a loan contract menu that acts as a self-selection mechanism to distinguish good from bad borrowers. Han et al. (2009) describe these processes in a SBSS model, which they confirm empirically in the U.S. market-based system. We investigate its applicability in Portugal, a country characterized by a bank-based system. The findings show that borrowers operating in riskier industries and with less credit availability must provide collateral and pay higher IRP to obtain a loan, as predict by SBOR (i.e., demand-side argument). Because borrower quality is not completely observable by lenders, borrowers with good credit scores willingly offer collateral in exchange for lower IRP. In addition, borrowers that know they have a high probability of success and strong project returns, such that they are unlikely to default on their loan, will pledge collateral in return for lower IRP, as predicted by the SBSS model (i.e., supply-side argument).

However, we reject the effects of loan size and loan maturity predicted by SBSS (i.e., H2). Instead, our results show that loan size decreases the probability of collateralization and IRP, suggesting that larger loans increase the potential payoff for banks and are assigned to borrowers with good observable characteristics. As loan maturity increases, in contrast, the lender is more likely to demand collateralization and IRP independently, especially if the borrower is bad or unobservably good, in line with MH arguments. These results are robust even when we control for the degree of collateralization. Furthermore, by examining the determinants of the explicit loan price, assuming joint negotiations in debt term contracts (not tested by Han et al., 2009), we reveal a substitute effect between collateral and IRP that confirms the signaling value of collateral predicted by the SBSS model. Therefore, SBSS sheds more light on entrepreneurial debt contracts than does SBOR.

These findings suggest a caveat for SMEs: If a good borrower cannot signal its creditworthiness with observed signals or collateral, it may suffer credit rations. In addition, by providing collateral to signal its creditworthiness, the SME incurs important opportunity costs, because those assets could be applied to other profitable projects. Additional research should consider the role of public and private mutual loan guarantees for SMEs, especially during recessions. In fact, another important dimension of the costs of corporate default is the losses incurred directly (and indirectly) by banks. The implementation of Basel III reforms proposed by the G20 and Basel Committee on Banking Supervision contributed to some expansion of the literature on recovery rates and loss given default. Indeed, Basel III represents a crucial step in strengthening the capital rules underlying banking operations, aimed at reducing the probability and severity of a systemic crisis (e.g., Bruche and González-Aguado, 2010; Bastos 2010). With this study we highlight the need to use instruments to increase the information shared among borrowers, lenders, and the market, if the goal is to reduce loan costs (i.e., collateral requirements and IRP), especially for good borrowers. Our results also

confirm that collateral is a substitute for loan spreads. Thus, it would be worthwhile to test the role of relationship lending between lenders and borrowers in the context of the SBSS model.

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Appendices

Appendix 1.1. Descriptive statistics by subsample

This table reports the descriptive statistics by subsample: Collateral=0 vs. Collateral=1

	Collateral = 0					Collateral = 1				
Variable	Obs.	Mean	Std. dev.	Min.	Max.	Obs.	Mean	Std. dev.	Min.	Max.
Observable Characteristics										
Industry risk	3,140	4.10	1.80	0.05	7.08	9,526	4.57	1.87	0.05	7.08
Credit availability	3,140	3,317,916.00	12,900,000.00	0.00	185,000,000.00	9,526	1,167,088.00	6,362,571.00	0.00	177,000,000.00
Private Information										
Credit Score AAA:BB	3,140	0.47	0.50	0	1	9,526	0.53	0.50	0	1
Credit Score BB-	3,140	0.21	0.41	0	1	9,526	0.18	0	0	1
Credit Score B+:B-	3,140	0.27	0.45	0	1	9,526	0.25	0	0	1
Credit Score CCC:C	3,140	0.04	0.20	0	1	9,526	0.04	0	0	1
Ex-post default	3,140	0.26	0.44	0	1	9,526	0.16	0.37	0	1
Loan Characteristics										
LoanSize	3,140	504,839.20	2,573,771.00	5000.00	67,000,000.00	9,526	252,973.70	1,275,651.00	5,000.00	65,000,000.00
LoanMaturity	3,140	29.29	39.72	1	336.00	9,526	48.91	23.33	1	240.00
LoanSize1Q	3,140	0.29	0.45	0	1	9,526	0.37	0.48	0	1
LoanSize2Q	3,140	0.21	0.41	0	1	9,526	0.24	0.43	0	1
LoanSize3Q	3,140	0.26	0.44	0	1	9,526	0.18	0.38	0	1
LoanSize4Q	3,140	0.24	0.43	0	1	9,526	0.22	0.41	0	1
Macroeconomic Conditions										
GDPpc	3,140	17,489.45	233.16	17,186.06	17,742.67	9,526	17,398.58	197.67	17,186.06	17,742.67
Financial Stability	3,140	0.21	0.41	0	1	9,526	0.07	0.25	0	1
Interaction effect										
INTER1	3,140	2.90	4.92	0	17.57	9,526	1.82	4.16	0	16.81
INTER2	3,140	0.09	0.28	0	1	9,526	0.05	0.22	0	1
INTER3	3,140	0.06	0.24	0	1	9,526	0.04	0.20	0	1
INTER4	3,140	0.07	0.25	0	1	9,526	0.03	0.18	0	1
INTER5	3,140	0.05	0.22	0	1	9,526	0.04	0.19	0	1
IVs										
Project finance	3,140	0.03	0.16	0	1	9,526	0.10	0.31	0	1
Euribor	3,140	2.96	1.08	1.25	4.12	9,526	2.46	1.10	1.25	4.12

Appendix 1.1. Descriptive statistics by subsample (Continuation)

This table reports the descriptive statistics by subsample: IRP_i < Median (IRP) *vs.* $IRP_i \geq$ Median (IRP)

	IRP < Median (i.e., <2.625)					IRP ≥ Median (i.e.,≥2.625)				
Variable	Obs.	Mean	Std. dev.	Min.	Max.	Obs.	Mean	Std. dev.	Min.	Max.
Observable Characteristics										
Industry risk	6,035	4.31	1.77	0.05	7.08	6,631	4.58	1.94	0.05	7.08
Credit availability	6,035	1,309,208.00	6,924,989.00	0	185,000,000.00	6,631	2,056,232.00	9,723,562.00	0	177,000,000.00
Private Information										
Credit Score AAA:BB	6,035	0.58	0.50	0	1	6,631	0.46	0.50	0	1
Credit Score BB-	6,035	0.17	0.38	0	1	6,631	0.21	0.40	0	1
Credit Score B+:B-	6,035	0.22	0.41	0	1	6,631	0.29	0.45	0	1
Credit Score CCC:C	6,035	0.03	0.17	0	1	6,631	0.05	0.21	0	1
Ex-post default	6,035	0.16	0.37	0	1	6,631	0.21	0.41	0	1
Loan Characteristics										
LoanSize	6,035	292,238.00	1,566,961.00	5,000.00	67,000,000.00	6,631	336,505.20	1,805,869.00	5,000.00	67,000,000.00
LoanMaturity	6,035	45.43	26.54	1	324.00	6,631	42.79	31.96	1	336.00
LoanSize1Q	6,035	0.35	0.48	0	1	6,631	0.35	0.48	0	1
LoanSize2Q	6,035	0.25	0.43	0	1	6,631	0.22	0.41	0	1
LoanSize3Q	6,035	0.17	0.38	0	1	6,631	0.22	0.41	0	1
LoanSize4Q	6,035	0.23	0.42	0	1	6,631	0.22	0.41	0	1
Macroeconomic Conditions										
GDPpc	6,035	17,398.32	228.72	1,7186.06	17,742.67	6,631	17441.84	190.54	1,7186.06	1,7742.67
Financial Stability	6,035	0.10	0.30	0	1	6,631	0.11	0.31	0	1
Interaction effects										
INTER1	6,035	1.78	4.12	0	17.57	6,631	2.37	4.60	0	15.78
INTER2	6,035	0.05	0.21	0	1	6,631	0.07	0.25	0	1
INTER3	6,035	0.05	0.22	0	1	6,631	0.04	0.21	0	1
INTER4	6,035	0.03	0.17	0	1	6,631	0.05	0.23	0	1
INTER5	6,035	0.03	0.18	0	1	6,631	0.04	0.21	0	1
IVs										
Project finance	6,035	0.12	0.33	0	1	6,631	0.05	0.22	0	1
Euribor	6,035	2.86	1.00	1.25	4.12	6,631	2.33	1.16	1.25	4.12

Appendix 1.1. Descriptive statistics by subsample *(Cont.)*

This table reports the descriptive statistics by subsample: Collateralization$_i$ < Median (Collateralization) *vs.* Collateralization$_i$≥ Median (Collateralization)

	Collateralization < Median (i.e.,< 1)					Collateralization ≥ Median (i.e.,≥ 1)				
Variable	Obs.	Mean	Std. dev.	Min.	Max.	Obs.	Mean	Std. dev.	Min.	Max.
Observable Characteristics										
Industry risk	5,993	4.52	1.83	0.05	7.08	6,673	4.39	1.89	0.05	7.08
Credit availability	5,993	2,188,015.00	989,9825.00	0	185,000,000.00	6,673	1,262,275.00	7,011,642.00	0	177,000,000.00
Private Information										
Credit Score AAA:BB	5,993	0.52	0.50	0	1	6,673	0.51	0.50	0	1
Credit Score BB-	5,993	0.20	0.40	0	1	6,673	0.19	0.39	0	1
Credit Score B+:B-	5,993	0.26	0.44	0	1	6,673	0.26	0.44	0	1
Credit Score CCC:C	5,993	0.03	0.17	0	1	6,673	0.05	0.21	0	1
Ex-post default	5,993	0.19	0.39	0	1	6,673	0.18	0.39	0	1
Loan Characteristics										
LoanSize	5,993	403,401.30	2,260,146.00	5,000.00	67,000,000.00	6,673	23,6391.20	928,063.50	5,000.00	30,000,000.00
LoanMaturity	5,993	38.91	32.67	1	336.00	6,673	48.66	25.53	1	240.00
LoanSize1Q	5,993	0.36	0.48	0	1	6,673	0.34	0.47	0	1
LoanSize2Q	5,993	0.22	0.42	0	1	6,673	0.24	0.43	0	1
LoanSize3Q	5,993	0.18	0.39	0	1	6,673	0.21	0.41	0	1
LoanSize4Q	5,993	0.24	0.43	0	1	6,673	0.21	0.41	0	1
Macroeconomic Conditions										
GDPpc	5,993	17,422.04	212.42	17,186.06	17,742.67	6,673	17,420.26	209.18	17,186.06	17,742.67
Financial Stability	5,993	0.12	0.32	0	1	6,673	0.09	0.29	0	1
Interaction effects										
INTER1	5,993	2.12	4.42	0	17.57	6,673	2.06	4.36	0	15.89
INTER2	5,993	0.06	0.24	0	1	6,673	0.05	0.22	0	1
INTER3	5,993	0.04	0.21	0	1	6,673	0.05	0.22	0	1
INTER4	5,993	0.04	0.20	0	1	6,673	0.04	0.20	0	1
INTER5	5,993	0.04	0.20	0	1	6,673	0.04	0.19	0	1
IVs										
Project finance	5,993	0.09	0.29	0	1	6,673	0.08	0.27	0	1
Euribor	5,993	2.59	1.11	1.25	4.12	6,673	2.58	1.13	1.25	4.12

Appendix 1.1. Descriptive statistics by subsample *(Cont.)*

Descriptive statistics by subsample: Collateralization$_i$ < Median (Collateralization)|Collateral=1 *vs.* Collateralization$_i$≥ Median (Collateralization)|Collateral=1

	Collateralization < Median (i.e.,< 1) (subsample Collateral=1)					Collateralization ≥ Median (i.e.,≥ 1) (subsample Collateral=1)				
Variable	Obs.	Mean	Std. dev.	Min.	Max.	Obs.	Mean	Std. dev.	Min.	Max.
Observable Characteristics										
Industry risk	2,853	4.98	1.76	0.05	7.08	6,673	4.39	1.89	0.05	7.08
Credit availability	2,853	944,451.80	4,485,276.00	0	102,000,000.00	6,673	126,2275.00	7,011,642.00	0	177,000,000.00
Private Information										
Credit Score AAA:BB	2,853	0.57	0.50	0	1	6,673	0.51	0.50	0	1
Credit Score BB-	2,853	0.18	0.38	0	1	6,673	0.19	0.39	0	1
Credit Score B+:B-	2,853	0.24	0.42	0	1	6,673	0.26	0.44	0	1
Credit Score CCC:C	2,853	0.02	0.14	0	1	6,673	0.05	0.21	0	1
Ex post default	2,853	0.11	0.31	0	1	6,673	0.18	0.39	0	1
Loan Characteristics										
LoanSize	2,853	291,759.10	1,848,691.00	10,000.00	65,000,000.00	6,673	236,391.20	928,063.50	5,000.00	30,000,000.00
LoanMaturity	2,853	49.51	17.08	4.00	240.00	6,673	48.66	25.53	1	240.00
LoanSize1Q	2,853	0.43	0.50	0	1	6,673	0.34	0.47	0	1
LoanSize2Q	2,853	0.23	0.42	0	1	6,673	0.24	0.43	0	1
LoanSize3Q	2,853	0.10	0.30	0	1	6,673	0.21	0.41	0	1
LoanSize4Q	2,853	0.23	0.42	0	1	6,673	0.21	0.41	0	1
Macroeconomic Conditions										
GDPpc	2,853	17,347.85	156.39	17,186.06	17,742.67	6,673	17,420.26	209.18	17,186.06	17,742.67
Financial Stability	2,853	0.02	0.12	0	1	6,673	0.09	0.29	0	1
Interaction effects										
INTER1	2,853	1.26	3.59	0	16.81	6,673	2.06	4.36	0	15.89
INTER2	2,853	0.04	0.20	0	1	6,673	0.05	0.22	0	1
INTER3	2,853	0.03	0.16	0	1	6,673	0.05	0.22	0	1
INTER4	2,853	0.01	0.11	0	1	6,673	0.04	0.20	0	1
INTER5	2,853	0.03	0.17	0	1	6,673	0.04	0.19	0	1
IVs										
Project finance	2,853	0.17	0.37	0	1	6,673	0.08	0.27	0	1
Euribor	2,853	2.20	1.00	1.25	4.12	6,673	2.58	1.13	1.25	4.12

Appendix 1.2-Probit estimation for *Collateral*, Exogeneity test for *IRP* and Validity of IV for *Collateral* - SBSS model

This table reports the Probit estimations for *Collateral* and the exogeneity test for *IRP* based on SBSS model, including proxies for both observable characteristics and private information. The right-hand column provides the first stage estimation for the validity of *Project Finance* as IV for *Collateral*. Standard errors are reported between brackets. *Euribor* is the IV for *Resid_IRP*. *** $p < .01$. ** $p < .05$. * $p < .1$

Probit estimation						
Dependent variable: *Collateral*						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**IV**
IRP	-0.258***	-0.258***	-0.258***	-0.258***	-0.259***	
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	
Observed Characteristics						
Industry risk	0.102***	0.067***	0.070***	0.067***	0.070***	
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	
Ln(Credit availability+1)	-0.064***	-0.060***	-0.069***	-0.060***	-0.069***	
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	
Private Information						
Credit Score AAA:BB	0.006	0.017	0.020	0.017	0.021	
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	
Credit Score BB-	0.045	0.041	0.042	0.041	0.042	
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	
Credit Score CCC:C	0.083	0.102	0.104	0.096	0.095	
	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	
Ex post default	-0.064*	-0.031	-0.025	-0.578**	-0.119*	
	(0.036)	(0.037)	(0.037)	(0.273)	(0.071)	
Other Variables						
Ln(LoanSize+1)	-0.098***	-0.092***		-0.102***		
	(0.013)	(0.013)		(0.014)		
Ln(LoanMaturity+1)	0.690***	0.668***	0.655***	0.666***	0.653***	
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	
LoanSize1q			-0.013		-0.018	
			(0.039)		(0.044)	
LoanSize3q			-0.182***		-0.220***	
			(0.043)		(0.049)	
LoanSize4q			-0.277***		-0.325***	
			(0.047)		(0.052)	
INTER1				0.049**		
				(0.024)		
INTER2					0.015	
					(0.093)	
INTER4					0.161	
					(0.100)	
INTER5					0.237**	
					(0.101)	
Ln(GDPpc+1)		-6.608***	-5.982***	-6.579***	-5.885***	
		(1.436)	(1.444)	(1.436)	(1.445)	
Financial stability		-0.253***	-0.255***	-0.255***	-0.258***	
		(0.051)	(0.051)	(0.051)	(0.051)	
Project Finance						0.770***
						(0.057)
Constant	0.547***	65.216***	58.305***	65.048***	57.377***	0.632***
	(0.129)	(14.022)	(14.111)	(14.023)	(14.121)	(0.013)
Observations	12,666	12,666	12,666	12,666	12,666	12,666
Log-likelihood	-5,147.79	-5,107.59	-5,110.60	-5,063.29f	-5,065.05	-6,983.67
LR chi-squared	3,890.98	3,971.38	3,965.36	4,059.96	4,056.45	219.22
Prob > chi-squared	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R-squared	0.274	0.280	0.280	0.286	0.286	0.020
Exogeneity test for *IRP*						
Resid_IRP	-0.507***	-0.471***	-0.465***	-0.468***	-0.463***	
	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	
Durbin chi-squared	131.215***	118.285***	114.398***	117.479***	113.522***	
Wu-Hausman F-stat	129.980***	117.310***	113.507***	116.527***	112.672***	

Appendix 1.3 - OLS estimation for *IRP* and Exogeneity test for *Collateral* and Validity of Instrumental Variable for *IRP* - SBSS model

This table reports the OLS estimations for *IRP* and the exogeneity test for *Collateral* based on SBSS model, including proxies for both observable characteristics and private information. The right-hand column provides the first-stage estimation for the validity of *Euribor* as IV for *IRP*. Standard errors are reported between brackets. *Project Finance* is the IV for *Resid_Collateral*. *** $p < .01$. ** $p < .05$. * $p < .1$

OLS regression Dependent variable: *IRP*						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**IV Validity**
Collateral	-0.674***	-0.675***	-0.676***	-0.676***	-0.678***	
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	
Observed Characteristics						
Industry risk	0.068***	0.068***	0.069***	0.068***	0.069***	
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	
Ln(Credit availability+1)	-0.048***	-0.047***	-0.045***	-0.047***	-0.046***	
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	
Private Information						
Credit Score AAA:BB	-0.279***	-0.280***	-0.278***	-0.280***	-0.277***	
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	
Credit Score BB-	-0.023	-0.024	-0.024	-0.024	-0.024	
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	
Credit Score CCC:C	0.297***	0.303***	0.304***	0.302***	0.299***	
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	
Ex post default	0.131***	0.134***	0.136***	-0.028	0.048	
	(0.027)	(0.027)	(0.027)	(0.208)	(0.051)	
Other Variables						
Ln(LoanSize+1)	-0.024***	-0.026***		-0.028***		
	(0.009)	(0.009)		(0.010)		
Ln(LoanMaturity+1)	-0.041***	-0.044***	-0.042***	-0.044***	-0.042***	
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	
LoanSize1q			0.009		-0.002	
			(0.027)		(0.030)	
LoanSize3q			-0.024		-0.071**	
			(0.031)		(0.034)	
LoanSize4q			-0.113***		-0.137***	
			(0.033)		(0.036)	
INTER1				0.015		
				(0.018)		
INTER2					0.044	
					(0.068)	
INTER4					0.219***	
					(0.074)	
INTER5					0.125*	
					(0.074)	
Ln(GDPpc+1)		3.407***	3.620***	3.414***	3.706***	
		(1.015)	(1.023)	(1.015)	(1.023)	
Financial stability		-0.156***	-0.157***	-0.156***	-0.159***	
		(0.039)	(0.039)	(0.039)	(0.039)	
Ln(Euribor+1)						-0.790***
						(0.030)
Constant	4.187***	-29.051***	-31.424***	-29.086***	-32.239***	3.856***
	(0.090)	(9.909)	(9.995)	(9.909)	(9.996)	(0.038)
Observations	12,666	12,666	12,666	12,666	12,666	12,666
F stat	174.18	144.50	122.85	132.51	100.52	684.29
Prob > F-stat	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.110	0.112	0.112	0.112	0.113	0.051
Adj. R-squared	0.111	0.111	0.111	0.111	0.112	0.051
Exogeneity test for *Collateral*						
Resid_Collateral	3.18***	3.67***	4.00***	3.73***	4.12***	
	(0.438)	(0.514)	(0.549)	(0.519)	(0.558)	
Durbin chi-squared	52.543***	51.159***	53.100***	51.550***	54.557***	
Wu-Hausman F-stat	52.372***	51.006***	52.941***	51.398***	54.400***	

Appendix 1.4 - Tobit estimation for *Collateralization*, Exogeneity test for *IRP* and Validity of IV for *Collateralization* - SBSS model

This table reports the Censored Tobit estimations for *Collateralization* and the exogeneity test for *IRP* based on SBSS model, including proxies for both observable characteristics and private information. The right-hand column provides the first stage estimation for the validity of *Project Finance* as IV for *Collateralization*. Standard errors are reported between brackets. *Euribor* is the IV for *Resid_IRP*. *** $p < .01$. ** $p < .05$. * $p < .1$

Tobit estimation

Dependent variable: *Collateralization*

	(1)	(2)	(3)	(4)	(5)	IV Validity
IRP	-0.088***	-0.088***	-0.088***	-0.088***	-0.088***	
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	
Observed Characteristics						
Industry risk	0.021***	0.009***	0.010***	0.010***	0.010***	
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	
Ln(Credit availability+1)	-0.017***	-0.016***	-0.022***	-0.016***	-0.022***	
	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	
Private Information						
Credit Score AAA,BB	-0.003	0.001	0.002	0.001	0.002	
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	
Credit Score BB-	0.010	0.009	0.009	0.009	0.009	
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	
Credit Score CCC:C	0.046*	0.053**	0.056**	0.051**	0.054**	
	(0.024)	(0.023)	(0.024)	(0.023)	(0.024)	
Ex post default	0.011	0.023*	0.025**	-0.191**	-0.001	
	(0.012)	(0.012)	(0.012)	(0.092)	(0.022)	
Other Variables						
Ln(LoanSize+1)	-0.059***	-0.056***		-0.060***		
	(0.004)	(0.004)		(0.004)		
Ln(LoanMaturity+1)	0.288***	0.281***	0.275***	0.280***	0.274***	
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	
LoanSize1q			-0.020*		-0.022*	
			(0.012)		(0.013)	
LoanSize3q			-0.068***		-0.077***	
			(0.013)		(0.015)	
LoanSize4q			-0.176***		-0.189***	
			(0.015)		(0.016)	
INTER1				0.019**		
				(0.008)		
INTER2					0.002	
					(0.030)	
INTER4					0.042	
					(0.033)	
INTER5					0.077**	
					(0.033)	
Ln(GDPpc+1)		-2.553***	-2.320***	-2.544***	-2.304***	
		(0.442)	(0.447)	(0.442)	(0.447)	
Financial stability		-0.085***	-0.089***	-0.086***	-0.090***	
		(0.018)	(0.018)	(0.018)	(0.018)	
Project Finance						0.170***
						(0.017)
Constant	0.604***	25.564***	22.801***	25.517***	22.649***	0.580***
	(0.042)	(4.319)	(4.367)	(4.319)	(4.368)	(0.005)
Observations	12,666	12,666	12,666	12,666	12,666	12,666
Left-Censored obs.	3,140	3,140	3,140	3,140	3,140	3,140
LR chi squared	4,135.82	4,232.32	4,205.92	4,237.78	4,213.66	96.65
Prob > chi squared	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R squared	0.185	0.189	0.188	0.190	0.188	0.004
Log likelihood	-9,114.50	-9,066.25	-9,079.45	-9,063.52	-9,075.58	11,134.08
Exogeneity test for *IRP*						
Resid_IRP	-0.075***	-0.071***	-0.072***	-0.070***	-0.072***	
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	
Durbin Chi-squared	194.678***	186.663***	166.157***	186.618***	166.153***	
Wu-Hausman F-stat	190.995***	183.321***	163.562***	183.297***	163.608***	

Appendix 1.5. Postestimations – Validity of Instrumental Variables

This table reports the exogeneity tests and the inferences for the validity of instrumental variable(s). *** $p < .01$. ** $p < .05$. * $p < .1$.

	(1)	(2)	(3)	(4)	(5)
Panel A					
Dependent Variable: *Collateral*					
Endogenous Variable: *IRP*, IV: *Euribor*					
Robust Exogeneity Tests					
Wooldridge's (1995) test					
Robust score chi-squared stat	125.867***	112.804***	108.530***	112.015***	107.571***
Robust regression F stat	128.898***	113.388***	108.997***	112.612***	107.028***
Weak Instruments Inference					
F-statistic	850.65***	839.70***	843.12***	839.57***	840.74***
Minimum Eigenvalue statistic	850.65	839.70	843.12	839.57	840.74
Wald Test (for 10% of rejection rate)	16.38	16.38	16.38	16.38	16.38
Panel B					
Dependent Variable: *IRP*					
Endogenous Variable: *Collateral*; IV: *Project Finance*					
Robust Exogeneity Tests					
Wooldridge´s (1995) test					
Robust score chi-squared stat	81.653***	80.040***	83.085***	80.540***	85.184***
Robust regression F stat	86.393***	84.103***	87.341***	84.627***	89.588***
Weak Instruments Inference					
F-statistic	48.24***	35.37***	30.88***	34.66***	29.92***
Minimum Eigenvalue statistic	48.24	35.37	30.88	34.66	29.92
Wald Test (for 10% of rejection rate)	16.38	16.38	16.38	16.38	16.38
Panel C					
Dependent Variable: *Collateralization*					
Endogenous Variable: *IRP*, IV: *Euribor*					
Robust Exogeneity Tests					
Wooldridge's (1995) test					
Robust score chi-squared stat	181.591***	174.059***	156.165 ***	174.468 ***	156.378 ***
Robust regression F stat	191.460***	182.215***	162.902***	182.567 ***	163.060***
Weak Instruments Inference					
F-statistic	1044.88***	1010.00***	1005.76***	1009.79 ***	1003.71***
Minimum Eigenvalue statistic	1044.88	1010.00	1005.76	1009.79	1003.71
Wald Test (for 10% of rejection rate)	16.38	16.38	16.38	16.38	16.38

CHAPTER 2
Mutual Guarantees in Portuguese Loan Markets: Evidence during the Financial Crisis

Abstract

In this study we scrutinize the role of mutual guarantees for Portuguese banks lending to small and medium-sized enterprises (SMEs). With data provided by one of the largest Portuguese banks, this article provides an initial appraisal of Portuguese mutual guarantee schemes (MGS) in response to the recent financial crisis. In particular, the analysis identifies the characteristics of the firm accessing mutual guaranteed loans and investigates the impact of MGS in loan pricing and on the ex post performance of borrowers. The findings provide comprehensive insights, confirming the value of MGS to improve Portuguese loan activity, especially for good SMEs operating in stressful contexts, by reducing the costs of borrowing and improving the ex post default rate. Mutual guarantees also can improve the loan recovery rate and enable banks to meet their commitments to banking regulation and supervision. Finally, these effects are especially notable with the combination of third-party guarantees and collateral.

Keywords: Public mutual credit guarantees; Small business finance; Financial crisis; Bank capital ratios; Collateral; Ex post default

JEL classification: D82; G18; G21; H12

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Resumo

Este estudo examina o papel das garantias mútuas nos empréstimos concedidos a pequenas e médias empresas (PMEs), por parte dos bancos portugueses. Com base em dados fornecidos por um dos maiores bancos portugueses, este artigo fornece uma primeira apreciação dos sistemas portugueses de Garantia Mútua em resposta à recente crise financeira. Em particular, a análise identifica as características das empresas que têm acesso a empréstimos garantidos por este sistema e investiga o impacto deste nos preços dos empréstimos bancários bem como sobre o desempenho *ex post* dos mutuários. Os resultados fornecem evidências assinaláveis confirmando o valor das garantias mútuas na melhoraria da atividade de empréstimos em Portugal, especialmente para as PMEs com boa notação de risco que operam em contextos de *stress*, reduzindo os custos dos empréstimos e reduzindo a taxa de incumprimento *ex post*. Os resultados sugerem que as garantias mútuas podem melhorar a taxa de recuperação de crédito, permitindo aos bancos cumprir os seus compromissos perante a regulação e supervisão bancárias. Finalmente, os resultados demonstram que estes efeitos são especialmente assinaláveis através da combinação entre garantias mútuas e garantias bancárias.

***Palavras-Chave**: Garantias mútuas públicas, Financiamento às PMEs, Crise Financeira, Rácios de capital bancário, garantias bancárias, Incumprimento*
Classificação *JEL*: *D82*; *G18*; *G21*; *H12*

2.1. Introduction

Asymmetric information between banks and borrowers leads to significant misallocation in credit markets. A lack of information about individual borrowers can prompt banks to raise interest rates inefficiently high, such that even worthy borrowers get driven out of the credit market (Stiglitz and Weiss, 1981). Yet firms with negative net present value projects could obtain financial support by taking advantage of the cross-subsidization of borrowers with worthy projects (Mankiw, 1986; De Meza and Webb, 1987). In both cases, the market fails, because banks cannot assess the actual riskiness of borrowers and are forced to offer the same contracts, with varying probabilities of success. When borrowers' wealth is sufficient, banks may bypass information asymmetries by offering a menu of contracts, in which collateral requirements act as a sorting device. Risky borrowers self-select, by choosing contracts marked by high repayment demands (i.e., high interest rates) and low collateral, while safe borrowers choose contracts with high collateral and low repayment demands (Bester, 1985; Besanko and Thakor, 1987).

Providing collateral can lessen the credit rationing that firms face, especially among small or medium-sized enterprises (SMEs) (Beck et al., 2010; Berger and Udell, 1998). First, it decreases lenders' risk in the event of default (Coco, 2000). Second, collateral rectifies credit market imperfections related to adverse problems (Deelen and Molenaar, 2004). Third, it reduces the costs of monitoring (Cowling and Mitchell, 2003). However, these features also depend on unique characteristics of the individual loan and firm (Berger and Udell, 1998; Columba et al., 2010), as well as on the legal procedures available for loan recovery (Zecchini and Ventura, 2009). If firms, especially smaller, younger ones, cannot post collateral and also have only a short credit history, they cannot meet rigorous reporting requirements, and public information about them is scarce (Columba et al., 2010). In this scenario, or when the legal system is inadequate to protect creditor rights (Zecchini and Ventura, 2009), SMEs' access to bank credit likely remains restricted, especially during economic downturns, with negative effects on industry dynamics, competitiveness, and growth (Beck and Demirgüc-Kunt, 2006).

In almost an half of countries, loan guaranteed funds have been created to help small and micro-enterprises gain access to the credit market (Green, 2003; Gonzàles et al., 2006; Beck et al., 2010; Cowling, 2010; Honohan, 2010). Europe has a long tradition diffusing mutual guarantee associations (AECM, 2010), and mutual guarantee schemes (MGS) are increasingly well developed in South and North America (Oehring, 1997; Riding and Haines, 2001), East Asia (Hatekayama et al., 1997), and North Africa (De Gobbi, 2003). These MGS are multilateral agreements that allow lenders, guarantors, and borrowers to interact with one another. The lenders are generally private financial intermediaries; guarantors may be private or public in nature. Both institutions interact to promote loan access for borrowers that typically have been underserved by formal credit markets. In this multi-party environment, guarantors facilitate borrowers' access to debt capital by distributing (costly) credit guarantees, which creates helpful conditions for firms, in terms of their investment and business activity cycles. The MGS appear likely to gain importance in the aftermath of the Basel II (and III) Capital Accords, which

note that such guarantees, as long as they comply with certain requirements, can serve to help banks mitigate credit risk in their small business lending and thus save regulatory resources (SPGM, 2007; Cardone-Riportella et al., 2008). The allocation of mutual guarantees thus has gained momentum recently, especially in Organization for Economic Co-operation and Development (OECD) countries onset of the international financial sector crisis. In this context, MGS represent preferred instruments to extend credit to SMEs, without compromising banks' capital requirements (Uesugi et al., 2010).

However, whether third-party guarantees are effective instruments to promote lending to SMEs remains unclear, in both academic and policy literature. Some articles indicate the effectiveness of MGS for providing additional credit (e.g., Boocock and Shariff, 2005; Gale, 1991; Riding et al., 2007) or decreasing the costs of borrowing (e.g., Zecchini and Ventura, 2009; Columba et al., 2010). But others argue that their effect on ex post performance is ambiguous (e.g., Cowling, 2010; Boschi et al., 2014). Moreover, it is not clear that MGS offer perfect substitutes for collateral, considering their distinctive value as signaling instruments (Honohan, 2010). Noting this lack of consensus about the efficiency of MGS as instruments to promote lending to small firms (Zecchini and Ventura, 2009), we consider the types of borrowers covered by a MGS, the relation between mutual guarantees and loan collateralization, and the impact of third-party guarantees on loan prices and ex post firm performance. With these assessments, we contribute to policy makers and practitioners related to the evaluation of credit operations under MGS.

With data from one of the major commercial banks operating in Portugal, covering 11,181 loans granted to SMEs (54.61% granted under MGS, 78.52% collateralized by owner or business assets) between 2008 and 2010, we provide consistent answers to those questions in a scenario marked by economic and financial adversity. During this period, the economy and Portugal's financial market suffered from the international financial crisis, which laid bare the structural weaknesses of the nation's economy and the failures in bank supervision. The Portuguese government therefore instituted a set of actions to prevent bank freezes, including the exploitation of MGS, in line with recommendations to OECD countries. The events during this period greatly deteriorated the credit conditions for small businesses, increasing interest in the value of MGS. Some key influences, according to both OECD (2014) and BdP (2010) surveys, were the increase of sovereign debt and deep economic recession, which had the potential to invoke a crowding out effect on financial markets; the increase of nonperforming loans, which may have led to decreased credit activity by nonfinancial firms; and adjustments to bank capital ratios, in line with the Basel II (III) Capital Accord, which revealed banking supervision failures, such as those related to the bankruptcy of the *Banco Privado Português* and the public bailout of the *Banco Português de Negócios* (both unlisted on stock exchanges).

With these analyses, we make several contributions. First, this article provides an initial study of Portuguese MGS for SME lending in the context of the financial crisis. Second, the data source does not support a panel data analysis, but it provides information about borrowers after they received loans, namely, whether they defaulted or not. With this information, we can

examine the "effectiveness" of MGS in an adversity setting (Uesugi et al., 2010). Third, we use data about the financial institution to control for the effect of the adjusted banking capital ratios imposed by the Basel Capital Accord on third-party guarantees. Fourth, we are the first testing explicitly the relation between mutual guarantees and (business and personal) collateral, such that it helps clarify their potential substitution effect. To the best of our knowledge, this assumption has not been tested previously (e.g., Honohan, 2010).

Therefore, Section 2.2. reviews the relevance of mutual guarantees for SMEs, and Section 2.3 characterizes Portuguese MGS specifically. Section 2.4 describes the data, method, and variables, followed by Section 2.5, which reports the results, and Section 2.6, which contains robustness tests. Section 2.7 summarizes the main conclusions.

2.2. The relevance of mutual guarantees: An overview

In the past two decades policy tools aimed at providing credit guarantees to SMEs have become extremely popular forms of public intervention to promote growth in the private sector, in both advanced and emerging economies (Boschi et al., 2014). A survey by the OECD (2013) noted that 19 of 23 countries had strengthened or introduced credit guarantee programs following the onset of the financial crisis.

The vast dissemination of MGS is based on the argument that mutual guaranteed loans reduce inefficiencies in banking markets for granting loans to SMEs. The MGS can help mitigate asymmetric information problems in the credit market for opaque borrowers, because the borrowers' creditworthiness is better known to a well-capitalized guarantor than to a lender (Honohan, 2010). With MGS, private information about the firm, beyond what the bank can normally see, is easily accessible: if MGS offer its guarantee to a firm they implicitly reveal to the bank that private information about the firm is good (Bartoli et al., 2013). That is, banks can interpret the MGS as a signal of the good quality of the borrower (Columba et al., 2010; Bartoli et al., 2013). Furthermore, MGS may help firms achieve joint responsibility, through increased peer monitoring, because members incur a penalty in the case of default by any single member (Columba et al., 2010). As a consequence, loan guarantee schemes may substitute for loan collateralization (Busetta and Zazzaro, 2012) and help small businesses avoid moral hazard or adverse information problems that can lead to credit rationing (Stiglitz and Weiss, 1981). Accordingly, the participation of a third-party in a loan contract may lead to reduced interest rates and increased credit availability for previously unfunded but potentially profitable projects (e.g., Gale 1990, 1991; Boocock and Shariff, 2005; Riding et al., 2007). Furthermore, the MGS alleviates some of the financial constraints of undercapitalized banks, which tend to miss profitable lending opportunities in uncertain settings (Diamond, 1989), such that they can better fund profitable projects. Overall then, the ex post performance of program participants should improve.

However, if MGS receive contributions from government agencies, mutual guarantees instead could exacerbate information problems and worsen credit conditions, such that they

would reduce the incentives for financial institutions to monitor guarantee users or smooth collateral requirements (Freixas and Rochet, 2008; Uesugi et al., 2010). Prior literature also provides evidence that managers of firms that have pledged no collateral are less likely to exert managerial effort (Boot et al., 1991) and tend to make riskier investments (Stulz and Johnson, 1985). If the bank loan is granted under MGS, the ex post performance of borrowers thus might worsen (de Meza 2002).

If the firms requesting mutual guarantees are not a random sample but rather represent a subsample that particularly needs the certification effect provided by MGS, third-party-guaranteed loans may attract firms that were rejected by banks (Columba et al., 2010) or discouraged borrowers (for a discussion of discouragement, see Kon and Story, 2003). Hence, it can be argued that these firms tend to be riskier than average (adverse selection). Honohan (2010) thus argues that during credit appraisals, lenders do not see a third-party guarantee as a perfect substitute for collateral. Under competitive pressure for bank loans, MGS instead might be used inefficiently, in the presence of self-selecting contracts, when borrowers cannot provide collateral to signal their information and credit quality. Furthermore, valuable collateral can act as a deterrent to moral hazard, reducing the likelihood of default (as is well established by theoretical literature; e.g., Besanko and Thakor, 1987a,b). Because MGS also do not cover the lender's entire exposure to risk, the bank has little incentive to grant attractively priced loans to the borrower (Boschi et al., 2014). Lenders thus may have no real interest in replacing collateral with mutual guarantees, because this substitution does not allow them to raise the loan's recovery rate in the case of default (Columba et al., 2010). Alternatively, the bank could establish the value of the guarantee offered by the MGS to the borrowing firm, which would reduce both the probability of default and the loss given default (Vogel and Adams, 1997). In this sense, the MGS acts as collateral available to the bank rather than to the borrower (Bartoli et al., 2013). If the purpose of mutual guarantees is not to allow the lender to bring an otherwise insufficiently secured loan into compliance with regulatory requirements but rather to reduce the lender's risk exposure pre funded projects and the loss due to default for the lender, the benefits of MGS, in terms of social welfare, may be minimal (Honohan, 2010).[15]

Empirically, Zecchini and Ventura (2009) and Columba et al. (2010) find that small firms affiliated with Italian MGS pay less for credit and that banks benefit from the willingness of MGS to post collateral, because it implies better screening and monitoring of firms. Boschi et al. (2014) caution though that guarantees below 25% of the loan amount are ineffective, because the Italian Partial Guarantee Scheme does not allow lenders to require additional business collateral or personal commitments against the portion of the loan backed by the fund guarantee. These authors therefore advise firms to decline guarantees and avoid the related costs if the coverage ratio is below the 25% threshold. By examining the effects of a massive

[15] Studying MGS in Malaysia, Boocock and Shariff (2005) find that the requirement for collateral is almost compulsory, which suggest the instruments are not substitutes. In such cases, the credit availability proved by mutual guarantees may diminish or be null (NERA, 1990).

credit guarantee program implemented by the Japanese government from 1998 to 2000, Uesugi et al. (2010) show that the ex post performance of participants, with the exception of firms with sizable net worth, deteriorated relative to that of their nonparticipating counterparts. Furthermore, the availability of loans did not increase for these program participants. Rather, major banks frequently used the MGS to replace non-guaranteed loans with guaranteed loans, to reduce their exposure to risky assets.

The cloud of doubt hovering over the actual social welfare of mutual guarantees may thicken during financial crises or while the banking market adjusted to the capital requirements of the Basel II (III) Capital Accords. Bartoli et al. (2013) study the role of MGS in affecting the lending policies undertaken by banks at the peak of the 2007–2009 crisis in Italy. Small firms supported by MGS were less likely to experience financial tensions, even at that time of utmost financial stress. Furthermore, MGS served a signaling function, beyond the simple provision of collateral, so the information provided was significant in enhancing bank–firm relations, through scoring and rating systems (for surveys of MGS, see Bosworth et al., 1987; Gudger, 1998).

2.3. Characteristics of Portuguese mutual guarantee systems

Mutual guarantee systems first emerged in Portugal in 1992, due to a public initiative by the Institute to Support Small and Medium Enterprises and Innovation (IAPMEI). Similar to other European Union (EU) countries, where alternative SMEs financing systems already existed (e.g., Germany, France, Italy, Spain; Columba et al., 2010; AECM 2010), the Portuguese Society of Mutual Guarantees (SPGM)[16] was created to implement quality assurance operations and other services to SMEs. In 2003, three MGS were introduced, *Garval*, *Lisgarante*, and *Norgarante*, which took over all SPGM operations associated with guarantee provisions. In 2007, *Agrogarante* was introduced specifically to support the primary sector.

In Portugal, three parties are involved in credit guarantee transactions: the small business borrower, a financial institution, and (at least) one mutual guarantee society that represents the national "reinsurance" fund (i.e., Mutual Counter Guarantee Fund), which itself is backed mainly, but not exclusively, by the government, using public funds to cover part of the risk of MGS and leverage their ability to support SMEs. Other institutions may participate, such as the IAPMEI or Portuguese Institute of Tourism.

Most guarantee applications are filed by banks or financial institutions on behalf of the borrowers, though some firms opt to file the application on their own. In the former case, the financial institution may conduct a preliminary screening before actually submitting the application to a mutual guarantee society. The society examines the application and makes a credit decision, on the basis of the track record of the firm and its shareholders; the conditions

[16] The SPGM's activity is regulated by legal norms listed in the *Decreto-Lei nº. 309-A/07* published by the *Diário da República Portuguesa*.

for growth for the firm's activity; the market in which it operates; its financial and economic situation; and its direct or indirect relationships with other firms. The maximum amount guaranteed to a borrower from the entire system is €1,000,000.00, conditional on a maximum of €500,000.00 provided by each society. The mutual guarantee covers 50–75% of bank loans or other financial products (e.g., leasing contracts, factoring). For example, for bank loans with a maturity of at least three years granted to smaller companies (fewer than 100 employees), the ratio could reach 75% of capital, benefiting from a counter-guarantee provided by the European Investment Fund (SPGM, 2007).

If the application is approved and there is an institution available to provide the loan, the credit granting process starts immediately (otherwise, the SPGM can collaborate to seek a lender). First, to obtain guaranteed loans, SMEs must become shareholders in the SPGM. Their share position corresponds to 2% of the issued guarantee they acquire from the promoter or from another mutualist (i.e., shareholder), which can be sold at their nominal value to SPGM or another firm, after the maturity of the guarantee. The mutualist character of these agreements helps support the SMEs and their development on favorable terms. The SMEs are not mere customers but also shareholders, which helps ensure strong customization and a real emphasis on assessing and meeting their needs. Second, the borrower must pay a guarantee commission annually, usually corresponding to minimum of 0.5% and a maximum of 4.5% of the outstanding amount of the guarantee, depending on the type of guarantee and the firm's own risk assessment. Third, the SPGM, or a debt collection institution, collects the loan.

2.4. Data, method, and variables

2.4.1. Data

We use data from one of the major commercial banks operating in Portugal, gathered between January 2008 and December 2010.[17] These data represent the Portuguese banking environment reasonably well, in that they came from a long-term credit decision period and cover most of this large bank's credit portfolio for different geographical regions. Interviews with account managers also revealed that the bank maintains a single general credit policy, according to which account managers may approve credit requests below a certain threshold on their own; if the credit request surpasses this threshold, the decision occurs at a central bank level. The degree of market concentration, measured by the Herfindahl-Hirschman index, was 1303, which indicated a moderately concentrated market (APB 2012: 29, 63).[18]

In Portugal, SMEs represent 99.6% of businesses and create 75.2% of private employment and 56.4% of trade (BdP, 2013). Accordingly, the data set comprises 11,181 loans

[17] We guaranteed this bank confidentiality and anonymity for it and its customers.

[18] Values of this ratio below 1000 suggest little bank concentration, values between 1000 and 1800 indicate moderate concentration, and values greater than 1800 imply a highly concentrated market.

granted to SMEs.[19] Most of the loans were issued in 2010 (43.08%) and 2009 (38.72%), rather than 2008 (18.20%). Previous research reveals that loan terms can differ as a function of the type of business operation (Berger and Udell, 1998), so we sought to focus on financial loans[20] and excluded unincorporated business, for which the assets are not separate from the owner's (usually classified as households).

2.4.2. Method

First, we investigate the determinants of the incidence of third-party guarantees. On the basis of our literature review and the characteristics of the Portuguese MGS, we consider the role of the borrower risk type and the impact of the lender's capital ratios on the decision to grant mutual guaranteed loans (e.g., SPGM, 2007; Cardone-Riportella et al., 2008; Ono et al., 2013). To test for the controversial substitution effect between collateral and mutual guarantees (Honohan, 2010), we also include the borrower´s collateralization profile, which controls for the different types of assets provided to secure the loan. We also control for the loan size and sector of activity. By including interactions between risk type variables, we note the potential cross-effect between observed risk and private information on mutual guaranteed loans. Therefore, we test the following model with a Probit estimator:

$$y_i = \beta_1 \text{borrower risk type}_i + \beta_2 \text{collateralization profile}_i + \beta_3 \text{lender characteristics}_i + \beta_4 \text{control variables}_i + \beta_5 \text{ interactions variables}_i + \varepsilon_i \text{ for } i = 1, \ldots, N, \quad \text{(Eq.1)}$$

where y_i is a binary variable (*MG*) that takes a value of 1 if the firm receives a mutual guaranteed loan and 0 otherwise.

Second, in line with Columba et al. (2010), we examine the effect of MGS on the explicit loan price (i.e., interest rate premium). Because the negotiation of the interest rate premium may depend on the borrower's characteristics, we include borrower risk type in this model. We also analyze bank loans granted during a period of adjustment (Basel II), so we include the lender's financial characteristics in the model too. We control for loan size and the sector of activity. Additionally, we control for the cross-effect between mutual guarantees and collateral availability on the loan interest rate premium, because the cost of borrowing frequently

[19] We define SMEs in line with the European Commission (2003/361/EC) and the Basel II agreement, as firms with fewer than 250 employees and annual business volumes less than €50 million or assets that do not exceed €43 million (EC, 2003)

[20] We also exclude loans that are mainly transaction driven (e.g., mortgages, equipment loans, motor vehicle loans, loans based on the purchase of fixed assets), because they are typically granted on a (business) collateral basis; in asset-based lending of this type (Steijvers and Voordeckers 2009; Berger and Udell, 2002), it is frequently mandatory to provide the assets funded by the loan as collateral, independent of the observable or private borrower's information. Including these loans in the sample would likely skew the global results, especially when we test the relation between mutual guarantees and loan collateralization.

depends on the presence of MGS (Columba et al. 2010) and the collateral pledged (Zecchini and Ventura, 2009). The model is:

$$y_i = \beta_1 MG_i + \beta_2 \text{borrower risk type}_i + \beta_3 \text{lender characteristics}_i + \beta_4 \text{control variables}_i + \beta_5 \text{interaction effect}_i + \varepsilon_i \text{ for } i=1, \ldots, N, \quad \text{(Eq. 2)}$$

where y_i is the interest rate premium (IRP) charged by the bank, beyond the index (i.e., Euribor 12 months).

When testing for the effect of mutual guarantees (and the interaction effect of mutual guarantees and collateralization) on the loan interest rate premium paid, we assume the possibility that these variables are jointly determined,[21] which may promote endogeneity concerns, caused by the correlation between the endogenous variables and the error term. We therefore followed the instrumental variables (IV) method proposed by Rivers and Vuong (1988) and Wooldridge (2010). First, ordinary least squares (OLS) serve to regress the mutual guarantee (and collateral variables) as possible endogenous variables on all independent and control variables, including IVs, to obtain the reduced form of the residuals (i.e., reduced form regression). Second, the OLS estimation expands to the IRP on all exogenous variables, including residuals obtained in the first step (e.g., Ono and Uesugi, 2009). If the residual t-statistics are not statistically significant, the results do not reject the null hypothesis that the contract terms are exogenous. If we find evidence of endogeneity, we perform Durbin (1954) and Wu-Hausman (Wu, 1974; Hausman, 1978) tests of the null hypothesis that the MG (Collateral) is exogenous. If the contract terms are endogenous, we must replace the OLS model with a two-stage least squares (2SLS) model for IRP. As checks on the validity of the estimations and instruments, we used the Durbin and Wu-Hausman tests expanded to Wooldridge's (1995) robust score and robust regression-based tests (see Baum, 2006), as well as the F-test and Cragg and Stock and Yogo (2005) test for weak identification (H_0: The instrumental variable is weak, such that Corr (x, z) = 0).

Finally, to investigate the socio-economic welfare effect of MGS (Honohan, 2013) we explicitly test the outcome of mutual guarantees in terms of the firm's ex post performance. The ex post performance of a borrower likely is linked to its current risk, so we include borrower risk type; the model also controls for the loan size and sector of activity. Again, we test the cross-effect between mutual guarantees and the incidence of collateral on the ex post performance of the firm, thus extending the investigation to its relation.[22] We use a Probit estimator to test the following model:

$$y_i = \beta_1 MG_i + \beta_2 \text{borrower risk type}_i + \beta_3 \text{interaction effect}_i + \varepsilon_i \text{ for } i = 1, \ldots, N. \quad \text{(Eq. 3)}$$

[21] Brick and Palia (2007) proved that loan interest rate negotiation and collateral requirements are jointly determined. See also Columba et al. (2010).

[22] We do not include the lender's characteristics in this model, because theoretically, bank capital ratios should not influence the borrower's ex post performance.

Because our data set does not include information about the financial performance of borrowing firms, we focus on loan performance (Uesugi et al., 2010; Cowling, 2010). That is, y_i is a binary variable that takes a value of 1 if the borrower does not have any loans in default at the time the loan was granted but defaults after obtaining the loan.

2.4.3. Variables

2.4.3.1. Dependent variables

The dependent variable *MG* in Equation 1 is binary; it is equal to 1 if the firm receives a mutual guaranteed loan and 0 otherwise. In Equation 2, *IRP* is the dependent variable, reflecting the interest rate premium charged by the bank, beyond the index (i.e., Euribor 12 months). *Default* is the dependent variable in Equation 3, and it takes a value of 1 if the borrower does not have any loan in default at the time the loan was granted but then defaults after obtaining the loan and 0 otherwise (Jiménez et al., 2009).

2.4.3.2. Independent variables

The lender and MGS examine the application for mutual guaranteed loans and make credit decisions, on the basis of their risk perceptions of the borrower, the market conditions in which the firm operates, its financial and economic situation, and the firm's track record (SPGM, 2007). Therefore, to analyze borrowers' risk type, we rely on *industry risk* (Han et al., 2009), *financial tension* (Bartoli et al., 2013), and *credit score* (Ono et al., 2013).[23] *Industry risk* is the ratio of the defaulted to total loans granted by the average industry.[24] *Financial tension* is the ratio between the loan amount approved by the bank to the firm and the total credit available in the entire financial system for this firm (as a percentage).[25,26] For a given loan size, high ratio values indicate relative financial distress for further funding rounds. *Credit*

[23] Age and size are commonly used to measure the informational asymmetries (i.e., opacity) of an SME and firm sales or profitability to measure firm risk. However, our data set comprises substantial information about the loan granted to a borrower, without much information about the borrower firm (such as age and firm size).

[24] Han et al. (2009) use industry profitability and industry risk to predict the incidence of collateral and the loan interest rate premium. Industry profitability is measured by industry average pre-tax income to total assets, and industry risk is measured by the standard deviation of profitability.

[25] Portuguese law mandates that all institutions report, on a monthly basis to the Banco de Portugal (BdP), all loans above 50 euros. This information is maintained in the Central Credit Register (CRC). Thus, when granting a new loan, a bank can observe the total amount borrowed from other banks, as well if the applicant has any credit overdue.

[26] Bartoli et al. (2013) define *Financial tension* as binary variable, equal to 1 if in December 2008, the firm was using more than 70% of its line of credit granted by the banking system and if in March 2009 (the peak of the crisis) it was using more than 80% (i.e., increase of more than 10%). It takes a value of 0 otherwise. Data limitations prevent us from using this measure, because we do not know the evolution of available credit in the banking system for the firm during the maturity of the loan.

score is defined by the lender at the time it grants the loan, using an internal ratings-based approach. This score combines data about the personal credit history of the small business owner with firm financial data, then allows for the definition of three binary credit score groups: *high credit score* equals 1 if the score is classified as AAA to BB; *medium credit score* equals 1 if the score if classified as BB- to B-; and *low credit score* is 1 for scores of CCC and C. Each variable equals 0 otherwise.[27]

Academic and empirical literature suggests that a mutual guarantee replaces the need to provide collateral, at least to some extent. By legal imposition, MGS limits the percentage of the loan that can be secured by a third-party guarantee though. This limitation can make mutual guarantees inefficient and unattractive for lenders and borrowers in the absence of collateral (Boschi et al., 2014). Furthermore, by posting their own collateral, borrowers provide a more credible signal of their creditworthiness and ex post commitment, which deters adverse selection (Bester, 1985; Chan and Kanatas, 1985) and moral hazard (Boot et al., 1991) and thereby reduces the likelihood of default (Besanko and Thakor, 1987). Therefore, posting extra collateral should help the borrower access a third-party guaranteed loan. In this framework, if collateral is required to receive a mutual guaranteed loan, both the borrower and lender likely privilege the use of personal assets, because personal collateral is more effective in limiting the borrower's risk preferences, in that it increases the chances that the borrower will feel any losses due to default personally (Mann, 1997a, b; Voordeckers and Steijvers, 2006; Menkhoff et al., 2012). Alternatively, the substitution effect might exist for business collateral if mutual guarantees promote lending activity even when the firm's business assets are constrained. To test whether posting extra collateral increases access to a mutual guaranteed loan, we use a binary variable that equals 1 if the borrower receives a mutual guaranteed loan with extra collateral and 0 otherwise (i.e., *Collateral*). To explicitly test the differences between the value of business and personal assets to access banking loans, we use two alternative binary variables: *Business collateral* equals 1 if the borrower has pledged firm assets as collateral, and *Personal collateral* equals 1 if the borrower has pledged personal assets as collateral to receive the loan. Each variable equals 0 otherwise.

To control for adjustments to the bank capital ratios, in line with the Basel II Capital Accord, we measured lender characteristics, in the form of *Tier 1* and *Solvability ratio* variables. *Tier 1* is the ratio of total equity, less revaluation reserves, to risk-based assets; *Solvability* is the ratio of equity to debt. We also control for the *loan size* and *sector* of activity. To examine the possibility of endogeneity in *MG* (and interaction effects of MGS and collateralization) and the IRP variables in Equation 2, we use *Project Finance*, a dummy variable that equals 1 if the loan was granted to finance a project and 0 otherwise (Godlewski and Weill, 2011) as an IV.

[27] The database provided by the bank reports four credit score categories: (1) Credit Score AAA to BB; (2) Credit Score BB-; (3) Credit Score B+ to B-; and (4) Credit Score CCC to C. Our objective is to examine behavior in the two extreme categories, high and low, so we aggregated the two intermediate levels.

The interaction effects among *credit score*, *industry risk,* and *financial tension* in Equation 1 seek to control for the relation between mutual guarantees and the firm´s risk. Therefore, *Inter1* is the interaction between *High credit score* and *Industry Risk*; *Inter2* is the interaction between *High credit score* and *Financial Tension*; *Inter3* is the interaction between *Low credit score* and *Industry Risk*; and *Inter4* is the interaction between *Low credit score* and *Financial Tension*. To control the relation between mutual guarantees and IRP (Equation 2) and ex post default (Equation 3), we use the variable *Inter 5*, which reflects the interaction of *MG* and *Collateral*. With this interaction, we test explicitly for the impact of posting extra collateral, as a signal of borrowers' credit quality, on both loan prices and ex post default.

2.5. Results

2.5.1. Descriptive statistics and univariate tests

Table 2.1 reports the descriptive statistics. The sample comprises 11,181 loans with a maximum volume of 65 million euros. Of these loans, 55% were supported by mutual guarantees and 79% were collateralized. According to this preliminary finding, collateral posted by borrowers is relevant for obtaining a loan in an MGS (Boschi et al., 2014). The sample includes 5,839 (52.2%) loans classified as high credit scores. Almost 17% of the sample loans experienced default, and the mean IRP is 2.89%. The mean of the Tier 1 ratio ranges between 7% and 10%; and the solvency ratio ranges between 10% and 15%[28], both above the minimum value required by the Basel II. The mean value of the loans granted is €251,984. The industry sectors most widely represented in the sample are wholesale and retail, repair of motor vehicles and motorcycles (Sector G, 34.5%), and manufacturing (Sector C, 25%). The least represented include electricity, gas, steam, hot and cold water, and cold air industries (Sector D, 0.1%), as well as artistic activities, entertainment, sports, and recreation (Sector R, 0.5%); service activities (Sector S, 0.6%); collection, purification, and distribution of water, sanitation waste management, and remediation activities (Sector E, 0.6%); education (Sector P, 0.7%); financial and insurance activities (Sector K, 0.8 %); and the extractive industry (Sector B, 1%).

Table 2.2 contains the results of the nonparametric univariate tests, for *MG* (Panel A) and *Default* (Panel B). At the mean level, mutual guaranteed loans go to firms that pay lower IRP (2.55% vs. 3.3%) and with lower ex post default events (11% vs. 24%). Panel A also shows that borrowers with high credit scores tend to receive these loans (59% vs. 44%), according to the positive relation between the *Industry Risk* (*Financial Tension)* and *MG*. We find a positive relation between mutual guaranteed loans and the incidence of collateral (incidence = 61% in nonguaranteed loans, 93% in mutual guaranteed loans). In line with prior literature and Table 2.1, this result indicates that poorly guaranteed firms do not obtain additional financing if their collateral guarantee intensity is too low (e.g., Boschi et al., 2014).

[28] For reasons of confidentiality, we do not report the absolute values of these two ratios. This information is available upon request.

With regard to the type of collateral, the results indicate a negative (positive) link between MG and business (personal) collateral. If the borrower is business collateral constrained, the lender may require personal collateral to provide (costly) guarantees (93% vs. 58%). Therefore, the coverage ratio between the guarantee and lending amount is an important tool to mitigate moral hazard, such that it serves as a performance bond against post-loan managerial shirking and risk-taking activities (Boot and Thakor 1990). In exchange, firms face lower loan IRP (2.55% vs. 3.3%) (Gama and Duarte, 2015).

The results further indicate that, at the mean, the incidence of default is higher for non-guaranteed loans, for loans granted to firms operating in riskier industries and with low credit scores, and among firms that pay higher loan IRP.

2.5.2. Determinants of mutual guaranteed loans

Table 2.3 contains the results for the determinants of mutual guaranteed loans (i.e., Equation 1).[29] Because we have several collateral and lender characteristics variables, we estimate different specifications to avoid multicollinearity. Specification [1] includes only borrower risk type variables; specifications [2] and [3] add collateral profile variables, Specifications [4] and [5] include lender characteristics but exclude collateral variables, Specification [6] features the borrower's risk profile and all control variables, and Specifications [7]–[11] employ the interactions variables, with different combinations of the collateral and lender characteristics variables. According to the Probit estimations, firms operating in riskier industries (*Industry risk* $p < .01$, specification [1], [2], [3] and [5]; $p < .05$ specification [4]) and in contexts with higher *financial tension* are more likely to obtain mutual guaranteed loans, regardless of the lender's preference for firms with *high credit score* (the coefficients are statistically significant in specifications [1]–[5], $p < .01$). Interaction effects (specifications [7]–[11]) confirm that firms operating in riskier sectors and/or with greater financial difficulties have the most likely access to mutual guaranteed loans, if and only if the bank identifies them as having high credit scores (positive coefficients of *Inter 1* are statistically significant in all specifications $p < .01$; positive coefficients of *Inter 2* are statistically significant at the 1% level in specifications [10] and [11] and the 5% level in specifications [7]; the coefficients of *Inter 3* and *Inter 4* are statistically significant at the 1% level in specifications [10]–[11] and [7]–[10], respectively).

The probability of benefiting from a mutual guaranteed loan thus ranges from 47% to 55%. A mutual guaranteed loan is more likely for borrowers that provide *collateral* ($p < .01$, specification [2]). Yet a closer analysis reveals that MG and business collateral are substitutes

[29] We isolate *Industry risk* and *Sector* variables when the first variable also varies depending on the activity sector. *Collateralization profile* and activity *sector* are isolated, because the ability to provide collateral relates closely to the characteristics of the individual loan and firm (Berger and Udell, 1998) which may vary across sectors. *Loan size* and *collateralization profile* are also isolated; these variables can be jointly determined, and it is very difficult to find a good instrumental variable for the loan size that is not related to the incidence of collateral (e.g., Brick and Palia, 2007).

(p < .01, specification [3]), whereas MG is a complement to personal collateral (p < .01, specification [3]). In line with the univariate tests results, we find that lenders value the provision of extra collateral, in the form of personal assets, in their credit decisions, either as a deterrent to moral hazard (e.g., Besanko and Thakor 1987) or simply to increase coverage of the secured loan.

Moreover, an increase of bank capital ratios (Tier 1 and Solvability ratio) increases the number of loans granted under MGS (p < .01, specifications [4] and [5]). It appears that under the new set-up imposed by Basel II, the relevance of MGS increases for Portuguese banks, because these schemes, in certain conditions (e.g., Basel II categorizes most MGS as guarantors; Gai, 2005; Vallascas, 2005), can help mitigate banks' SMEs portfolio risks and reduce regulatory capital requirements. Furthermore, smaller loans are more likely to attract a mutual guarantee (p < .01, specification [6]). Assuming that loan size is a good proxy for firm size (e.g., Columba et al., 2010), this result indicates that mutual guarantees actually are used to extend credit to smaller firms, which tend to be constrained in their business assets (Menkhoff et al., 2012), and to fund previously unfunded, profitable projects (Gale 1990, 1991). Human capital-intensive activities, such as information and communication (Sector J) or human health (Sector Q) sectors, are most likely to benefit from mutual guarantees. Agriculture, animal production, or fishing (Sector A),[30] financial and insurance activities (Sector K), and real estate (Sector L) are the sectors less likely to benefit from them. The results for Specifications [8]–[11] remain unchanged, compared with those reported in specifications [2]–[5].

[30] The early development stage of Portuguese MGS in Sector A during the study period might explain this result (see Section 2.3).

Table 2.1. Variables definition and descriptive statistics

This table presents variables definition and descriptive statistics. The *Default* variable is based on information available in the Central Credit Register. *Industry risk* is calculated as the ratio of nonperforming loans to total loans granted, by industrial sector. *Credit Scores* are internal scores assigned by the risk department of the bank to the loan applicant. The Tier 1 and Solvability ratios are available in the annual report of the financial institution. [a] See footnote 28.

Variable	Definition	Obs.	Mean	Std. dev.	Min.	Max.
Dependent variables						
MG	Equals 1 if borrower receives a mutual guaranteed loan (0,1)	11,181	0.546	0.498	0	1
IRP	Difference between the contractual interest rate for the loan and the prime rate	11,181	2.890	1.145	0.50	13.78
Default	Equals 1 if borrower did not default previously but defaulted after the loan was granted (0,1)	11,181	0.172	0.377	0	1
Borrower risk type						
Industry risk	Ratio of the default loans divided by total loan granted by industry	11,181	4.689	1.803	0.125	7.075
Financial Tension	Ratio between the loan amount approved by the bank to the firm and the total credit available in the entire financial system for the firm (%)	11,181	39.370	27.001	0.024	100
High credit score	Equals 1 if the loan is classified with an internal credit score of AAA to BB (0, 1).	11,181	0.522	0.500	0	1
Medium credit score	Equals 1 if the loan is classified with an internal credit score of BB- to B- (0,1)	11,181	0.444	0.497	0	1
Low credit score	Equals 1 if the loan is classified with an internal credit score of CCC to C (0,1)	11,181	0.033	0.179	0	1
Collateralization profile						
Collateral	Equals 1 if borrower has pledged collateral (0,1)	11,181	0.785	0.411	0	1
Business collateral	Equals 1 if borrower has pledged firm assets as collateral (0,1)	11,181	0.078	0.268	0	1
Personal collateral	Equals 1 if borrower has pledged personal assets as collateral (0,1)	11,181	0.770	0.421	0	1
Lender characteristics						
Tier 1	Ratio [(total equity – revaluation reserves)/risk-based assets][a]	11,181	[7:10]	0.684	[7:10]	[7:10]
Solvability Ratio	Ratio (equity/debt) [a]	11,181	[10:15]	0.686	[10:15	[10:15]
Interaction variables						
Inter1	[High credit score × Industry Risk]	11,181	2.466	2.689	0	7.075
Inter2	[High credit score × Financial Tension]	11,181	19.710	26.814	0	100
Inter3	[Low credit score × Industry Risk]	11,181	0.134	0.800	0	7.075
Inter4	[Low credit score × Financial Tension]	11,181	1.626	10.103	0	100
Inter5	[MG × Collateral]	11,181	0.506	0.500	0	1

Table 2.1. Descriptive statistics *(Continuation)*

Variable	Definition	Obs.	Mean	Std. dev.	Min.	Max.
Control variables						
LoanSize	Loan amount measured in euros	11,181	251,984.500	1,304,331.000	5,000	65,000,000
Sector_A	Equals 1 if borrower belongs to the agriculture, animal production, or fishing industry (0,1)	11,181	0.017	0.130	0	1
Sector_B	Equals 1 if borrower belongs to the extractive industry (0,1)	11,181	0.010	0.101	0	1
Sector_C	Equals 1 if borrower belongs to the manufacturing industry (0,1)	11,181	0.250	0.433	0	1
Sector_D	Equals 1 if borrower belongs to the electricity, gas, steam, hot and cold water, and cold air industry (0,1)	11,181	0.001	0.025	0	1
Sector_E	Equals 1 if borrower belongs to the collection, purification and distribution of water, sanitation waste management and remediation activities (0,1)	11,181	0.006	0.078	0	1
Sector_F	Equals 1 if borrower belongs to the construction industry (0,1)	11,181	0.129	0.335	0	1
Sector_G	Equals 1 if borrower belongs to the wholesale and retail repair of motor vehicles and motorcycles industry (0,1)	11,181	0.345	0.475	0	1
Sector_H	Equals 1 if borrower belongs to the transportation and storage industry (0,1)	11,181	0.037	0.189	0	1
Sector_I	Equals 1 if borrower belongs to the lodging, restaurant, and similar industries (0,1)	11,181	0.039	0.194	0	1
Sector_J	Equals 1 if borrower belongs to the information and communication activities industry (0,1)	11,181	0.019	0.135	0	1
Sector_K	Equals 1 if borrower belongs to the financial and insurance activities industry (0,1)	11,181	0.008	0.087	0	1
Sector_L	Equals 1 if borrower belongs to the real estate industry (0,1)	11,181	0.021	0.143	0	1
Sector_M	Equals 1 if borrower belongs to the scientific and technical consultancy	11,181	0.051	0.220	0	1
Sector_N	Equals 1 if borrower belongs to the administrative and support services	11,181	0.023	0.151	0	1
Sector_P	Equals 1 if borrower belongs to the education industry (0,1)	11,181	0.007	0.083	0	1
Sector_Q	Equals 1 if borrower belongs to the human health activities and social	11,181	0.026	0.158	0	1
Sector_R	Equals 1 if borrower belongs to the artistic activities, entertainment, sports, and recreation (0,1)	11,181	0.005	0.074	0	1
Sector_S	Equals 1 if borrower belongs to the other service activities industry (0,1)	11,181	0.006	0.075	0	1
Instrumental Variable						
Project Finance	Equals 1 if the loan was granted to finance a project (0,1)	11,181	0.323	0.468	0	1

Table 2.2. Univariate Test (nonparametric)

This table presents univariate tests for independent variables. *MG* = 1 if the borrower received a mutual guaranteed loan (0,1); *IRP* = difference between the contractual interest rate for the loan and the prime rate; *Default* = 1 if the borrower did not default previously but defaulted after the loan was granted (0,1). *Wilcoxon-Mann-Whitney* test is conducted for continuous variable on mean; a z-test applied to binary variables at the median. H0: mean (y = 0) = mean (y = 1). DIFF = mean (y = 1). The left-hand column reports the difference in means: Panel A Mean (MG = 0) – Mean (MG = 1), and Panel B Mean (Default = 0) – Mean (Default = 1).*** $p < .01$. ** $p < .05$. * $p < .1$.

Panel A: Mutual Guarantees (*MG*)

	Without Mutual Guarantees (N=5,075)				*With Mutual Guarantees (N=6,106)*				*Mean Diff*
Variable	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.	
Dependent variables									
IRP	3.30	1.31	0.50	13.78	2.55	0.84	0.88	8.00	2.89***
Default	0.24	0.43	0	1	0.11	0.31	0	1	0.13***
Industry risk	4.33	1.84	0	7.08	4.99	1.71	0	7.08	-0.66***
Financial Tension	36.89	27.92	0	100	41.43	26.04	0	100	-4.54***
High credit score	0.44	0.50	0	1	0.59	0.49	0	1	-0.15***
Low credit score	0.05	0.22	0	1	0.02	0.13	0	1	0.04***
Collateral	0.61	0.49	0	1	0.93	0.26	0	1	-0.31***
Business collateral	0.14	0.35	0	1	0.02	0.15	0	1	0.12***
Personal collateral	0.58	0.49	0	1	0.93	0.26	0	1	-0.34***
Tier 1	8.18	0.80	7.00	8.90	8.58	0.51	7.00	8.90	-0.40***
Solvability Ratio	11.92	0.82	10.70	12.60	12.30	0.49	10.70	12.60	-0.38***
LoanSize	367,920	1,907,672	5,000	65,000	155,624	265,398.90	5,000	4,830,319	212,295.8***

Panel B: Ex post default (*Default*)

	Not Defaulted (N=9,262)				*Defaulted (N=1,919)*				*Mean Diff*
Variable	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.	
Dependent variables									
MG	0.59	0.49	0	1	0.35	0.48	0	1	0.23***
IRP	2.82	1.08	1	13	3.21	1.35	1	14	-0.40***
Industry risk	4.68	1.81	0	7	4.71	1.76	0	7	-0.028
Financial Tension	39.77	26.55	0	100	37.45	28.99	0	100	2.31***
High credit score	0.59	0.49	0	1	0.20	0.40	0	1	0.39***
Low credit score	0.03	0.16	0	1	0.07	0.26	0	1	-0.04***

Table 2.3. Mutual Guaranteed Loans

This panel reports the marginal effects in the Probit estimations for *MG*. *dMG/dx* is the discrete change of the dummy variable from 0 to 1. All industry sectors are controlled but only statistically significant sectors are reported: *Sector_A* = agriculture, animal production, or fishing industry; *Sector_J* = information and communication activities; *Sector_K* = financial and insurance activities; *Sector_L* = real estate industry; *Sector_Q* = human health activities and social support. Including binary variables for sectors implies the non-inclusion of *Industry Risk*, due to the potential for collinearity. Standard errors are reported in brackets. *** $p < .01$ ** $p < .05$ * $p < .1$.

Panel A: Probit Marginal Effects

Dependent variable: *MG*

	(1)	(2)	(3)	(4)	(5)	(6)
Borrower risk type						
Industry risk	0.053***	0.050***	0.049***	0.012**	0.021***	
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	
Financial tension	0.002***	0.001***	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
High credit score	0.143***	0.139***	0.132***	0.165***	0.159***	0.139***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Low credit score	-0.207***	-0.214***	-0.225***	-0.206***	-0.213***	-0.239***
	(0.027)	(0.028)	(0.028)	(0.028)	(0.027)	(0.026)
Collateralization						
Collateral		0.451***				
		(0.010)				
Business collateral			-0.454***			
			(0.012)			
Personal collateral			0.491***			
			(0.009)			
Lender						
Tier 1				0.212***		
				(0.009)		
Solvability					0.190***	
					(0.008)	
Control variables						
Ln(LoanSize+1)						-0.249***
						(0.065)
Sector						
Sector_A						-0.237***
						(0.058)
Sector_J						0.141**
						(0.066)
Sector_K						-0.429***
						(0.054)
Sector_L						-0.154***
						(0.071)
Sector_Q						0.117**
						(0.066)
Pr(MG)	0.548	0.541	0.536	0.545	0.545	0.545
Observations	11,181	11,181	11,181	11,181	11,181	11,181
LR chi^2	802.89	2,305.61	3,250.51	1,415.50	1,349.68	694.62
Prob.>chi^2	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.052	0.150	0.211	0.092	0.088	0.045

Table 2.3. Mutual Guaranteed Loans (Cont.)

This panel reports the marginal effects in the Probit estimations for *MG*. *dMG/dx* is the discrete change of the dummy variable from 0 to 1. Inter1= [High credit score x Industry Risk]; Inter2=[High credit score x Financial Tension]; Inter3=[Low credit score x Industry Risk]; Inter4=[Low credit score x Financial Tension]. Standard errors are reported in brackets. *** $p < .01$ ** $p < .05$ * $p < .1$.

Panel B: Probit Marginal Effects

Dependent variable: *MG*

	(7)	(8)	(9)	(10)	(11)
Interaction variables					
Inter 1	0.039***	0.042***	0.038***	0.017***	0.019***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Inter 2	0.001**	-0.001	0.001	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)
Inter 3	-0.005	0.001	0.006	-0.038***	-0.036***
	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)
Inter 4	-0.002***	-0.003***	-0.004***	-0.001***	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Collateralization profile					
Collateral		0.454***			
		(0.008)			
Business collateral			-0.415***		
			(0.010)		
Personal collateral			0.492***		
			(0.008)		
Lender characteristics					
Tier 1				0.276***	
				(0.006)	
Solvability Ratio					0.270***
					(0.006)
Pr(MG)	0.490	0.475	0.465	0.466	0.469
Observations	12,474	12,474	12,474	12,474	12,474
LR chi^2	663.49	2,642.71	3,715.89	2,969.20	2,800.61
Prob.>chi^2	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.038	0.153	0.215	0.172	0.162

2.5.3. Mutual guaranteed loans and the cost of borrowing

Tables 2.4 and 2.5 report estimations of the effect of mutual guarantees on loan IRP (Equation 2). Because mutual guarantees, the effect of posting extra collateral (*Inter 5*), and the cost of borrowing (IRP) could be jointly determined, in Table 2.4 we report benchmark estimations to evaluate the potential presence of endogeneity among these variables. We first regress the IRP on all variables, assuming that *MG* and *Inter 5* (i.e., interaction effect between *MG* and *Collateral*) are exogenous (Ono and Uesugi, 2009). Then we report endogeneity tests: the residual t-statistics of the potential endogenous variables (*MG* and *Inter5*) in the first step, as well as the Durbin chi-square (Durbin, 1954) and Wu-Hausman F-test (Wu, 1974; Hausman, 1978).

Table 2.4. Mutual Guaranteed Loans and Loan Interest Rate Premium -OLS

This panel reports the single OLS estimator for *IRP* on all exogenous variables, including the possible *MG (Inter5)* endogenous variable, plus the residuals of IRP obtained in the first step. Inter 5 = [MG × Collateral]. All industry sectors are controlled (Specifications [4] and [8]), but only statistically significant coefficients sectors are reported. *Sector_B* = 1 if borrower belongs to the extractive industry (0,1); Sector_E = 1 if borrower belongs to the collection, purification, and distribution of water, sanitation waste management and remediation activities (0,1); Sector_K = 1 if borrower belongs to the financial and insurance activities industry (0,1), *Sector_M* = 1 if borrower belongs to the scientific and technical consultancy industry (0,1). Including the sector binary variables implies the non-inclusion of *Industry Risk*, due to the potential for collinearity. Residual t-statistics and Durbin and Wu-Hausman tests are reported, to test the hypothesis of endogeneity of *MG* (*Inter5*) explaining IRP, such that H_0: The variable *MG* (*Inter5*) is exogenous. Standard errors are reported in brackets. *** $p < .01$. ** $p < .05$. * $p < .1$.

First Stage, Ordinary Least Squares								
Dependent variable: *IRP*								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
MG	-0.785***	-0.922***	-0.849***	-0.735***				
	(0.021)	(0.021)	(0.021)	(0.021)				
Borrower risk type								
Industry risk	0.102***	0.008	0.064***		0.096***	0.007	0.062***	
	(0.006)	(0.006)	(0.006)		(0.006)	(0.006)	(0.006)	
Financial tension	0.002***	0.002***	0.002***	0.002***	0.002***	0.001***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
High credit score	-0.251***	-0.198***	-0.230***	-0.237***	-0.265***	-0.217***	-0.247***	-0.250***
	(0.021)	(0.020)	(0.020)	(0.021)	(0.021)	(0.020)	(0.021)	(0.021)
Low credit score	0.274***	0.282***	0.271***	0.196***	0.306***	0.318***	0.305***	0.230***
	(0.057)	(0.055)	(0.057)	(0.058)	(0.058)	(0.056)	(0.057)	(0.058)
Lender characteristics								
Tier 1		0.491***				0.465***		
		(0.017)				(0.017)		
Solvability			0.231***				0.210***	
			(0.017)				(0.017)	
Control variables								
Ln(LoanSize+1)				-0.093***				-0.091***
				(0.008)				(0.008)
Sector								
Sector_B				0.774*				0.736*
				(0.414)				(0.418)
Sector_E				0.935**				0.898**
				(0.422)				(0.425)
Sector_K				0.794*				0.790*
				(0.418)				(0.421)
Sector_M				0.759*				0.717*
				(0.405)				(0.408)
Interaction variables								
Inter5					-0.716***	-0.836***	-0.771***	-0.670***
					(0.021)	(0.021)	(0.021)	(0.021)
Constant	2.867***	-0.738***	0.278	3.749***	2.840***	-0.575***	0.480**	3.710***
	(0.035)	(0.131)	(0.191)	(0.415)	(0.035)	(0.132)	(0.193)	(0.419)
Observations	11,181	11,181	11,181	11,181	11,181	11,181	11,181	11,181
F	395.13	488.41	366.57	82.23	344.89	424.40	317.27	72.18
Prob>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.150	0.208	0.165	0.140	0.134	0.186	0.146	0.125
Adj. R-squared	0.150	0.207	0.164	0.138	0.133	0.185	0.145	0.123
Exogeneity tests for *MG (Inter5)*								
Resid_MG(Inter5)	-0.001	0.077	0.037	0.012	0.171***	0.286***	0.228***	0.173***
	(0.021)	(0.050)	(0.051)	(0.049)	(0.052)	(0.054)	(0.055)	(0.052)
Durbin chi-squared	0.0002	2.393	0.528	0.063	10.694***	28.458***	17.431***	11.181***
Wu-Hausman F-stat	0.0003	2.394	0.528	0.063	10.690***	28.406***	17.416***	11.194***

Table 2.5. Mutual Guaranteed Loans and Loan Interest Rate Premium -2SLS

This panel reports the two-stage least squares for *IRP*. *Project Finance* is the instrumental variable for endogenous MG (Inter5). Inter 5 = [MG × Collateral]. All industry sectors are controlled (Specifications [4] and [8]) but only statistically significant coefficients are reported. *Sector_B* = 1 if borrower belongs to the extractive industry (0,1); Sector_E = 1 if borrower belongs to the collection, purification, and distribution of water, sanitation waste management, and remediation activities (0,1); Sector_K = 1 if borrower belongs to the financial and insurance industry (0,1), *Sector_M* = 1 if borrower belongs to the scientific and technical consultancy industry (0,1). Including the sector binary variables implies the non-inclusion of *Industry Risk,* due to potential problems of collinearity. Standard errors are reported in brackets. *** $p < .01$. ** $p < .05$. * $p < .1$.

Two-Stage Least Squares
Dependent variable: *IRP*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MG (*fitted values)*	-0.784***	-0.982***	-0.878***	-0.744***				
	(0.043)	(0.044)	(0.045)	(0.042)				
Borrower risk type								
Industry risk	0.102***	0.009	0.064***		0.103***	0.010	0.065***	
	(0.006)	(0.006)	(0.006)		(0.006)	(0.007)	(0.006)	
Financial tension	0.002***	0.002***	0.002***	0.002***	0.003***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
High credit score	-0.251***	-0.189***	-0.226***	-0.235***	-0.247***	-0.183***	-0.221***	-0.232***
	(0.021)	(0.021)	(0.021)	(0.022)	(0.022)	(0.021)	(0.022)	(0.022)
Low credit score	0.275***	0.271***	0.266***	0.194***	0.284***	0.283***	0.276***	0.202***
	(0.058)	(0.056)	(0.057)	(0.058)	(0.058)	(0.057)	(0.058)	(0.059)
Lender characteristics								
Tier 1		0.503***				0.508***		
		(0.019)				(0.019)		
Solvability			0.236***				0.241***	
			(0.018)				(0.019)	
Control variables								
Ln(LoanSize+1)				-0.093***				-0.093***
Sector_B				0.777*				0.775*
				(0.414)				(0.418)
Sector_E				0.937**				0.921**
				(0.422)				(0.426)
Sector_K				0.793*				0.770*
				(0.418)				(0.422)
Sector_M				0.762*				0.757*
				(0.405)				(0.409)
Interaction variables								
Inter5 (*fitted*					-0.853***	-1.070***	-0.957***	-0.809***
					(0.047)	(0.049)	(0.050)	(0.046)
Constant	2.867***	-0.814***	0.226	3.752***	2.860***	-0.859***	0.158	3.755***
	(0.035)	(0.140)	(0.204)	(0.415)	(0.035)	(0.143)	(0.208)	(0.420)
Observations	11,181	11,181	11,181	11,181	11,181	11,181	11,181	11,181
F	177.70	238.79	161.23	39.61	173.63	229.82	156.60	38.78
Prob.>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.150	0.207	0.164	0.140	0.130	0.176	0.140	0.121

For the OLS estimations (Equations 1–4), the residual t-statistics in the estimations that include the *MG* variable fail to reject the null hypothesis of exogeneity at a 10% statistical significance level. When we interact *MG* with *Collateral* (*Inter 5*), the residual t-statistics reject the null hypothesis at a 1% statistical significance level. The Durbin chi-square and Wu-Hausman F-test confirm the previous results. With this mixed evidence about the presence of endogeneity, we refit the estiamtions using a 2SLS model (Ono and Uesugi, 2009). The IV for *MG* and *Inter 5* variables is *Project Finance*.

Table 2.5 contains these results; they are very similar to those obtained from OLS. Specification [1] includes only the fitted value of MG and the borrower's risk type; Specifications [2] and [3] include the lender characteristics; Specification 4 replaces industry risk with sector variables and the loan size (i.e., control variables). Then Specifications [5]–[8] follow the same pattern but substitute the fitted value of MG by *Inter 5* (fitted value). These results broadly confirm that borrowers benefit from a reduction in loan IRP due to a willingness to provide MG (negative coefficients in Specifications [1]–[4] are statistically significant, $p < .01$), in line with Zecchini and Ventura (2009) and Columba et al. (2010). This reduction is particularly noteworthy if the firm provides extra collateral (negative coefficients of fitted values of *Inter 5* in Specification [5]–[8] are statistically significant, $p < .01$). These results are partially in line with Boschi et al. (2014): Below a certain level of the third-party guarantee, the borrower benefits in terms of its costs when it posts extra collateral. If borrowers offer collateral and the loan is mutual guaranteed, the lender interprets it as a good signal while also enjoying reduced risk exposure. In turn, these borrowers benefit from a discounted IRP. This evidence also confirms Honohan's (2010) prediction that, in terms of credit decisions, lenders do not regard mutual guarantees as a perfect substitute for collateral, despite academic predictions that they offer identical signaling value (e.g., Busetta and Zazzaro, 2012).

Furthermore, the results confirm that firms operating in a stressful context (i.e., riskier industries, high financial tension) and those with low credit scores pay higher IRP, while those with higher credit scores pay lower IRP ($p < .01$; Han et al., 2009). The results suggest that increasing bank capital ratios (Tier 1 and Solvability ratio) increases loan pricing—a result that was expected once the Portuguese banking sector committed to increasing its capital ratios and constrained credit provision by increasing IRP (e.g., Stiglitz and Weiss, 1981). The negative coefficients of *LoanSize* in Specifications [4] and [8] ($p < .01$) confirm that large loans relate negatively to IRP (Gama and Duarte, 2015). In addition, the extractive industry (Sector B); collection, purification, and distribution of water, sanitation waste management and remediation activities (Sector E); financial and insurance activities (Sector K); and scientific and technical consultancies (Sector M) pay higher IRP for their bank loans.

2.5.4. Mutual guaranteed loans and ex post performance

Table 2.6 reports Probit estimations of the effect of MG and *Inter 5* on ex post performance loans (Equation 3). The first specification comprises only the MG variable and

borrower's risk variables, the second substitutes industry risk with sector activity variables, and then the subsequent specifications follow the previously set pattern by including the interaction variable (*Inter 5*). The negative coefficients of *MG* and *Inter 5* (statistically significant in all specifications, p < .01) suggest that mutual guaranteed loans are less likely to enter into default. These results confirm that borrowers who benefit from MGS show higher ex post performance, in partial contrast with the findings of Ono et al. (2013)[31] and in line with Bartoli et al. (2013).

In line with our predictions, firms operating in riskier industries have a higher likelihood of default (positive coefficients of *industry risk* in specifications [1] and [3] are statistically significant, *p* < .01). Yet firms operating in contexts marked by greater financial tension have a lower probability of ex post default (positive coefficients of *financial tension* are statistically significant, *p* < .01 in specifications [1] and [3] and *p* < .05 in specifications [2] and [5]). As expected, borrowers assigned a high (low) credit score entered default less (more) (negative [positive] coefficients of *high [low] credit score* are statistically significant at the 1% [5%] level in all specifications). This evidence reinforces the outcomes from Table 2.3, as well as the value of public mutual guarantees to provide funds to good firms that simply are operating in adverse contexts (i.e., greater financial tension) and thus facing difficulties receiving funds (Gale, 1990, 1991).

However, the lack of a significant effect of *loan size* on ex post performance does not confirm the prediction that large loans tend to be riskier (Leeth and Scott, 1989). Extractive (Sector B), manufacturing (Sector C), construction (Sector F), wholesale and retail repair of motor vehicles and motorcycles (Sector G), transportation and storage (Sector H), real estate (Sector H), and scientific and technical consultancies (Sector M) are the sectors most likely to enter default.

[31] Ono el al. (2013) show that the ex post performance of firms that received mutual guaranteed loans, in an emergency program, deteriorated more than that of firms that received non-emergency mutual guaranteed loans. They do not find such a performance "deterioration" effect when a non-main bank extended the emergency mutual guaranteed loans though.

Table 2.6. Mutual Guaranteed Loans and Ex Post Performance

This table reports the marginal effects after Probit estimations for *MG* controlling for interaction effects. *dMG/dx* is the discrete change of dummy variable from 0 to 1. Inter 5 = [MG × Collateralization]. All industry sectors are controlled (specifications [2] and [4]) but only statistically significant coefficients are reported. *Sector_B* = extractive industry; *Sector_C* = manufacturing industry; *Sector_F* = construction industry; *Sector_G* = wholesale and retail repair of motor vehicles and motorcycles industry; *Sector_H* = transportation and storage industry; *Sector L* = real estate industry; *Sector_M* = scientific and technical consultancy. Including the sector binary variables implies the non-inclusion of *Industry Risk*, due to potential problems of collinearity. Standard errors are reported in brackets. *** $p < .01$. ** $p < .05$. * $p < .1$.

Probit Marginal Effects

Dependent variable: *Default*

	(1)	(2)	(3)	(4)
MG	-0.102***	-0.100***		
	(0.007)	(0.007)		
Borrower risk type				
Industry Risk	0.007***		0.007***	
	(0.002)		(0.002)	
Financial Tension	-0.001***	-0.001**	-0.001***	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
High credit score	-0.213***	-0.212***	-0.203***	-0.212***
	(0.007)	(0.007)	(0.007)	(0.007)
Low credit score	0.045**	0.036**	0.048**	0.039**
	(0.019)	(0.018)	(0.019)	(0.018)
Control variables				
Ln(LoanSize+1)		-0.004		-0.003
		(0.003)		(0.003)
Sector_B		0.360***		0.358***
		(0.109)		(0.108)
Sector_C		0.194***		0.194***
		(0.073)		(0.073)
Sector_F		0.339***		0.336***
		(0.090)		(0.089)
Sector_G		0.158**		0.157**
		(0.064)		(0.064)
Sector_H		0.172**		0.172**
		(0.087)		(0.087)
Sector_L		0.368***		0.369***
		(0.101)		(0.101)
Sector_M		0.141*		0.140*
		(0.081)		(0.081)
Interaction				
Inter 5			-0.101***	-0.099***
			(0.007)	(0.007)
Pr(Default)	0.140	0.133	0.139	0.147
Observations	11,181	11,174	11,181	11,174
LR chi^2	1,251.10	1,514.79	1,252.16	1,516.44
Prob.>chi^2	0.000	0.000	0.000	0.000
Pseudo R^2	0.122	0.148	0.122	0.148

2.6. Post-estimation and robustness tests

With post-estimation tests, we check the *IRP* and *MG* (and *Inter 5*) to confirm the results of the Durbin and Wu-Hausman tests. The F-statistic for *Project Finance* as an IV (statistically significant at 1% in all specifications) is greater than 10, so the IV is not weak (Stock et al., 2002). The Stock and Yogo (2005) tests also reject the null hypothesis of a weak IV (10% rejection rate), after we confirm that the Cragg and Donald (1993) minimum Eigenvalue statistics are higher than the critical value obtained in the 2SLS Wald test (see the appendix 2.1).

In Appendices 2.2–2.4, we provide the results of a subsample analysis.[32] The results generally confirm the previously identified relations. Appendix 2.2 contains the results related to determinants of mutual guaranteed loans and confirm that third-party guaranteed loans are granted mainly to good firms operating in adverse contexts (i.e., risker industries or financial tension). These results also confirm the predicted probability of obtaining a mutual guaranteed loan (with independent variables at their mean values), such that Prob (MG) is higher for collateralized loans (65%) than for non-collateralized loans (17%). Furthermore, borrowers classified with a high credit score are more likely to obtain a mutual guaranteed loan (62%) than those with low credit scores (45%) when both provide extra collateral.

The results of the robustness test related to the effect of *MG* on *IRP* show that mutual guaranteed loans pay lower loan prices, especially for collateralized loans (Appendix 2.3). The positive effect of banking capital ratios on loan price is even higher for non-collateralized loans. Appendix 2.4. reports on the robustness test for the influence of *MG* on ex post performance, such that this performance improves with mutual credit guarantees, independent of collateral requirements. However, the predicted probability of default when the independent variables are at their mean (Prob (Default)) is higher for noncollateralized loans (i.e., 22% vs. 12%).

These results support the thesis that the efficiency of mutual guarantees does not exempt loan collateralization. However, they reveal that banks use third-party guarantees to extend (cheaper) credit to good firms that are suffering increased exposure to credit rationing. Doing so reduces the banks' risk exposure and losses in the case of default, while increasing the ex post performance of the borrowers. These effects are especially noticeable when third-party guarantees combine with collateral.

2.7. Concluding remarks

Credit guarantee schemes might emerge for three main reasons. First, the informational advantages they provide can help overcome information asymmetries, improve borrowers' access to bank loans, and reduce the costs of borrowing for certain borrowers.

[32] The robustness tests do not include the control variables (i.e., loan size and sector activity). These results are available on request.

Second, MGS help diversify risk across lenders that exhibit sectorial or geographic specialization. Third, MGS can exploit regulatory arbitrage, if they are not subject to the same regulatory requirements as the lender (e.g., Beck et al., 2010; Columba et al., 2010). The importance of mutual guarantees in Portugal thus has increased, serving as privileged instruments to absorb the negative impacts of the international financial crisis of 2008–2009 on the banking sector, even as this sector reacts to the Basel II (and III) Accords.

The many competing pressures for public funds suggests the strong need to evaluate the effectiveness of MGS that include the participation of government agencies. To the best of our knowledge, this study is the first comprehensive evaluation of the types of loan covered by mutual guarantees, the relation between guarantees and extra collateral, and the effectiveness of mutual guarantees in terms of reducing borrowing costs and affecting the ex post performance of both the firm and the loan.

With this study, we find that MGS privileges high type borrowers, such that mutual guarantees and collateral (broadly measured) are complementary loan tools. However, MG and business collateral function more as substitutes, while MG complements personal collateral. These results suggest that lenders value the provision of extra collateral in the form of personal assets, either as a deterrent to moral hazard or as a means to increase their coverage of a secured loan. In light of the Basel II (and III) Accords, MGS allow banks to mitigate their credit risk associated to business lending, save regulatory capital, and redub both the probability of default and the losses if default occurs. Accordingly, an increase of bank capital ratios increases the number of loans granted. The results further confirm that mutual guaranteed loans pay lower IRP, especially in the presence of collateralized loans. In contrast with de Meza (2002), we find that MGS reduce the probability of ex post default, independent of the collateral requirements, though the evidences suggests that this negative relation increases in the presence of mutual guaranteed and collateralized loans.

The comprehensive insights confirm the value of MGS as a tool to improve Portuguese banking loan activity, especially for good SMEs operating in stressful contexts, and to reduce borrowers' ex post default, while still enabling banks to adhere to new banking regulations. However, efficiency of these mutual guarantees does not exempt borrowers from loan collateralization. The intervention of the government in credit guarantee systems thus is important for providing additional funds to constrained SMEs but has less relevance for risk assessment, screening, and monitoring. In line with Boschi et al. (2014), we assert that it is unacceptable to ignore the heterogeneity in guarantees or consider all firms equally. In addition to the signaling role of MGS, the pure provision of guarantees is still required, so collateral remains virtually compulsory. The obstacles to access bank loans remain for SMEs that cannot provide collateral.

Future investigations should address the impact of MGS using the value of the guarantees provided. From a financial stability perspective, the coverage ratio—namely, the ratio between the guaranteed and borrowed amount—constitutes an important instrument for minimizing risk, by limiting moral hazard problems for both borrowers and lenders (Boschi et

al., 2014). Empirical studies of the value of mutual guarantees largely neglect this approach, mainly due to data limitations that prevent clear analyses of the financial impact of partial versus total coverage ratios on banks' and firms' performance. Further research should investigate the relation between mutual guarantees and the coverage ratios of business and personal collateral. We show that mutual guarantees and collateral are complementary, mainly by increasing signals of the borrower's creditworthiness. Nonetheless we wonder if, once the signal exists, borrowers might receive a "discount" on the ratio of collateral required, in the presence of a mutual guaranteed loan.

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Appendices

Appendix 2.1. Postestimations – Validity of Instrumental Variable

This table reports the exogeneity tests and the inferences for the validity of instrumental variable(s). *** $p < .01$. ** $p < .05$. * $p < .1$.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A								
Dependent Variable	IRP							
Endogenous Variable	GM	GM	GM	GM	Inter 5	Inter 5	Inter 5	Inter 5
Instrumental Variable	Euribor							
Robust Exogeneity Tests								
Wooldridge's (1995) test								
Robust score chi-squared stat	<0.001	3.377*	0.707	0.083	13.948***	38.346***	22.630***	14.525***
Robust regression F stat	<0.001	3.376*	0.706	0.083	14.011***	39.007***	22.812***	14.549***
Weak Instruments Inference								
F-statistic	3,488.22***	3,154.88***	3,184.73***	3,568.66***	2,749.48***	2,464.37***	2,488.49***	2,825.77***
Minimum Eigenvalue statistic	3,488.22	3,154.88	3,184.73	3,568.66	2,749.48	2,464.37	2,488.49	2,825.77
Wald Test (for 10% of rejection rate)	16.38	16.38	16.38	16.38	16.38	16.38	16.38	16.38

Appendix 2.2. Robustness Tests: Mutual Guaranteed Loans

This table reports the marginal effects after Probit estimations for *MG*. *dMG/dx* is the discrete change of the dummy variable from 0 to 1. Standard errors are reported in brackets. *** $p < .01$. ** $p < .05$. * $p < .1$

Probit Marginal Effects												
Dependent variable: *MG*												
	Collateral=1			Collateral=0			High credit score=1			High credit score=0		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Risk type												
Industry risk	0.048***	0.048***	0.023***	0.027***	-0.003	0.007	0.048***	0.012***	0.022***	0.131***	0.012***	0.022***
	(0.003)	(0.009)	(0.003)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.010)	(0.004)	(0.004)
Financial tension	0.001***	0.001*	0.001**	0.002***	0.002***	0.002***	0.001***	0.001***	0.002***	0.003***	0.002***	0.002***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
High credit score	0.136***	0.156***	0.152***	0.068***	0.077***	0.072***						
	(0.011)	(0.011)	(0.011)	(0.016)	(0.016)	(0.016)						
Low credit score	-0.199***	-0.200***	-0.205***	-0.135***	-0.121***	-0.130***						
	(0.032)	(0.033)	(0.033)	(0.024)	(0.024)	(0.023)						
Collateralization profile												
Collateral							0.481***			0.405***		
							(0.015)			(0.013)		
Lender characteristics												
Tier 1		0.172***			0.123***			0.184***			0.244***	
		(0.009)			(0.124)			(0.011)			(0.014)	
Solvability			0.170***			0.090***			0.156***			0.232***
			(0.009)			(0.012)			(0.010)			(0.013)
Pr(MG)	0.651	0.652	0.651	0.172	0.159	0.163	0.621	0.621	0.620	0.454	0.458	0.457
Observations	8,779	8,779	8,779	2,402	2,402	2,402	5,839	5,839	5,839	5,342	5,342	5,342
LR chi^2	550.59	894.46	916.54	132.92	223.36	187.94	1,108.83	537.29	485.22	901.43	593.10	584.04
Prob.>chi^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.048	0.078	0.080	0.058	0.097	0.081	0.143	0.069	0.062	0.122	0.080	0.079

Appendix 2.3. Robustness Tests: Mutual Guaranteed Loans and Loan Interest Percentage

This table reports the OLS and 2SLS for *IRP* by subsamples. The MG in the 2SLS estimation is the fitted value of MG obtained using *Project Finance* as the IV. Standard errors are reported in brackets. *** $p < .01$. ** $p < .05$. * $p < .1$.

Dependent variable: *IRP*												
	OLS estimations						**2SLS estimations**					
	Collateral=1			Collateral=0			Collateral=1			Collateral=0		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
MG	-1.113***	-1.158***	-1.132***	-0.585***	-0.744***	-0.669***	-1.049***	-1.114***	-1.075***	-0.606***	-0.850***	-0.734***
	(0.049)	(0.050)	(0.050)	(0.025)	(0.024)	(0.025)	(0.096)	(0.100)	(0.098)	(0.054)	(0.054)	(0.056)
Risk type												
Industry risk	0.095***	0.051***	0.074***	0.103***	-0.007	0.060***	0.093***	0.051***	0.073***	0.104***	-0.005	0.061***
	(0.011)	(0.014)	(0.013)	(0.006)	(0.007)	(0.007)	(0.011)	(0.014)	(0.013)	(0.007)	(0.007)	(0.007)
Financial	0.004***	0.004***	0.004***	0.003***	0.002***	0.003***	0.004***	0.003***	0.004***	0.003***	0.002***	0.003***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
High credit	-0.205***	-0.190***	-0.199***	-0.266***	-0.193***	-0.236***	-0.210***	-0.194***	-0.203***	-0.263***	-0.178***	-0.227***
	(0.038)	(0.038)	(0.038)	(0.024)	(0.022)	(0.023)	(0.039)	(0.039)	(0.039)	(0.025)	(0.024)	(0.024)
Low credit	-0.057	-0.043	-0.054	0.399***	0.400***	0.393***	-0.049	-0.038	-0.047	0.395***	0.380***	0.380***
	(0.100)	(0.099)	(0.100)	(0.067)	(0.063)	(0.066)	(0.100)	(0.100)	(0.100)	(0.068)	(0.064)	(0.067)
Lender characteristics												
Tier 1		0.159***			0.657***			0.154***			0.675***	
		(0.031)			(0.020)			(0.033)			(0.022)	
Solvability			0.081***			0.319***			0.077***			0.331***
			(0.029)			(0.020)			(0.029)			(0.022)
Constant	3.154***	2.066***	2.293***	2.635***	-2.298***	-1.004***	3.157***	2.102***	2.341***	2.642***	-2.402***	-1.111***
	(0.061)	(0.222)	(0.310)	(0.041)	(0.156)	(0.233)	(0.061)	(0.232)	(0.318)	(0.044)	(0.163)	(0.247)
Observations	2,402	2,402	2,402	8,779	8,779	8,779	2,402	2,402	2,402	8,779	8,779	8,779
F	122.06	107.12	103.35	212.75	376.53	224.36	43.93	38.07	36.87	126.17	255.36	132.84
Prob.>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.203	0.212	0.206	0.108	0.205	0.133	0.202	0.211	0.205	0.108	0.203	0.132
Adj. R-squared	0.201	0.210	0.204	0.108	0.204	0.133	0.201	0.211	0.203	0.108	0.203	0.132

Appendix 2.4. Robustness Tests: Mutual Guaranteed Loans and Ex Post Performance

This table reports the marginal effects after Probit estimations for *MG*. *dMG/dx* is the discrete change of dummy variable from 0 to 1. Standard errors are reported in brackets.*** $p < .01$. ** $p < .05$. * $p < .1$.

Probit Marginal Effects

Dependent variable: *Default*

	Collateral =1	Collateral=0
MG	-0.090**	-0.077***
	(0.021)	(0.021)
Risk type		
Industry risk	0.007***	0.007
	(0.002)	(0.005)
Financial tension	-0.001	-0.001***
	(0.000)	(0.000)
High credit score	-0.179***	-0.294***
	(0.008)	(0.017)
Low credit score	0.031**	0.106**
	(0.020)	(0.049)
Pr(Default)	0.122	0.220
Observations	8,779	2,402
LR chi^2	812.25	344.24
Prob.>chi^2	0.000	0.000
Pseudo R^2	0.110	0.127

CHAPTER 3
Business Collateral and Personal Collateral in SME Lending: Evidence from Less-Developed Countries

Abstract

Using a database of banking credit approvals for small and medium-sized enterprises (SMEs) operating in less-developed countries throughout Eastern Europe and Central Asia, this article extends empirical evidences on the determinants of collateral by examining the simultaneous determinants of business collateral and personal collateral/commitments. Controlling for the level of collateral provided, we report first-hand results regarding the impact of the recently reformed credit environment on collateral requirements. We find that younger firms use personal collateral as a signal their creditworthiness and commitment to access a loan. This signal is interpreted through a gesture of posting personal assets rather than through its level. The findings endorse the importance of producing and sharing private information to reduce the need to provide collateral. The results also suggest that market concentration increases "lazy" behavior of banks, in the form of asking for (personal) collateral not to mitigate observable risk but rather to reduce screening efforts. This article rejects the hypothesis that lenders privilege business assets as a debt seniority signal for larger loans. The results also indicate that reforms pertaining to the depth of information-sharing instruments by public credit registries have practical effects on mitigating credit constraints and reducing collateral requirements when coupled with public reforms on its coverage. In addition, using a continuation ratio model, we uncover several differences in the determinants of the collateralization decision and the type and value of the collateral provided.

Keywords: SMEs lending; Personal collateral; Business collateral; Level of personal and business collateral; Less-developed countries

JEL classification: *G21; G30; G32; C35; O16*

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Resumo

Recorrendo a uma base de dados de crédito bancário aprovado para pequenas e médias empresas (PMEs) que operam em países menos desenvolvidos em toda a Europa Oriental e da Ásia Central, este artigo estende as evidências empíricas sobre os determinantes das garantias bancárias examinando simultaneamente os determinantes das garantias bancárias reais e pessoais. Controlando a cobertura das garantias bancárias prestadas, este capítulo fornece resultados únicos sobre o impacto do ambiente de crédito recentemente sujeito a um conjunto de reformas (por exemplo, ao nível dos centros públicos e privados de recolha e partilha de informação - DBR, 2010). Concluímos que as empresas jovens usam as garantias pessoais como sinal da sua capacidade creditícia e de compromisso para aceder ao crédito bancário. Este efeito de sinalização é alcançado através da prestação de ativos pessoais como garantia do empréstimo bancário. Os resultados reforçam ainda a importância em recolher e partilhar informações privadas sobre os mutuários entre credores, reduzindo deste modo a necessidade de prestar garantias bancárias. Sugerem também que o aumento da concentração bancária promove um comportamento ocioso dos bancos, que se traduz num aumento das exigências de garantias pessoais, não para mitigar o risco, mas sim para reduzir os custos de "screening" e monotorização do risco. Os resultados indicam ainda que reformas relativamente à "profundidade" dos instrumentos de partilha de informação por parte de registos públicos de crédito apenas têm efeitos práticos sobre a atenuação de restrições de crédito e redução das exigências de garantias bancárias quando acompanhadas de reformas públicas sobre a sua cobertura. Este estudo revela ainda várias diferenças entre os determinantes: da incidência de garantias bancárias; do tipo de ativos usados para garantir a obtenção de crédito; e do valor da(s) própria(s) garantia(s) prestada(s).

***Palavras-Chave**: Financiamento às PMEs, Garantias bancárias pessoais; Garantias bancárias reais; Nível de garantias bancárias externas e internas; Países menos desenvolvidos*

Classificação *JEL*: *D82; G18; G21; H12*

3.1. Introduction

Recent literature shows that small and medium-sized enterprises (SMEs) report not only greater financing obstacles than large firms but also that the effects of these constraints are stronger for SMEs than they are for large firms (for an overview, see Beck et al., 2005, 2006). Both the high transaction costs related to relationship lending and the high risk intrinsic to SME lending explain the reluctance of financial institutions to reach out to SMEs (Beck and de la Torre, 2007). Therefore, collateralization appears to be a crucial component of a firm's access to external financing, particularly in less-developed countries where the financial environment typically involves more opaque information and weak enforcement (Hainz, 2003; Menkhoff et al., 2006). For example, Beck et al. (2006), using the World Business Environment Survey, examine 12 financing obstacles and report that collateral requirements are the third most important. The European Bank for Reconstruction and Development (EBRD)–World Bank Business Environment and Enterprise Performance Survey (BEEPS) results for firms in Eastern Europe and Central Asia show that high collateral requirements are the fourth most important reason firms do not apply for external loans.

Collateral serves as a signaling device for borrower quality, mitigating the lender's adverse selection problem (e.g., Bester, 1985; Chan and Kanatas, 1985; Besanko and Thakor, 1987a, b; Boot et al., 1991); it lowers the agency costs of debt by preventing the problem of asset substitution (Jensen and Meckling, 1976); it minimizes the underinvestment problem (Myers, 1977; see also Stulz and Johnson, 1985); and it reduce *ex post* risk-shifting behavior, thus solving the moral hazard problem (Boot et al., 1991). Therefore, in scenarios with both adverse selection and moral hazard, stronger credit protection from collateral leads to better credit terms or even credit approval that otherwise would not have been granted.

In addressing how borrowers' (un)observed risk is related to collateral requirements, empirical research has primarily focused on SMEs operating in developed countries and largely examines only a single country (e.g., Leeth and Scott, 1989; Berger and Udell, 1990, 1995; Cowling, 1999; Brau, 2002; Jiménez and Saurina, 2004; Hernández-Cánovas and Martínez-Solano, 2006; Jiménez et al., 2006; Han et al., 2009; Berger et al., 2011a, b). In less-developed institutions/countries, however, information asymmetries are more pronounced, and it is often difficult for banks to conduct risk assessments; data might be sparse and of limited reliability because SMEs' financial statements are generally not audited (Menkhoff et al., 2012). In addition, weak credit information systems, which often exclude the smallest firms, make it even more difficult to collect historical credit information on firms. Furthermore, net losses following default are high, because in many emerging markets, weaknesses in collateral registration, contract enforcement, bankruptcy codes, and the judicial process and collection mechanisms limit banks' ability to recover assets from the enterprise (Doing Business Report [DBR] 2010; Hanedar et al., 2014b). Thus, collateral requirements for obtaining a loan increase. Entrepreneurial (vs. corporate finance) models (Bolton Committee, 1971) show that small businesses are often owned and managed by the same individual; thus, the personal

characteristics and wealth of SME owner-managers have a greater influence on firm performance than is the case for large companies (e.g., Tirole, 2010). Because the owner's personal wealth cannot be separated entirely from the assets of the business, it frequently serves as a means to access bank loans (Ang et al., 1995); thus, the availability of collateral is mainly determined by the business owner's personal wealth. Because small borrowers typically lack assets to pledge as collateral (Menkhoff et al., 2012) or tend to be business collateral constrained, because the financial system imposes stringent limitations on the range of assets the lender can accept to secure the loan (DBR, 2010), borrowers may complement or substitute their ability to provide business assets by providing outside (i.e., owner) assets to collateralize the loan.

It is well documented in developed loan markets that SMEs rely on personal and business wealth to negotiate the contractual details of lending arrangements (e.g., Voordeckers and Steijvers, 2006; Brick and Palia, 2007; Ortiz-Molina and Penas, 2008; Ono and Uesugi, 2009; Steijvers and Voordeckers, 2009; Steijvers et al., 2010; Ono et al., 2012; Peltoniemi and Vieru, 2013; Gama and Duarte, 2015). Empirical research that analyzes the trade-off effect of both types of collateral in less-developed loan markets is scant though. To the best of our knowledge, to date, only one empirical study (La Porta et al., 2003) has examined the lending process to SMEs operating in less-developed countries (Mexico). In this study, the researchers used a single-country approach to analyze the determinants of personal guarantees (vs. business collateral) rather than the determinants of personal collateral.[33] Moreover, due to data limitations, no empirical research has employed the level of business and personal collateral as a dependent variable to test the robustness of existing findings regarding determinants of the incidence of both types of collateral. Instead, prior literature has assumed that the level of business and personal collateral should not matter as much as the decision to pledge personal and/or business assets as a signaling gesture to collateralize the loan. However, deciding on a level of (personal or business) collateral as opposed to deciding whether to take (personal or business) collateral is not the same thing (for an extensive overview of the level-of-collateral debate, see Hanley, 2002).

This paper contributes to extant literature in three ways. First, by examining loans granted to SMEs operating in less-developed countries (i.e., Eastern Europe and Central Asia), we provide unique empirical evidence pertaining to the determinants of both business and personal collateral. Simultaneously, we extend the work of Hanedar et al. (2014b), who study the same set of countries but remain silent on the issue of joint business and personal collateral. Second, we stressed the empirical research regarding the level of business and personal collateral extending the methodology of Voordeckers and Steijvers (2006). With an integrated

[33] Personal collateral means that collateral is pledged in the form of the owner's assets. Personal guarantees are defined as an owner's obligation for repayment by a letter of compromise. Thus, in the second case, the loan is not collateralized because the lender only relies on the willingness of the borrowers to repay. We thank to anonymous referee for this comment.

approach, we test whether the binary business and personal collateral outcome variables proxy for business and personal collateral levels (Hanley, 2002). Third, we report first-hand results on the impact of the recently reformed credit environment on collateral requirements in less-developed countries (e.g., number of private and public credit bureaus created). The findings hold potential value for policy makers in these developing countries for drafting and implementing policies that increase access to lending.

We organize the remainder of this paper as follows: In Section 3.2, we review related literature on the determinants of business collateral and personal collateral. In Section 3.3, we describe the data, method, and variables. In Section 3.4, we report the results, and in Section 3.5, we provide robustness tests. We offer some concluding remarks in Section 3.6.

3.2. Determinants of Business Collateral and Personal Collateral

The provision of collateral can ease conditions of credit rationing that firms face, especially SMEs (e.g., Berger and Udell, 1998), through several channels: First, it decreases lenders' risk in the event of default (Coco, 2000); second, it rectifies credit market imperfections related to adverse problems (Deelen and Molenaar, 2004); and third, it reduces the costs of monitoring in the relationship between borrowers and lenders (Cowling and Mitchell, 2003). Because the financial environment in less-developed countries typically involves more opaque information and weak enforcement (Hainz, 2003; Menkhoff et al., 2006), firms in these countries are more likely to experience difficulties obtaining access to external financing due the lack of collateralizable assets (Menkhoff et al., 2006, 2012).

The majority of theoretical contributions consider "secured" debt, but with a few exceptions (e.g., Chan and Kanatas, 1985; Mann, 1997), they do not take into account any explicit distinction between personal and business collateral. The economic impact of requiring a pledge of personal collateral is different from that requiring a pledge of business collateral though. Whereas Chan and Kanatas (1985) postulate that business and personal collateral are similar, Mann (1997) argues that the implicit value of personal collateral as a disciplining device that limits borrower's *ex post* risk behavior is higher than that for business collateral, because the principal feels the consequences of any *ex post* managerial shirking and risk-taking activities personally. Moreover, personal collateral can serve as a better signaling instrument: The owner of a lower-quality firm cannot afford to imitate the owner of a high-quality firm due to the threat of losing personal assets (Brick and Palia, 2007). In addition, personal collateral can be viewed as a substitute for equity investment by the owner. In the case of default, the personal assets could be sold to repay the loan. Therefore, in a low transparent environment, the use of personal assets to access a loan is a more credible signal of quality (and mitigates adverse selection problems). A pledge of business collateral also reduces the firm owner's freedom due to the restricted possibility of selling business assets to invest back into new projects (Smith and Warner, 1979) or using it to spark consumption (John et al., 2003). In summary, whereas moral hazard and adverse selection apply primarily to personal collateral, business collateral

is used mainly to reduce conflicts of interest among multiple lenders by providing a priority of debt claims (Menkhoff et al., 2012).

The following subsections outline literature related to the determinants of collateral (business and personal) that is in some way also linked to the depth of moral hazard and adverse selection problems. Considering the broad literature on the topic, we concentrate the analysis only on studies that are most related to our data set characteristics, namely, less-developed countries (see Appendix 3.1 for an overview of studies on collateral issues covering developed and less-developed countries). Transition countries are a relevant sample to study, because since 2005, less-developed countries, especially those in Eastern Europe and Central Asia, have experienced both strong credit market development and considerable institutional change, including the introduction of information-sharing systems and reforms to the collateral concept. Historically, many reforms have resulted from recessions or financial crises.

Empirically, the economies in Eastern Europe and Central Asia have been among the most active reformers in the world, in part to make access to finance easier, which became more difficult after the financial crisis of 2008. Since 2005, nearly two-thirds of new credit bureaus have been created by these economies, and the coverage of credit information and the number of companies using movable assets as collateral have increased dramatically. For example, since 2008–2009, any business owner can offer movable assets, such as inventory and accounts receivables, as security to generate capital for expansion and influence the value of collateral in the credit acquisition process (DBR, 2010). Private-sector credit in less-developed countries has increased from 24.2% of gross domestic product (GDP) in 2005 to 46.5% at the end of 2009. The quality of lending, however, has become worse, with the ratio of nonperforming loans to total gross loans in banks' portfolios increasing from 3.3% in 2005 to 7.2% at the end of 2009 (according to World Bank Data Indicators). Thus, we examine how collateral requirements (business and personal) are related to firm characteristics, loan characteristics, and credit market environment.

3.2.1. Firm Characteristics

Researchers have used firm age and firm size extensively as proxies to measure information costs in the lending process. The experience of the chief executive officer (CEO)/manager explains firm viability and firm credibility (Hanley, 2002; Voordeckers and Steijvers, 2006). Older and larger firms and more experienced CEOs/managers are likely to have a longer track record and more and better established relationships with lenders (Berger and Udell, 1995). Thus, they tend to go through screening processes more easily, which reduces the incidence of collateralized loans (e.g., Smith and Warner, 1979; Chan and Kanatas, 1985; Leeth and Scott, 1989). If a lender requires collateral, we would expect that older and larger firms could use business assets rather than personal assets to secure the loan (e.g., Steijvers and Voordeckers, 2009; Hernández-Cánovas and Martínez-Solano, 2010) because they have developed more credibility and are less asset-constrained than younger/smaller firms.

Another firm characteristic that could influence the use of collateral is ownership structure (Voordeckers and Steijvers, 2006; Steijvers and Voordeckers, 2009). Traditional agency models predict that concentrated ownership and owner-managed firms lead to a minimum level of (or even zero) agency costs between owners and managers (Jensen and Meckling, 1976; Fama and Jensen, 1983). This model assumes that firms characterized by concentrated ownership are more motivated by and concerned about long-term survival and firm reputation (Ang, 1992), which in turn promotes an alignment between the interests of a lender and those of a firm as the relationship matures, thus reducing risk (Diamond, 1989). Some studies, however, contest the traditional agency view, arguing that agency costs in concentrated ownership can be even higher than in firms with fractional ownership due to the possible negative effects of self-control and parental altruism with regard to management efficiency (e.g., Schulze et al., 2001, 2003). From a collateral point of view, due to the stronger social bonds inherent in concentrated ownership, borrowers should be less opposed to offering personal collateral than firms characterized by greater shareholder diversification (Voordeckers and Steijvers, 2006), because when some or all partners pledge personal collateral, the actions of one shareholder can place the wealth and personal assets of all others at risk (Ang et al., 1995). Thus, when the decision to secure a loan is made to mitigate agency costs, firms characterized by concentrated ownership may be more willing to provide personal collateral.

Observable credit risk is used extensively to explain the stringency of collateral requirements, and the literature provides several variables as proxies, such as prior default (or overdue on payments) (e.g., Jiménez et al., 2006; Hanedar et al., 2014b) and a track record of losses experienced as a result of theft, robbery, vandalism, or arson by firms operating in less-developed countries (Hanedar et al., 2014b). Firm quality is also measured by the presence of international recognition of quality certification (Hanedar et al., 2014a, b). We expect lenders to require more stringent collateral requirements from firms with a history of overdue payments or a track record of losses due to crime and less stringent requirements for borrowers with quality certifications. If there is indeed a positive relationship between observable credit risk and incidence (and level) of collateral (e.g., Han et al., 2009), we also expect an increase in the incidence (and level) of personal collateral versus business collateral, because the value of an owner's assets is more appropriate to sufficiently discipline a borrower's behavior.

Trade credit and the track record of a borrower as a "customer" of financial products/services can be used as signaling instruments, mitigating the adverse selection problem and decreasing the value of collateral as a screening device. For example, trade credit can play an important role in the credit decision process of banks when suppliers have private and more accurate information about their customers (Biais and Gollier, 1997), which they can in turn convey to the bank when extending credit (Voordeckers and Steijvers, 2006; Gama and van Auken, 2014). Similarly, checking/savings accounts and contracted overdrafts, for example, might be credible ways for banks to collect private information about firms, which can then be shared among themselves. Thus, when the signaling effect of the information shared is strong

enough, the risk of lending decreases and the need to provide collateral as a signal device may decrease, especially for personal collateral.

3.2.2. Loan characteristics

The maturity and size of a loan are broadly viewed as determinants of the incidence and the degree of collateralization. Much theoretical and empirical literature asserts that loan maturity is positively related to collateral requirements (e.g., Leeth and Scott 1989; Boot et al. 1991; Harhoff and Körting, 1998; Degryse and Van Cayseele, 2000), in that long-term debt affords the borrower sufficient opportunity to alter the project in subtle ways or even from low-risk to high-risk projects (Jensen and Meckling 1976). Furthermore, the likelihood of an adverse event becomes greater when the duration of the loan is longer. In such cases, collateral has the power to decrease the *ex ante* risk assessment of a loan (Voordeckers and Steijvers 2006). A pledge of collateral (especially personal collateral) is an effective mechanism for the creditor to get a guarantee of a certain value in the future: A company may not retain its value in the long run, but collateral most likely does (Mann 1997). In contrast, Stulz and Johnson (1985) predict that long-term loans rely less on collateral.

Regarding loan size, a firm taking on more debt theoretically attains a higher level of leverage and thus increases its risk of not repaying the loan (Leeth and Scott, 1989; Avery et al., 1998). Consequently, banks are likely to ask for more protection in the form of collateral (e.g., Degryse and Van Cayseele 2000). Furthermore, because pledging collateral involves numerous costs that can only be fully recovered with large loans through economies of scale, the likelihood of pledging collateral is greater for larger loans than for smaller loans (e.g., Jackson and Kronman, 1979). Empirically, however, there is no consensus regarding the relationship between loan size and collateralization. For example, some authors show that larger loans are more likely secured (e.g., Harhoff and Körting, 1998; Degryse and Van Cayseele, 2000; Han et al., 2009; Menkhoff et al., 2012; Gama and Duarte, 2015), whereas Boot et al. (1991) show the opposite. Because an asset can be pledged only once and its evaluation is costly, by asking for collateral, the main bank ensures its loan seniority to other creditors' claims and creates a barrier to entry for other banks (Menkhoff et al., 2012). Thus, the hypothetical positive relationship between loan size and collateralization privileges business collateral over personal collateral.

3.2.3. Lender market characteristics

A stream of literature argues that as bank competition increases, a bank's incentive to invest in information collection may decrease, because borrowers may attempt to switch to other banks. Thus, in increasingly competitive conditions, a bank's power to extract rents will be reduced, which increases the likelihood of relying on collateral (Besanko and Thakor, 1987 a,b; Petersen and Rajan, 1995). Another theoretical perspective argues that competition may induce banks to invest even more in relationship lending (Boot and Thakor, 2000), because

client-driven lending helps a bank distinguish itself from competitors. As such, the lender would be more likely to relax contractual terms (Berlin and Butler, 2002). Some authors suggest that high concentration induces banks to demand (more) collateral because it is used not only to solve the adverse selection or moral hazard problems but also to extract rents (Hainz, 2003; Hainz et al., 2013). Thus, these views suggest that collateral and loan market concentration are complementary (e.g., Voordeckers and Steijvers, 2006).

The proximity between bank branches and customers' locations (i.e., physical distance; Jiménez et al., 2009) is relevant in determining the terms of banking services. Customers' transportation costs produce spatial differentiation of banks, thus reducing competition. Banks' costs of gathering and processing site-specific information about potential borrowers increase with distance (Petersen and Rajan, 2002), so more distant banks will be less informed about local credit market conditions than banks that are closer to the borrowers. Accordingly, Hainz et al. (2013) show that firms located near a bank are best financed through screening contracts, whereas more distant borrowers are required to pledge collateral. Nonetheless, in the case of Spain, Jiménez et al. (2009) show that the likelihood of collateral is lower for loans granted by distant than by local lenders, which supports the lender-based theory that collateral is used by local lenders to profit from their superior information advantage about the credit risk of the borrower, which increases the informational rents that "inside banks" can extract (see the sixth proposition in Inderst and Mueller, 2007).

3.2.4. Credit environment characteristics

When a bank evaluates a request for credit, it can either collect information about the applicant first-hand or source this information from other lenders that have already dealt with the applicant. Information exchange between lenders can occur voluntarily through private credit bureaus or be enforced by regulation through public credit registries. Thus, we argue that institutional and legal development environments are central issues to explaining the determinants of collateral.

Sharing information among lenders allows banks to obtain information about loan applicants' repayment histories and current debt exposure. In countries with weaker information-sharing instruments, lenders may experience difficulties measuring credit risk, particularly if they are unfamiliar with the loan applicant before the loan application. Accordingly, information sharing is an important tool for reducing informational asymmetries and eventually decreasing adverse selection problems (Hanedar et al., 2014b), which in turn can make access to finance easier, particularly for SMEs (Djankov et al., 2007).

In line with these arguments, empirical research has tested the role of information-sharing instruments to increase information and quality traceability (e.g., Pagano and Jappeli, 1993) and increase the availability of credit (e.g., Brown et al., 2009) and the need for collateral in loan arrangements (e.g., Djankov et al., 2007; Brown et al., 2011; Godlewski and Weill, 2011; Hanedar et al., 2014b). If information-sharing instruments reduce information asymmetries, we would expect to find that they substitute for collateral requirements (broadly measured).

However, in an investigation of lending arrangements of firms operating in less-developed countries, Hanedar et al. (2014b) report empirical evidence contrary to this prediction. The authors argue that deeper shared information also helps extend credit to new and previously unfunded firms, which in turn increases the mean collateral requirements for new funded firms.

The legal framework of creditor rights also potentially affects the value of collateral. Economies that rank high on ease of obtaining credit typically have a legal system that encourages lending by financial institutions to the private sector (DBR, 2010). Laws in such environments ensure secured creditors' rights through a registration mechanism for secured interests, they allow out-of-court enforcement of security rights, and they protect secured creditors during insolvency processes. Accordingly, some empirical studies show that strong conditions of creditor protection expand the availability of favorable-term loans (e.g., Qian and Strahan, 2007; Djankov et al., 2007) promoting the development of financial markets (Claessens and Yurtoglu, 2013), particularly in situations involving severe adverse selection problems in these markets (e.g., Pagano and Jappelli, 1993). However, how the strength of legal rights affects collateral requirements remains an open empirical question.

Empirical research has also used GDP per capita to control for the effect of economic development on collateral requirements, predicting that a country's development is negatively related to collateral stringency (e.g., Godlewski and Weill, 2011).

3.3. Data, Method, and Variables

3.3.1. Data

We use the fourth-round database of the BEEPS, conducted from 2007 to 2009, which covers approximately 11,728 enterprises in 29 countries. The BEEPS is a joint initiative of the EBRD and the World Bank Group. The survey was first undertaken on behalf of the EBRD and the World Bank in 1999–2000; it was administered to approximately 4,000 enterprises in 26 countries of Eastern Europe and Central Asia to assess the environment for private enterprise and business development. In the second round of the BEEPS (2002), the survey was administered to approximately 6,500 enterprises in 27 countries. In the third round of the BEEPS (2005), the survey included approximately 9,500 enterprises in 28 countries. The fourth-round BEEPS (2008–2009) underwent several changes from the 2005 round, offering numerous advantages compared with those used in previous studies (e.g., Hanedar et al., 2014b).

First, the "new" BEEPS allows for greater comparability of European and Central Asian countries with countries in other regions, whereas previous rounds only allow for cross-regional comparisons at a more limited level. Second, this survey was restructured to make it compatible with Enterprise Surveys' Enterprise Analysis Unit of the World Bank to collect feedback from enterprises in EBRD countries of operation on the state of the private sector as well as to help build a panel of enterprise data. Thus, unlike in previous rounds, this data set makes it possible to track changes in the business environment over time. Third, this data set covers the most recent contextual changes faced by several countries, such as the deterioration of access to

finance as well as crime and corruption. It also reports numerous strides many countries have made in governance and regulations between these periods.

To complement the BEEPS information, we also use the Bankscope database and indicators provided by the World Bank (i.e., World Bank Data Indicators and the Doing Business Report [DBR]) and the Global Financial Development Database. The data set includes 10,620 SMEs (i.e., 3,265 medium firms, 4,841 small firms, and 2,514 micro firms) operating in less-developed countries. To reconcile the definition of SME with both the BEEPS definition and Organisation for Economic Co-operation and Development (OECD) conventions, we define SMEs as firms with a maximum of 250 full-time employees.[34] Our final sample comprises 3,403 SMEs that requested loans that were ultimately approved by a bank and reported information regarding collateral requirements. For the distribution of the sample by firm size and data for different years and countries, see Appendices 3.2 and 3.3.[35]

3.3.2. Method

In literature examining the determinants of business and/or personal collateral (and guarantees), previous studies have relied extensively on logit and probit models (e.g., Avery et al., 1998; La Porta, 2003; Hernández-Cánovas and Martínez-Solano, 2006, 2010; Ono et al., 2012; Peltoniemi and Vieru, 2013) or used instrumental (single) models (e.g., Brick and Palia, 2007; Ono and Uesugi, 2009; Gama and Duarte, 2015). Voordeckers and Steijvers (2006), in their preliminary approach, tested both determinants using an ordered probit model. The problems with these approaches is that it is not possible to investigate whether the determinants of a choice of asking for collateral or not differs from the determinants of the choice of type of collateral, once the decision is made to ask for collateral (Voordeckers and Steijvers, 2006). This limitation is particularly relevant if we assume that the borrower and the lender first negotiate the inclusion of collateral in the loan contract and then negotiate the type of collateral (business or personal collateral) to ensure the fulfillment of the agreement.

To overcome this limitation, we employ a continuation ratio model.[36] The continuation ratio model comprises two probit models: the first model estimates the choice between collateralization and no collateralization (Eq. 1), and the second model estimates the choice between business collateral (only) and personal collateral (with or without business collateral) after borrowers and lenders have already agreed to provide collateral in loan arrangements (Eq. 2). Our first estimator of the continuation ratio probit (CRP) model is written as follows:

[34] The BEEPS definition of enterprise size is as follows: small firms = 2–49 employees, medium firms =50–249 employees, and large firms = 250–9,999 employees.

[35] We built the final sample on the basis of answers to the following survey questions: "At this time, does this establishment have a line of credit or loan from a financial institution?" [yes, no, don't know], and "Referring only to this most recent loan or line of credit, did financing required collateral?" [yes, no, don't know.]

[36] For an overview of the continuation ratio model, see Long and Freese (2001, p. 170).

$$\text{Collateral}_i = \alpha + \beta_1 \text{firm charac.}_i + \beta_2 \text{loan charac.}_i + \beta_3 \text{lender-market charac.}_i + \beta_4 \text{Credit´s environ.}_i + \varepsilon_i \text{ for i=1, …, N ,} \quad \text{(Eq.1)}$$

where $Collateral_i$ is a binary variable that takes a value of 1 if the firm has pledged collateral to obtain an external loan and 0 otherwise; and ε_i is the error term.

Our second estimator of the CRP model is written as follows:

$$PC_i = \alpha + \beta_1 \text{firm charac.}_i + \beta_2 \text{loan charac.}_i + \beta_3 \text{lender-market charac.}_i + \beta_4 \text{Credit´s environ.}_i + \varepsilon_f \text{ , if } Collateral=1 \text{ for i=1, …, N ,} \quad \text{(Eq.2)}$$

where PC_i is the binary variable that takes a value of 1 if the firm has pledged personal collateral to obtain an external loan and 0 if the firm has pledged only business collateral to obtain the loan; and ε_i is the error term.

We extend the continuation ratio model to analyze the determinants of business and personal collateral level (i.e., *BCr* and *PCr*, respectively). With this approach, we test whether the binary business collateral and personal collateral outcome variables proxy for business and personal collateral levels. In line with the continuation ratio model, we argue that the first decision is to require (or not require) collateral on a loan contract; then, it is necessary to negotiate the amount of collateral and the type of collateral. To capture this sequence of negotiation events, we use the truncated regression model (i.e., the second estimator of the two-step model), which is theoretically more appropriate than using single ordinary least squares. Nonetheless, our two-step model differs from that typically estimated in previous studies investigating the collateral-to-loan ratio for an undistinguished type of collateral (e.g., Hanedar et al., 2014b). We are not interested in dropping all regressands' null observations, because our model outputs two different regressand clusters of zeros in *BCr* and *PCr*: one cluster produced by noncollateralized loans (Eq. 1), which we dropped, and another cluster of zeros produced by loans collateralized by the alternative type of assets (i.e., business collateral vs. personal collateral [Eq. 2]), which we included.[37] Thus, our truncated regression is written as follows:

[37] Alternatively, several authors apply the censored regression model (i.e., Tobit) (e.g., Lehman and Neuberger, 2001; Hanley, 2002; La Porta et al. 2003; Menkhoff et al., 2006). This model enables the researcher to divide the firms in two groups: one about which there is information on the regressor and the regressand (i.e., collateral-to-loan ratio) and another consisting of firms about which there is have information only on the regressor but not on the regressand because it includes firms that do not pledged collateral. Thus, if we employ a Tobit model, we are also able to censor the sample for both clusters of regressands' null values.

$$BCr_i = \beta_1 \text{firm charac.}_i + \beta_2 \text{loan charac.}_i + \beta_3 \text{lender-market charac.}_i + \beta_4 \text{Credit´s environ.}_i + \varepsilon_i \text{ , if Collateral=1 for i=1, …, N , } and \quad \textbf{(Eq.3)}$$

$$PCr_i = \beta_1 \text{firm charac.}_i + \beta_2 \text{loan charac.}_i + \beta_3 \text{lender-market charac.}_i + \beta_4 \text{Credit´s environ.}_i + \varepsilon_i \text{ , if Collateral=1 for i=1, …, N} \quad \textbf{(Eq.4)}$$

where BCr_i and PCr_i are the levels of business and personal collateral (i.e., percentage of loan size), respectively, provided by firms requested to collateralize the loan; and ε_i is the error term.

3.3.3. Variables

3.3.3.1. Dependent variables

To test the determinants of the incidence of collateral, we use a dummy variable that takes a value of 1 if the firm has pledged collateral to obtain an external loan and 0 otherwise (*Collateral*). To test the determinants of personal collateral (vs. business collateral) after lenders decide to ask for collateral, we use a dummy variable *(PC)* that takes a value of 1 if the borrower provides personal collateral (with or without business collateral) to secure the loan and 0 if the borrower provides only business assets to secure the loan (e.g., Voordeckers and Steijvers, 2006).[38] To explain the level of business collateral and personal collateral provided, once the decision to collateralize the loan is made, we uses the ratio of business or personal collateral value to loan size (%)—that is, *BCr* and *PCr*, respectively.

[38] We extracted the classification of the type of collateral from the following survey question: "Referring only to this most recent loan or line of credit, what type of collateral was required?" We coded the response "personal assets of owners (house, etc.)" as personal commitment and the remaining answers ("land, building under ownership of the establishment"; "machinery and equipment including movables"; "accounts receivable and inventories") as business commitments. We coded the response "other forms of collateral not including in the categories above" as business collateral in line with Avery et al. (1998). For more details, see Appendix 3.4.

3.3.3.2. Independent variables

Table 3.1. - Variable definitions and sources

This table presents variable definition and the sources of the data. BEEPS = 2009 Business Environment and Enterprise Performance Survey; GFDD = Global Financial Development Database; DBR = Doing Business Report. WBDI = World Bank Data Indicators.

Variable	Definition	Source
Collateralization		
Collateral	Equals 1 if the firm has pledged collateral to obtain an external loan (0, 1)	BEEPS
PC	Equals 1 if the firm has pledged personal collateral to obtain an external loan and 0 if firm provide only business collateral (0,1)	BEEPS
BCr	Percentage of business collateral value to loan size	BEEPS
PCr	Percentage of personal collateral value to loan size	BEEPS
Firm Characteristics		
Age	Age of firm, measured as the number of years that the firm has been operating	BEEPS
Size	Size of the firm, measured as the number of full-time employees	BEEPS
Experience	Experience of top manager measure in years	BEEPS
Ownership	Percentage ownership of the firm held by the largest shareholder	BEEPS
Overdue	Equals 1 if the SME has utility payments or tax payment that are overdue by more than 90 days (0, 1)	BEEPS
Crime	Equals 1 if the SME has experienced any losses as a result of theft, robbery, vandalism, or arson (0,1)	BEEPS
Quality	Equals one if the firm has an internationally recognized quality certification, such as ISO 9000 or ISO 9002 (0, 1)	BEEPS
Trade Credit	Percentage of a firm's purchases of material inputs and services paid on credit	BEEPS
Financial Openness	Number of active products/services contracted by the firm with entire banking sector (checking or savings account; overdrafts)	BEEPS
Loan Characteristics		
LoanSize	Loan amount measured in U.S. dollars	BEEPS
Lender Market Characteristics		
City	Equals 1 if the firm is located in the capital or in a city with a population over 1 million (0, 1)	BEEPS
Cr	Share of the assets of the three largest banks in total banking system assets	BANKSCOPE
Brpc	Number of branches per 100,000 adults	GFDD
Credit Environment Characteristics		
CreditInfo	Depth of credit information index (0 = weak to 6 = strong)	DBR
LegalRights	Strength of legal rights index (0 = weak to 12 = strong)	WBDI
GDPpcppp	Gross domestic product per capita based on purchasing power parity (constant 2005 international dollars)	WBDI

Firm characteristics include *Age* (measured as the number of years the firm has been operating), *Size* (measured as the number of the firm's full-time employees) (e.g., Leeth and Scott, 1989), and *Experience* (years of experience as a top manager) (e.g., Steijvers and Voordeckers, 2009). To examine the impact of agency costs, we employ the variable *Ownership*, measured as the percentage ownership of the firm held by the largest shareholder. To proxy for borrower risk, we include three binary variables: *Overdue* (1 if firm has payments overdue more than 90 days and 0 otherwise), *Crime* (1 if firm experienced any episode of crime and 0 otherwise), and *Quality* (1 if firm has an internationally recognized quality certification and 0 otherwise) (e.g., Hanedar et al., 2014b). To control for the value of private information shared

with banks, we define the variables *TradeCredit* (percentage of a firm's purchases of material inputs and services paid on credit; Voordeckers and Steijvers, 2006) and *FinancialOpenness* (the number of active products/services contracted by the firm with the entire banking sector in terms of overdrafts and savings/checking). Loan characteristics include only *LoanSize* (loan amount measured in U.S. dollars) (e.g., Leeth and Scott, 1989; Jiménez et al., 2006; Godlewski and Weill, 2011); due to data limitations, we cannot measure loan maturity. Lender market characteristics include *City* (1 if the firm is located in the capital or in a city with population of more than 1 million) (Hanedar et al., 2014b) and *Brpc* (the number of branches per 100,000 adults) (Hanedar, et al., 2014a) as measures for the proximity between bank branches and customers' locations, and *Cr* (share of the assets of the three largest banks in total banking system assets) as a proxy for banking market competition (Hainz et al., 2013). Credit environment characteristics include *CreditInfo* (the depth of the credit information index [DBR, 2010]), *LegalRights* (the strength of the legal rights index), and GDP per capita (*GDPpcppp*) (Godlewski and Weill, 2011). Table 3.1 presents definitions and sources of variables.

3.4. Results

3.4.1. Descriptive statistics

Table 3.2. reports descriptive statistics. The final sample includes 3,403 SMEs, of which 1,279 (37.5%) are medium-sized firms, 1,529 (45%) are small firms, and 595 (17.5%) are micro firms. Approximately 83% of the SMEs provided collateral to receive bank loans. The collateral-to-loan ratios (*BCr* and *PCr*) range from 0% to 600%. Credit granted to SMEs uses mainly business collateral to secure loans. At the mean, approximately 71% of the loan amount is secured only by business assets (*BCr*), and personal collateral covers 29% of the loan (*PCr*) mean. Among firms that provided collateral, the mean of the business collateral-to-loan ratio (measured by *truncated BCr*) is 87%, and the mean of personal collateral-to-loan ratio (measured by *truncated PCr*) is approximately 36%. These statistics show that loan collateralization privileges business assets over personal assets. Appendix 3.5 reports the correlation matrix.

The sample includes a majority of firms with high concentrated ownership (mean of *Ownership* is 77%). Only 8.7% of the firms report being overdue on utility or tax payments, which may indicate that loans are primarily granted to good firms. The size of the loan ranges between US$1,170.19 and US$54,000,000, suggesting that the sample is heterogeneous and covers banking loans for different goals and type of firms. Variables measuring informational opacity/traceability(i.e., *TradeCredit* and *FinancialOpenness*) reveal that approximately 64% of the firms' inputs are paid on credit and the majority of firms have overdrafts and checking/savings accounts in addition to the given line of credit in study. Less-developed countries covered in the final sample report a satisfactory quality of data distributed by public and private registries. The mean value of *CreditInfo*, weighted by the number of observations by country/year, is 4.187. The nonweighted mean value of this variable is 4.17 among countries included in 2009, 4.10 among countries included in 2008, and 3.34 among countries included in

2007[39] The sample also reports a satisfactory level of protection of the lender's rights through collateral and bankruptcy laws. The mean value of *LegalRights* weighted by the number of observations by country/year is 5.806. The nonweighted mean value of this variable is 6.54 among countries included in 2009, 6.39 among countries included in 2008, and 6.43 among countries included in 2007.[40] Compared with Hanedar et al. (2014b), who used a similar database between 2002–2005, we conclude that from 2004 (when the World Bank started providing statistics about the strength of legal rights), substantial changes were undertaken regarding the depth of private information shared among creditors, as well as the strength of credit protection.

Table 3.2. – Descriptive statistics

This table reports descriptive statistics for dependent and independent variables.
[a] Variables truncated for collateral's null observations (i.e., Collateral = 0)

Variable	Obs.	Mean	Median	St. Dev.	Min	Max
Collateralization						
Collateral	3,403	0.831	1	0.374	0	1
PC	3,399	0.242	0	0.428	0	1
PC *(truncated)* [a]	2,826	0.291	0	0.454	0	1
BCr	3,063	70.795	40	85.478	0	600
BCr *(truncated)*	2,490	87.087	90	87.001	0	600
PCr	3,063	29.233	0	66.657	0	600
PCr *(truncated)*	2,490	35.960	0	72.277	0	600
Firm Characteristics						
Age	3,362	14.78	13	11.76	1	182
Size	3,397	57.037	30	60.421	1	250
Experience	3,362	17.327	15	10.327	1	75
Ownership	3,311	77.009	96	27.177	1	100
Overdue	3,385	0.087	0	0.283	0	1
Crime	3,393	0.262	0	0.440	0	1
Quality	3,285	0.282	0	0.450	0	1
TradeCredit	2,570	63.794	70	30.995	0	100
FinancialOpenne	3,210	1.499	2	0.572	0	2
Loan Characteristics						
LoanSize	3,390	610,501.2	95,465.39	2,556,781	1,170.193	54,000,000
Lender Market						
City	3,403	0.391	0	0.488	0	1
Cr	3,403	57.770	57.67	18.756	31.810	100.000
Brpc	3,357	26.468	24.43	16.436	3.490	92.680
Credit Environment Characteristics						
CreditInfo	3,403	4.187	5	1.541	0	6
LegalRights	3,403	5.806	6	2.286	2	10
GDPpcppp	3,403	11,953.280	11,985.2	6,006.293	1,660.860	27,225.500

[39] Statistics are not reported but are available on request.

[40] Statistics are not reported but are available on request.

3.4.2. Discussion of results

3.4.2.1. Incidence of Collateral

Table 3.3 reports the estimations for the CRP model. Because our data set includes several specific country variables (i.e., credit market environments), we estimate different regressions to avoid collinearity problems. Thus, the left-hand side of each column provides the results for the determinants of the incidence of collateral (Eq. 1), whereas the right-hand side shows the determinants of collateralization through personal assets, given that the bank has already decided to ask for some kind of collateral (Eq. 2).

Table 3.3. – Continuation ratio probit (CRP) Model

This table reports the first and second estimators of the CRP. Left-hand side columns report the results of the first estimator (dependent variable: *Collateral*) and the right-hand side the results of the second estimator (dependent variable: *PC)* for collateralized loans. Standard errors are in parentheses. ***p < .01, **p <.05, *p < .1.

	(1)		(2)		(3)	
	Collateral	**PC**	**Collateral**	**PC**	**Collateral**	**PC**
Firm Characteristics						
Age	-0.007**	-0.012***	-0.007**	-0.013***	-0.007**	-0.01227***
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
Size	0.001	-0.003***	0.001	-0.003***	0.001	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.007)	(0.001)
Experience	-0.007**	0.002	-0.008***	0.002	-0.008**	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Ownership	0.001	0.002*	0.002	0.002*	0.002	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Overdue	0.090	0.153	0.095	0.153	0.086	0.154
	(0.119)	(0.112)	(0.120)	(0.113)	(0.118)	(0.112)
Crime	0.148*	0.049	0.184**	0.027	0.165**	0.058
	(0.076)	(0.070)	(0.076)	(0.071)	(0.076)	(0.070)
Quality	-0.189**	-0.126*	-0.199***	-0.137*	-0.195**	-0.131*
	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)
TradeCredit	-0.005***	-0.002**	-0.004***	-0.002*	-0.004***	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
FinancialOpenness	-0.133**	-0.034	-0.151**	-0.066	-0.155**	-0.051
	(0.062)	(0.058)	(0.061)	(0.058)	(0.061)	(0.057)
Loan Characteristics						
Ln(LoanSize)	0.180***	-0.017	0.184***	-0.015	0.182***	-0.017
	(0.023)	(0.022)	(0.023)	(0.022)	(0.023)	(0.022)
Lender Market Characteristics						
City	-0.197***	0.262***	-0.249***	0.254***	-0.229***	0.247***
	(0.069)	(0.066)	(0.068)	(0.066)	(0.067)	(0.066)
Cr	0.004**	0.003*				
	(0.002)	(0.002)				
Brpc			-0.004*	0.004**		
			(0.002)	(0.002)		
Credit Environment Characteristics						
CreditInfo					-0.001	0.004
					(0.022)	(0.021)
Constant	-0.667**	-0.334	-0.358	-0.257	-0.430	-0.157
	(0.297)	(0.294)	(0.279)	(0.276)	(0.294)	(0.283)
Observations	2,224	1,830	2,189	1,798	2,224	1,830
Log-likelihood	-954.50	-1,036.10	-945.00	-1,017.82	-956.80	-1,037.54
LR chi^2	156.13	97.26	152.32	97.68	151.53	94.37
Prob > chi^2	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo-R^2	0.074	0.045	0.074	0.046	0.073	0.044

Table 3.3. – Continuation ratio probit (CRP) Model (Continuation)

	(4)		(5)	
	Collateral	**PC**	**Collateral**	**PC**
Firm Characteristics				
Age	-0.007**	-0.013***	-0.006**	-0.012***
	(0.003)	(0.004)	(0.003)	(0.004)
Size	0.001	-0.003***	0.001	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Experience	-0.008**	0.001	-0.006**	0.002
	(0.003)	(0.004)	(0.003)	(0.003)
Ownership	0.002	0.002*	0.001	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
Overdue	0.100	0.152	0.072	0.143
	(0.118)	(0.113)	(0.122)	(0.113)
Crime	0.161**	0.058	0.243***	0.080
	(0.076)	(0.070)	(0.078)	(0.071)
Quality	-0.195**	-0.131*	-0.155**	-0.119
	(0.077)	(0.077)	(0.078)	(0.077)
TradeCredit	-0.005***	-0.002**	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
FinancialOpenne	-0.148**	-0.051	-0.083	-0.034
	(0.061)	(0.057)	(0.063)	(0.058)
Loan Characteristics				
Ln(LoanSize)	0.184***	-0.01649	0.216***	-0.009
	(0.023)	(0.022)	(0.024)	(0.022)
Lender Market Characteristics				
City	-0.216***	0.247***	-0.332***	0.228***
	(0.067)	(0.066)	(0.070)	(0.066)
Cr				
Brpc				
Credit Environment Characteristics				
CreditInfo				
LegalRights	0.031**	-0.002		
	(0.015)	(0.014)		
Ln(GDPpcppp)			-0.625***	-0.136**
			(0.074)	(0.058)
Constant	-0.64395**	-0.132	4.727***	0.945*
	(0.29308)	(0.281)	(0.677)	(0.537)
Observations	2,224	1,830	2,224	1,830
Log-likelihood	-954.57	-1,037.55	-916.14	-1,034.82
LR chi^2	155.99	94.35	232.85	99.81
Prob > chi^2	0.000	0.000	0.000	0.000

Estimation results regarding the determinants of the incidence of collateral yield negative coefficients for *Age* ($p < .05$) and *Experience* ($p < .05$) in all specifications, in line with our predictions: Older firms and firms with a top manager who has a high degree of experience are less likely to have to provide collateral. However, the *Size* and *Ownership* variables do not reveal any statistically significant relationship with the incidence of collateral. The positive coefficients for *Crime* ($p < .1$ in specification [1]; $p < .05$ in specifications [2]–[4]; $p < .01$ in specification [5]) and negative coefficients for *Quality* ($p < .01$ in specification [2]; $p < .05$ in the remaining specifications) confirm that observable credit risk is positively associated with a high incidence of collateral, in line with the observed risk hypothesis (e.g., Berger and Udell, 1990). However, the positive coefficients for the variable *Overdue* are not statistically significant in any specification, which may be justified by the reduced number of firms that

were overdue on payments receiving loans. The negative coefficients for *TradeCredit* ($p < .01$ in specification [1]–[4]) and *FinancialOpeness* ($p < .05$ specifications [1]–[4]) confirm the importance of producing and sharing private information between firms and lenders to reduce informational asymmetries and, consequently, the need to provide collateral to receive the loan.

In line with Leeth and Scott's (1989) arguments, we find that an increase of *LoanSize* positively affects the incidence of collateral ($p < .01$ in all specifications). The negative coefficients of the *City* variable ($p < .01$ in specifications [1]–[5]) and *Brpc* ($p < .1$ in specification [2]) suggest that borrowers located in big cities (in which financial centers are primarily located and the distance between lender and borrower is lower) and those operating in countries with a more extensively branched banking system (in which local competitiveness tends to be higher) are less likely to be required to provide collateral. These results, in contrast with those of Jiménez et al. (2009), suggest that borrowers benefit from being located in a more developed and representative banking market, in which banks have greater access to reliable hard data to better screen the borrowers, compared with those operating in less-developed and theoretically more opaque countries. Thus, in line with Hainz et al. (2013), our results suggest that firms that are located close to a bank are financed by a screening contract and those that are located further away are financed by a collateralized contract in the absence of trustworthy hard data. In support of this paradigm, Table 3.3 shows that firms operating in a more highly concentrated banking market (*Cr*) have a greater probability of providing collateral ($p < .05$ in specification [1]).

The first estimator does not report any significant relationship between the depth of information-sharing instruments (*CreditInfo*) and the likelihood of collateralization. The positive coefficient of the variable *LegalRights* ($p < .05$ in specification [4]) is not surprising if we assume that an increase of creditor/lender protection facilitates the granting of credit to firms on a collateral basis (we test this assumption in depth in Section 3.5. ["Robustness Tests"]). Finally, our estimations suggest that lenders exercise a less restrictive policy of collateralization in countries with higher GDP per capita ($p < .01$ in specification [5]).

We report the second estimator of the CRP in the right-hand side of each specification, which provides the outcomes regarding the determinants of collateralization through personal assets. The results show that to meet a collateral request, older and larger borrowers can use business assets ($p < .01$ in all specification). Alternatively, these results confirm that younger and smaller firms, which are business-asset constrained, meet collateral requirements by offering owners' patrimony. Although weakly statistically significant ($p < .10$), the positive coefficients of *Ownership* confirm that firms with concentrated ownership are more likely to provide personal collateral than those with fragmented ownership, which privileges business assets for securing a loan. These findings corroborate the assumption that firms with concentrated ownership have a strong commitment to long-term survival and the reputation of the firm. In line with previous estimations, the coefficients of the variable *Overdue* are not statistically significant. The negative coefficients of the variables *Quality* ($p < .10$ in

specifications [1]–[4]) and *TradeCredit* ($p < .05$ in specifications [1], [3], and [4]; $p < .10$ in specification [2]) show that if a borrower needs to provide collateral, lenders allow borrowers to exchange personal with business assets to secure these unlikely collateralizable loans (as suggested by the first estimator). The ability to trade personal collateral for business collateral may be justified in part because these firms tend to be larger and less opaque, with a range of sufficient business assets to secure the loan.

The experience of top managers (*Experience*), firm losses due to crime events (*Crime*), and the number of financial services with the banking sector (*FinancialOpeness*) do not influence the type of collateral used to secure the loan but rather influence only collateralization likelihood, as broadly measured. We fail to accept the hypothesis that lenders requesting collateral privilege business assets as a debt seniority signal for larger loans (the coefficients of *LoanSize* are negative and not statistically significant in any specification). Lenders do not ask for a specific type of asset as a function of the loan size, suggesting that they recognize that posting collateral is a satisfactory gesture to mitigate moral hazard problems. Among collateralized contracts, firms located in big cities *(City)* ($p < .01$ in all specifications) and those operating in countries with a branched banking market (*Brpc*) ($p < .05$ in specification [2]) are more likely to provide personal collateral, whereas other firms tend to provide business collateral. The variable *Cr* yields similar results, showing that a concentrated banking market increases the likelihood of providing personal collateral ($p < .10$ in specification [1]). A possible explanation is that once the ability to switch lenders in a concentrated banking market is limited, lenders privilege personal assets to secure a loan, because the assets provide a more credible signal to the lender and reduce the lender's efforts in screening and monitoring the firm's quality and *ex post* behavior (i.e., the "lazy" argument; see Mann, 1997). In line with the first estimator, *CreditInfo* does not show a statistically significant relationship with the trade-off of business collateral versus personal collateral. The coefficient of *LegalRights*, which is not statistically significant, suggests that the strength of legal rights only influences collateralization likelihood as broadly measured; it does not influence the substitution policy between types of assets to secure the loan. Economic development (*GDPppcpp*) reduces the likelihood of choosing personal collateral to meet a collateralization request.

3.4.2.2. Level of Collateral

Table 3.4 reports the truncated regression estimations for business and personal collateral level (*BCr* and *PCr*, respectively) as an extension of the continuation ratio model (Eq. 3 and 4).

Table 3.4. – Truncated regression model *(left-truncated if Collateral=0)*

This table reports the results of truncated regression model conditioned to collateralized loans. Left-hand side columns report the results regarding the determinants of the level of business collateral (i.e., dependent variable: *BCr*) and the right-hand side the results regarding the determinants of the level of personal collateral (i.e., dependent variable: *PCr)* for collateralized loans. Standard errors are in parentheses. ***p < .01, **p < .05, *p < .1.

	(1)		(2)		(3)	
	BCr	**PCr**	**BCr**	**PCr**	**BCr**	**PCr**
Firm Characteristics						
Age	0.459**	-0.258	0.481**	-0.240	0.451**	-0.253
	(0.200)	(0.173)	(0.200)	(0.172)	(0.201)	(0.173)
Size	0.087**	-0.104***	0.0878**	-0.105***	0.092**	-0.104***
	(0.039)	(0.034)	(0.039)	(0.034)	(0.039)	(0.034)
Experience	0.137	-0.022	0.181	0.057	0.190	-0.014
	(0.218)	(0.189)	(0.215)	(0.186)	(0.217)	(0.188)
Ownership	-0.079	0.174**	-0.112	0.174***	-0.101	0.169**
	(0.079)	(0.068)	(0.078)	(0.067)	(0.078)	(0.068)
Overdue	-10.794	-0.160	-10.931	0.744	-11.084	-0.104
	(7.590)	(6.565)	(7.578)	(6.541)	(7.597)	(6.568)
Crime	-2.087	2.588	-0.512	2.651	-2.486	2.340
	(4.655)	(4.027)	(4.641)	(4.006)	(4.649)	(4.019)
Quality	0.528	-2.749	0.539	-3.076	1.064	-2.775
	(4.938)	(4.271)	(4.938)	(4.262)	(4.946)	(4.276)
TradeCredit	0.209***	-0.142**	0.205***	-0.131**	0.208***	-0.145**
	(0.070)	(0.061)	(0.070)	(0.061)	(0.070)	(0.061)
FinancialOpenne	2.861	-3.637	4.462	-5.045	3.870	-3.299
	(3.839)	(3.321)	(3.803)	(3.282)	(3.790)	(3.277)
Loan Characteristics						
Ln(LoanSize)	0.272	-0.597	-0.05026	-0.003	0.24384	-0.606
	(1.423)	(1.231)	(1.42518)	(1.230)	(1.42357)	(1.231)
Lender Market Characteristics						
City	-18.859***	7.359*	-17.149***	7.165*	-17.762***	7.619**
	(4.415)	(3.819)	(4.362)	(3.765)	(4.379)	(3.785)
Cr	-0.205*	-0.057				
	(0.118)	(0.102)				
Brpc			-0.178	-0.190		
			(0.140)	(0.120)		
Credit Environment Characteristics						
CreditInfo					-1.430	0.515
					(1.369)	(1.183)
LegalRights						
Ln(GDPpcppp)						
Constant	79.903***	55.984***	73.581***	50.395***	72.938***	50.426***
	(19.276)	(16.673)	(17.930)	(15.476)	(18.681)	(16.149)
Observations	1,652	1,652	1,625	1,625	1,652	1,652
F stat	4.73	3.81	4.74	3.85	4.66	3.80
Prob > F Stat	0.000	0.000	0.000	0.000	0.000	0.000
R^2	0.034	0.027	0.034	0.028	0.033	0.027
Adj. R^2	0.027	0.020	0.027	0.021	0.026	0.020

Table 3.4. – Truncated regression model *(left-truncated if Collateral=0) (Continuation)*

	(4)		(5)	
	BCr	**PCr**	**BCr**	**PCr**
Firm Characteristics				
Age	0.469**	-0.255	0.476**	-0.236
	(0.200)	(0.173)	(0.201)	(0.173)
Size	0.097**	-0.101***	0.089**	-0.106***
	(0.039)	(0.0340)	(0.039)	(0.034)
Experience	0.192	-0.006	0.195	0.015
	(0.216)	(0.187)	(0.217)	(0.187)
Ownership	-0.096	0.169**	-0.106	0.159**
	(0.078)	(0.068)	(0.078)	(0.068)
Overdue	-9.067	0.361	-11.188	-0.688
	(7.583)	(6.577)	(7.599)	(6.561)
Crime	-2.565	2.457	-2.065	3.429
	(4.628)	(4.014)	(4.677)	(4.038)
Quality	0.355	-2.807	1.220	-1.987
	(4.922)	(4.269)	(4.953)	(4.276)
TradeCredit	0.186***	-0.149**	0.234***	-0.096
	(0.070)	(0.061)	(0.075)	(0.065)
FinancialOpenne	4.582	-3.143	4.448	-2.548
	(3.779)	(3.278)	(3.813)	(3.292)
Loan Characteristics				
Ln(LoanSize)	0.042	-0.666	0.507	-0.184
	(1.419)	(1.231)	(1.442)	(1.245)
Lender Market Characteristics				
City	-17.192***	7.838**	-18.502***	6.578*
	(4.366)	(3.786)	(4.416)	(3.813)
Cr				
Brpc				
Credit Environment				
CreditInfo				
LegalRights	3.355***	1.009		
	(0.918)	(0.796)		
Ln(GDPpcppp)			-4.306	-7.159**
			(3.873)	(3.344)
Constant	49.091***	46.991***	103.109***	109.651***
	(18.498)	(16.044)	(35.738)	(30.856)
Observations	1,652	1,652	1,652	1,652
F stat	5.80	3.03	4.76	4.17
Prob > F Stat	0.000	0.000	0.000	0.000
R^2	0.041	0.028	0.034	0.030
Adj. R^2	0.034	0.021	0.027	0.023

The truncated regression model shows that the ratio of personal collateral is not influenced by the age of firm, even though it reduces the likelihood of providing personal collateral (i.e., second estimator of CRP model). However, older firms tend to provide a higher level of business assets in collateralized contracts ($p < .05$ in all specifications). Together, these results confirm that younger firms use personal collateral as a signal of creditworthiness and commitment when obtaining access to a loan. This signal is interpreted through the gesture of posting personal assets rather than through its level. Older firms, which are theoretically less risky and better known, provide a higher ratio of business collateral to access the loan. These

results suggest that dichotomous variables proxy the level of collateral provided, but only to a limited extent.

The positive coefficients of *Size* in *BCr* ($p < .05$ in all specifications) and the negative sign in *PCr* ($p < .01$ in all specifications) confirm that when required to provide collateral, larger firms trade higher ratios of personal collateral for business collateral, in part because they tend to be less business-asset constrained. These results are in line with the second estimator of the CRP model. Table 3.4 also confirms that ownership concentration increases not only the likelihood of providing personal collateral but also the level of personal collateral provided ($p < .01$ in specification [2]; $p < .05$ in the remaining specifications). Nonetheless, no statistically significant effect is reported for *BCr*. These results are consistent with the notion of a "dark side of altruism" with respect to small firms, given the high agency costs with lenders. In line with binary outcomes (Eq. 2), the results do not indicate a significant relationship between *BCr* or *PCr* and *Experience*, *Overdue*, *Crime*, and *FinancialOpeness*. When we investigate the *Quality* effect, the *p*-value of the variable falls from 10% in binary outcomes to more than 10% in the study of collateral-to-loan ratios. This table shows that trade credit allows borrowers to exchange personal collateral for business collateral, also regarding its level, if the lender requires them to provide collateral ($p < .05$ in specifications [1]–[4]).

Consistent with previous estimations, the size of loan does not influence the level of business or personal collateral provided. In addition, the positive coefficient of *City* in *BCr* ($p < .01$) and the negative coefficient in *PCr* ($p < .10$ in specifications [1], [2], and [5]; $p < .05$ in the remaining specifications) confirm that the local (distant) lender will exchange business (personal) assets for personal (business) assets to secure the loan. These results suggest that an increase of banking concentration decreases the level of business collateral, which may suggest that market concentration increases banks' "lazy" behavior by asking for collateral not to mitigate observable risk but rather to reduce their screening efforts (see Table 3.4).

The coefficient of *CreditInfo* does not appear statistically related to the collateralization policy. Although it does not influence the choice between personal and business collateral when the borrower is requested to provide collateral (the second estimator of the continuation ratio model), this table shows that the strength of legal rights is positively related to the level of business collateral. Finally, the model shows that the negative impact of an increase in GDP per capita on collateralization falls when we analyze the value of personal collateral and is null with respect to the level of business collateral provided.

3.5. Robustness Tests

Partially in line with Hanedar et al. (2014b), our results seem to suggest that more intensive information-sharing instruments mitigate neither the presence of (business and personal) collateral nor its level. Likewise, the increase of legal protection by credit rights does not prove to be instrumental in either reducing the likelihood of loan collateralization or reducing the level of (business and personal) collateral. Instead, in countries with stronger credit rights, the borrower is more likely to be requested to pledge collateral and to provide

higher levels of business collateral. When interpreting these results, it is important to emphasize that we observe only firms with approved loan applications, that is, those that passed the lender's credit evaluation. Thus, it could be argued that the depth of information-sharing instruments and the strength of legal rights positively affect the approval of loan requests more than they mitigate collateral requirements. To test this assumption, similar to Hanedar et al. (2014b), we investigate the impact of both factors in extending credit. Based on the 2009 BEEPS, we used *ProbRejected* (which takes a value of 1 if the firm reported access to finance as a severe problem and 0 otherwise[41]) as the dependent variable.[42] Then, we ran a probit model on *ProbRejected* over *CreditInfo*, *LegalRights,* and the set of independent variables, except for *LoanSize* and country variables.[43]

The probit model yields a negative coefficient for *LegalRights* ($p < .05$), confirming that credit access is less stringent for firms operating in countries with better credit protection laws. This result sheds more light on the relationship of legal rights, credit rationing, and collateralization terms, leading us to conclude that reliable credit protection laws decrease banks' reluctance in extending credit using a collateralized contract. Nonetheless, contrary to Hanedar et al. (2014b), we do not find a statistically significant effect of the depth of information-sharing instruments (*CreditInfo)* on providing credit access.

To extend the study of the value of information-sharing instruments, we adopt alternative variables to *CreditInfo*. Similar to Godlewski and Weill (2011), we select two variables measuring the presence and dissemination of private and public information-sharing instruments in the market: *Priv_cbr* (measured as the number of firms listed by a private credit bureau with current information on repayment history, unpaid debts, or outstanding credit, as percentage of the adult population) and *Pub_creg* (measured as the number of firms listed by the public credit registry with current information on repayment history, unpaid debts, or outstanding credit as percentage of the adult population).[44] These variables enable us to control for the coverage of information-sharing instruments rather than the type of instruments adopted (DBR, 2010). Accordingly, we expect to find a negative relationship between those variables and collateral requirements. To test this assumption, we re-run the CRP model (Eq. 2; see Table 3.5) and the truncated regression model (Eq. 3 and 4; see Table 3.6) using *Priv_cbr* and *Pub_creg* as independent variables. First, we replaced the variable *CreditInfo* with these alternative variables and tested them separately. Second, we tested the interaction effect

[41] The question in the survey is as follows: "Is access to finance, which includes availability and cost, interest rates, fees and collateral requirements, No Obstacle, A Minor Obstacle, A Moderate Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishments?"

[42] We assume that the severity of access to finance in some way predicts the likelihood of firms being discouraged to apply for a loans or being rejected.

[43] Estimations are not reported here, but they are available upon request.

[44] Variables provided by the World Bank (World Bank Data Indicators.)

between the depth of information-sharing instruments and its coverage (i.e., Inter1: *CreditInfo* × *Priv_cbr*; Inter2: *CreditInfo* × *Pub_creg*).

Table 3.5 reports the results of the CRP model. The first estimator (left-hand side of each column) shows that firms operating in countries with higher coverage of information-sharing instruments by private credit bureaus (*Priv_cbr*: $p < .01$) tend to receive screening contracts (*Pub_creg* is not statistically significant). Furthermore, the results suggest that the depth of information-sharing instruments helps reduce collateralized loans if these instruments provide information about a higher percentage of firms (Inter1: $p < .01$; Inter2: $p < .05$).

The results provided by the second estimator (right-hand side of each column) suggest that an increasing percentage of firms listed by public credit registries increases preference for personal collateral to secure loans (*Pubcreg*: $p < .01$; Inter2: $p < .05$; *Privcbr* and Inter1 variables have positive coefficients but are not statistically significant). This unexpected evidence is not in accordance with predictions that the value of personal collateral decreases (mitigating moral hazard and adverse selection) in an environment with higher informational traceability (Menkhoff et al., 2012). However, it is possible that an increase in the coverage of information-sharing instruments acts as device to mitigate credit rationing, especially for younger and more opaque firms, which, when required to meet collateral request, tend to use personal collateral.

Table 3.5 also confirms the robustness of the previous results (reported in Table 3.4) because a firm's level variables report similar effects on the incidence of collateral (except for *Ownership*) as well as explaining the type of assets used to meet collateral requests. The positive coefficients of *Ownership* are statistically significant in this table ($p < .05$ when we insert *Priv_cbr* and Inter1 into the equation), in line with Schulze et al. (2001, 2003).

Table 3.6 suggest that increasing the coverage of information-sharing instruments lowers ratios for both business and personal collateral in the presence of collateralized contracts (*BCr* and *PCr* estimations: *Pub_creg* and Inter 2: $p < .01$; *Priv_cbr* and Inter1 are not statistically significant in either the *BCr* or the *PCr* estimations). These results confirm that increasing the likelihood of providing personal collateral does not necessarily relate with the level of personal collateral. Table 3.6 also confirms the robustness of the previous results (reported in Table 3.4).

Table 3.5. –Coverage of information-sharing instruments (CRP model)

This table reports the results of robustness of CRP model by including proxies for share-information. Left-hand side columns report the results of the first estimator (dependent variable: *Collateral*) and the right-hand side the results of the second estimator (dependent variable: *PC*) for collateralized loans. *Priv_cbr* is the number of individuals of firms listed by a private credit bureau with current information on repayment history, unpaid debts, or credit outstanding, as a percentage of the adult population. *Pub_creg* in number of individuals of firms listed by public credit registry with current information on repayment history, unpaid debts, or credit outstanding as percentage of the adult population). Inter1 = *CreditInfo* × *Priv_cbr*; Inter2 = *CreditInfo* × *Pub_creg*. Standard errors are in parentheses. ***p < .01, **p < .05, *p < .1.

	Collateral	**PC**	**Collateral**	**PC**
Firm Characteristics				
Age	-0.007**	-0.011***	-0.007**	-0.012***
	(0.003)	(0.004)	(0.003)	(0.004)
Size	< -0.001	-0.003***	0.001	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Experience	-0.005	< -0.001	-0.008**	0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Ownership	0.003**	0.002*	0.002	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
Overdue	0.124	0.166	0.092	0.135
	(0.125)	(0.114)	(0.119)	(0.113)
Crime	0.179**	0.041	0.163**	0.068
	(0.083)	(0.072)	(0.076)	(0.070)
Quality	-0.143*	-0.142*	-0.193**	-0.136*
	(0.083)	(0.079)	(0.077)	(0.077)
TradeCredit	-0.003**	-0.002*	-0.004***	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
FinancialOpenness	-0.078	-0.056	-0.159***	-0.023
	(0.066)	(0.059)	(0.061)	(0.058)
Loan Characteristics				
Ln(LoanSize)	0.242***	-0.024	0.181***	-0.013
	(0.025)	(0.022)	(0.023)	(0.022)
Lender Market Characteristics				
City	-0.361***	0.252***	-0.218***	0.209***
	(0.072)	(0.0670)	(0.069)	(0.067)
Credit Environment Characteristics				
Priv_cbr	-0.008***	0.002		
	(0.002)	(0.002)		
Pub_creg			-0.004	0.014***
			(0.005)	(0.005)
Inter1				
Inter2				
Constant	-1.143***	-0.066	-0.402	-0.280
	(0.302)	(0.284)	(0.280)	(0.276)
Observations.	2,076	1,740	2,224	1,830
Log-likelihood	-956.59	-995.90	-956.59	-1,033.54
LR chi^2	151.96	84.16	151.96	102.37
Prob > chi^2	0.000	0.000	0.000	0.000
Pseudo-R^2	0.074	0.041	0.074	0.047

Table 3.5. –Coverage of information-sharing instruments (CRP model) *(Continuation)*

	Collateral	PC	Collateral	PC
Firm Characteristics				
Age	-0.007**	-0.01122***	-0.007***	-0.012***
	(0.003)	(0.00374)	(0.003)	(0.004)
Size	< -0.001	-0.00255***	0.001	-0.003***
	(0.001)	(0.00065)	(0.007)	(0.001)
Experience	-0.005	0.00008	-0.007**	<0.001
	(0.003)	(0.00346)	(0.003)	(0.003)
Ownership	0.003**	0.00214*	0.001	0.003**
	(0.001)	(0.00124)	(0.001)	(0.001)
Overdue	0.135	0.16989	0.105	0.133
	(0.125)	(0.11396)	(0.119)	(0.113)
Crime	0.179**	0.04131	0.155**	0.069
	(0.083)	(0.07207)	(0.076)	(0.070)
Quality	-0.135	-0.13700*	-0.186**	-0.139*
	(0.083)	(0.07940)	(0.077)	(0.077)
TradeCredit	-0.003**	-0.00203*	-0.004***	-0.002**
	(0.001)	(0.00108)	(0.001)	(0.001)
FinancialOpenne	-0.078	-0.05140	-0.164***	-0.033
	(0.066)	(0.05886)	(0.061)	(0.058)
Loan Characteristics				
Ln(LoanSize)	0.244***	-0.02250	0.178***	-0.0124
	(0.025)	(0.02229)	(0.023)	(0.022)
Lender Market Characteristics				
City	-0.355***	0.25001***	-0.189***	0.209***
	(0.072)	(0.067)	(0.070)	(0.068)
Credit Environment Characteristics				
Priv_cbr				
Pub_creg				
Inter1	-0.002***	<0.001		
	(< 0.001)	(<0.001)		
Inter2			-0.003**	0.003**
			(0.001)	(0.001)
Constant	-1.155***	-0.089	-0.322	-0.266
	(0.302)	(0.284)	(0.282)	(0.277)
Observations.	2,076	1,740	2,224	1,830
Log-likelihood	-814.44	-995.51	-954.81	-1,034.78
LR chi^2	199.41	83.31	155.50	99.90
Prob > chi^2	0.000	0.000	0.000	0.000
Pseudo-R^2	0.110	0.040	0.075	0.046

Table 3.6. –Coverage of information-sharing instruments (Truncated regression model)

This table reports the results of robustness tests using of truncated models by including proxies for share-information. Left-hand side columns report the results regarding the determinants of the level of business collateral (i.e., dependent variable = *BCr*), and the right-hand side reports the results regarding the determinants of the level of personal collateral (i.e., dependent variable = *PCr)* for collateralized loans *Priv_cbr* is the number of individuals of firms listed by a private credit bureau with current information on repayment history, unpaid debts, or credit outstanding, as percentage of the adult population. *Pub_creg* in number of individuals of firms listed by public credit registry with current information on repayment history, unpaid debts, or credit outstanding as percentage of the adult population). Inter1 = *CreditInfo* × *Priv_cbr*; Inter2 = *CreditInfo* × *Pub_creg*. Standard errors are in parentheses. ***$p < .01$, **$p < .05$, *$p < .1$.

	BCr	PCr	BCr	PCr
Firm Characteristics				
Age	0.512**	-0.214	0.425**	-0.272
	(0.219)	(0.191)	(0.199)	(0.173)
Size	0.073*	-0.104***	0.085**	-0.106***
	(0.041)	(0.035)	(0.039)	(0.034)
Experience	0.238	-0.045	0.262	0.024
	(0.225)	(0.196)	(0.216)	(0.188)
Ownership	-0.076	0.173**	-0.093	0.171**
	(0.081)	(0.070)	(0.078)	(0.067)
Overdue	-10.720	0.701	-8.741	0.692
	(7.812)	(6.803)	(7.560)	(6.568)
Crime	-0.915	1.974	-3.717	2.000
	(4.813)	(4.192)	(4.620)	(4.014)
Quality	3.180	-2.685	1.268	-2.480
	(5.188)	(4.518)	(4.909)	(4.264)
TradeCredit	0.239***	-0.124**	0.195***	-0.147**
	(0.073)	(0.063)	(0.070)	(0.061)
FinancialOpenne	4.725	-2.386	0.726	-4.654
	(3.939)	(3.431)	(3.827)	(3.325)
Loan Characteristics				
Ln(LoanSize)	0.723	-0.623	-0.169	-0.774
	(1.487)	(1.295)	(1.417)	(1.231)
Lender Market Characteristics				
City	-19.860***	7.370*	-13.605***	9.377**
	(4.505)	(3.924)	(4.442)	(3.859)
Credit Environment Characteristics				
Priv_cbr	-0.172	-0.015		
	(0.107)	(0.093)		
Pub_creg			-1.529***	-0.626**
			(0.325)	(0.282)
Inter1				
Inter2				
Constant	59.572***	50.566***	82.303***	58.612***
	(18.893)	(16.453)	(18.052)	(15.683)
Observations	1,573	1,573	1,652	1,652
F stat	4.85	3.26	6.56	4.22
Prob > F Stat	0.000	0.000	0.000	0.000
R^2	0.036	0.025	0.046	0.030
Adj. R^2	0.029	0.017	0.039	0.023

Table 3.6. –Coverage of information-sharing instruments (Truncated regression model) *(Continuation)*

	BCr	PCr	BCr	PCr
Firm Characteristics				
Age	0.504**	-0.210	0.401**	-0.278
	(0.219)	(0.191)	(0.199)	(0.173)
Size	0.074*	-0.105***	0.083**	-0.106***
	(0.041)	(0.035)	(0.039)	(0.034)
Experience	0.229	-0.042	0.308	0.033
	(0.225)	(0.196)	(0.216)	(0.188)
Ownership	-0.076	0.174**	-0.117	0.163**
	(0.081)	(0.070)	(0.077)	(0.068)
Overdue	-10.738	0.818	-7.891	0.817
	(7.819)	(6.808)	(7.547)	(6.574)
Crime	-0.898	2.001	-4.161	1.927
	(4.815)	(4.192)	(4.611)	(4.017)
Quality	3.104	-2.548	1.871	-2.313
	(5.196)	(4.524)	(4.899)	(4.268)
TradeCredit	0.237***	-0.123*	0.211***	-0.141**
	(0.073)	(0.063)	(0.070)	(0.061)
FinancialOpenness	4.579	-2.305	0.940	-4.341
	(3.935)	(3.426)	(3.795)	(3.306)
Loan Characteristics				
Ln(LoanSize)	0.701	-0.587	-0.371	-0.811
	(1.489)	(1.297)	(1.415)	(1.233)
Lender Market Characteristics				
City	-19.759***	7.366*	-12.049***	9.583**
	(4.505)	(3.922)	(4.464)	(3.888)
Credit Environment Characteristics				
Priv_cbr				
Pub_creg				
Inter1	-0.034	-0.007		
	(0.024)	(0.020)		
Inter2			-0.472***	-0.158**
			(0.085)	(0.074)
Constant	60.128***	50.100***	86.131***	58.773***
	(18.892)	(16.449)	(18.048)	(15.721)
Observations	1,573	1,573	1,652	1,652
F stat	4.80	3.27	7.28	4.18
Prob > F Stat	0.000	0.000	0.000	0.000
R^2	0.036	0.025	0.051	0.030
Adj. R^2	0.028	0.017	0.044	0.023

Finally, we re-run the probit model on *ProbRejected* and replaced *CreditInfo* with *Priv_cbr, Pub_creg*, and the interaction variables,[45] with the aim of testing the robustness of previous evidence about the value of information-sharing mechanisms in mitigating credit rationing. The results show that coverage by public credit registries adds value to the depth of information-sharing instruments, reducing credit rationing (negative coefficients of *Pub_creg* and Inter2 are statistically significant at the 1% level, whereas the negative coefficients of *Priv_cbr* and Inter1 are not statistically significant at the 10% level). Thus, we conclude that reforms pertaining to the depth of information-sharing instruments by public credit registries

[45] Estimations are not reported here, but they are available upon request.

have practical effects in mitigating credit constraints and reducing the collateral requirements only when coupled with public reforms on its coverage.

3.6. Concluding Remarks

Using a database of credit approvals for SMEs from a cross-country sample of less-developed economies, including transition economies from Eastern Europe and Central Asia, the current research extends empirical evidence on the determinants of collateral by examining the simultaneous determinants of business collateral and personal collateral/commitments. This is a worthwhile sample to study, not only due to the scarcity of literature in this domain but also because these economies have recently experienced both strong credit market development and considerable institutional changes. Employing a CRP model, we examine the determinants of both the choice to ask for collateral and the choice of the type of collateral (business or personal) once the decision to ask for collateral has been made. Furthermore, our method enables us to control for the level of collateral provided.

Regarding the determinants of collateralization, the results confirm that observable credit risk is positively associated with the incidence of collateral. We found that younger firms use personal collateral as a signal of creditworthiness and commitment to access a loan. This signal is interpreted through the gesture of posting personal assets rather than through its level. If required to provide collateral, larger firms trade higher ratios of personal collateral for business collateral.

Our results endorse the importance of producing and sharing private information among lenders to reduce information asymmetries and, consequently, the need to provide collateral to receive the loan. Furthermore, contrary to Jiménez et al. (2009), we find that borrowers benefit from being located in a more developed, representative, and competitive banking market. These results suggest that firms located close to a bank are financed by a screening contract. Contrary to the theoretical models of Manove et al. (2001) and Hainz et al. (2013), this study reveals that banks operating in a concentrated banking system use their market power to increase lending under collateralized contracts, especially with respect to personal assets. Moreover, truncated regression estimations show that an increase of banking concentration increases the level of collateral. These results suggest that the market concentration increases "lazy" behavior by banks insofar as they ask for collateral not to mitigate observable risk but rather to reduce screening efforts. Furthermore, our results show that lenders operating in less-developed countries do not ask for a specific type of asset (or value) as a function of the loan size, suggesting that they recognize that posting collateral is a satisfactory gesture to mitigate moral hazard problems. These surprising results reject the hypothesis that lenders requesting collateral privilege business assets as a debt seniority signal for larger loans (Menkhoff et al., 2012).

Finally, these findings consistently suggest that reliable credit protection laws decrease banks' reluctance to extend credit through collateralized contracts. We also find that reforms

pertaining to the depth of information-sharing instruments by public credit registries have practical effects in mitigating credit constraints and reducing the collateral requirements only when coupled with public reforms on its coverage. The results show that the explanatory power of models predicting (business and personal) collateral requirements and credit rationing yields when we include the interaction effects between public coverage and the depth of information-sharing mechanisms.

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Appendices

Appendix 3.1. – Empirical studies on "determinants" of collateral

This table report an overview about literature that broadly tested the determinants of collateral. Other studies on collateralization issues are not included.
[a]AEL – Applied Economic Letters; FBR – Family Business Review; FR – The Financial Review; JBF – Journal of Banking and Finance; JBFA – Journal of Business Finance and Accounting; JEBO –Journal of Economic Behavior and Organization; JEF – Journal of Entrepreneurial Finance; JFE – Journal of Financial Economics; JFI – Journal of Financial Intermediation; JFQA – Journal of Financial and Quantitative Analysis; JFSR – Journal Finance Services Research; JJIE – Journal of the Japanese and International Economies ; JMCB – Journal of Money, Credit and Banking; JSBM – Journal of Small Business Management ; QJE – The Quarterly Journal of Economics; SBE – Small Business Economics; SMEF –Survey on Small and Medium-Sized Enterprises Finance; TJF – The Journal of Finance; VC – Venture Capital: An International Journal of Entrepreneurial Finance; WSEAS – WSEAS Transactions on Business and Economics.
[b]AO – Angola; ARG – Argentina; AUS – Australia; AT – Austria; BEL – Belgium; BD – Bangladesh; BG – Bulgaria; BOL – Bolivia; BRA - Brazil; CAM –Cameroon; CH - Switzerland; CI – Ivory Coast; CL –Chile; CN – China; CO – Colombia; CRT – Croatia; CZ – Czech Republic; DK – Denmark; EC – Ecuador; EECA – Eastern Europe and Central Asia developing countries ; EGY – Egypt; FIN – Finland ; FRA - France; GER – Germany; GH – Ghana GR – Greece; GT – Guatemala; HKG – Hong-Kong; HU – Hungary; IDN – Indonesia; IND – India; IT – Italy; IR – Iran; IRE – Ireland; IL – Israel; ISR – Israel ; JAM – Jamaica; JP – Japan; KAZ – Kazakhstan; KR – South Korea; LT – Lithuania; LKA – Sri Lanka; MA – Morocco; MEX – Mexico; MY – Malaysia; NL – Netherland; NO – Norway; NZ – New Zealand; OM – Oman; PAN – Panama; PE – Peru; PG – Papua New Guinea; PH – Philippines; PL – Poland; PK – Pakistan; PT – Portugal; ROU – Romania; RU – Russia; SA – South Arabia; SE – Sweden; SG – Singapore; SP – Spain; SI – Slovenia; SK – Slovakia; TLD – Thailand; TUN- Tunisia; TR – Turkey; TW –Taiwan; UK – United Kingdom; US – United States; VE – Venezuela; VN – Vietnam; ZA – South Africa
[c]ABCCS – Association of British Chambers of Commerce Survey; BEEPS – Business Environment and Enterprise Performance Survey; CIR – Credit Register of the Bank of Spain; CIRC – Central de Información de Riesgos Credicticios; CSMAR – China Securities Markets and Accounting Research Database; EBRD – European Bank for Reconstruction and Development; EOSMEs – Economic Observatory of SMEs; FID – Financial Information Database; LPC – Loan Pricing Corporation DealScan database ; SNFIB – Survey of the National Federation of Independent Business; NSSBF – National Survey of Small Business Finance; FRBoCCB – Federal Reserve Bank of Chicago Commercial Bank; HCD - Holding Company Database; SABE – Sistema de Análisis de Balances Españoles; SABI – Iberian Balance sheet Analysis System; SFE –Survey of the Financial Environment ; SMBC - Seventeen Mexican Banks Circa; SSBCS – Survey of Small Business Credit Scoring ; SSMGF – Survey of Small and Medium-Sized German Firms; STBL – Federal Reserve's Survey of Terms of Bank Lending; WBDI – World Bank Data Indicators
[d]According to International Monetary Fund Classification. [e] MBS – Market-based System; BBS – Bank-based system.

Author	Year	Journal [a]	Approach to Collateral	Home Markets [b]	Data Source [c]	Economic Class. [d]	Financial Structure [e]	Time Frame	Sample (Observations)
Orgler	1970	JMCB	Incidence of collateral	US	Set of credit file coming from bank examiners	Advanced economy	MBS	Nonspecified	300 loans (75 bad loans; 225 good loans). Firm size not specified/conditioned
Leeth and Scott	1989	JFQA	Incidence of collateral	US	SNFIB	Advanced economy	MBS	1980; 1982	2,609 loans to SMEs
Berger and Udell	1990	JME	Incidence of collateral	US	STBL	Advanced economy	MBS	1977–1988	1,127,479 to SMEs and large firms

Appendix 3.1. – Empirical studies on "determinants" of collateral *(Continuation)*

Author	Year	Journal [a]	Approach to Collateral	Home Markets [b]	Data Source [c]	Economic Class. [d]	Financial Structure [e]	Time Frame	Sample (Observations)
Ang et al.	1995	JEF	Incidence of PC	US	NSSBF	Advanced economy	MBS	1987	692 loans SMEs
Berger and Udell	1995	JME	Incidence of collateral	US	SNFIB	Advanced economy	MBS	1987	692 loans SMEs
Blackwell and Winters	1997	JFR	Incidence of collateral	US	Set of credit file coming from six banks from two holding companies	Advanced economy	MBS	1998	174 loans to SMEs
Avery et al.	1998	JBF	Incidence of PC	US	NSSBF	Advanced economy	MBS	1987; 1993	1,462 loans to SMEs
Harhoff and Körting	1998	JBF	Incidence of collateral	GER	SSMGF	Advanced economy	BBS	1997	994 loans to SMEs
Machaeur and Weber	1998	JBF	Non collateralised percentage of Line of Credit	GER	Set of credit files coming from the five major banks	Advanced economy	BBS	1992-1996	125 customer relationships (mediums-sized firms)
Cowling	1999	AEL	Incidence of collateral	UK	ABCCS	Advanced economy	MBS	1991	272 loans to SMEs
Degryse and van Cayseele	2000	JFI	Incidence of collateral	BEL	Set of credit file coming from one bank	Advanced economy	BBS	1995-1997	17,429 loans to SMEs
Dennis et al.	2000	JFQA	Incidence of collateral	US	LPC	Advanced economy	MBS	1987-1995	2,634 medium/large publicly traded companies

Appendix 3.1. – Empirical studies on "determinants" of collateral *(Continuation)*

Author	Year	Journal [a]	Approach to Collateral	Home Markets [b]	Data Source [c]	Economic Class. [d]	Financial Structure [e]	Time Frame	Sample (Observations)
Cressy and Toivanen	2001	VC	Collateral fraction	UK	Set of credit file coming from one representative bank	Advanced economy	MBS	1987–1990	2,767 loans to SMEs
Lehmann and Neuberger	2001	JEBO	Collateral-to-loan ratio	GER	Survey of Banks	Advanced economy	BBS	1997	354 loans to SMEs
Hanley	2002	SBE	Incidence of collateral; Amount of collateral	UK	Set of credit files coming from the major retail bank	Advanced economy	BBS	1999	4,335 loans to SMEs
La Porta et al.	2003	QJE	Incidence of collateral; Incidence of PC; Collateral-to-loan ratio	MEX	SMBC	Developing economy/emerging market	MBS	1995	1,577 loans to SMEs
Gonas et al.	2004	FR	Incidence of collateral	UK	LPC; FRBoCCB; HCD	Advanced economy	MBS	1988–2001	7,619 loans to SMEs and large firms
Jiménez and Saurina	2004	JBF	Collateral-to-loan ratio	SP	CIR	Advanced economy	BBS	1987, 1990, 1993, 1997, 2000	3,167,326 loans to SMEs and larger firms
Chakraborty and Hu	2006	JFI	Incidence of collateral	US	NSSBF	Advanced economy	MBS	1993	1,632 loans to SMEs
Hernández-Cánovas and Martínez-Solano	2006	JSBM	Incidence of PC	SP	SABE	Advanced economy	BBS	1999–2000	184 loans to SMEs

Appendix 3.1. – Empirical studies on "determinants" of collateral *(Continuation)*

Author	Year	Journal [a]	Approach to Collateral	Home Markets [b]	Data Source [c]	Economic Class. [d]	Financial Structure [e]	Time Frame	Sample (Observations)
Jiménez et al.	2006	JFE	Incidence of collateral; Collateral-to-loan ratio	SP	CIR	Advanced economy	BBS	1984-2002	568,903 loans. Firm size not specified/conditioned
Menkhoff et al.	2006	JBF	Incidence of collateral; collateral-to-loan ratio	TLD	Set of credit files coming from nine banks	Developing economies/emerging markets	MBS	2000-2001	208 loans to SMEs Vs. 208 loans to Larger firms
Voordeckers and Steijvers	2006	JBF	Degree of collateral	BEL	Set of credit files coming from one bank	Advanced economy	BBS	2000-2003	234 loans to SMEs
Brick and Palia	2007	JFI	Incidence of BC; Incidence of PC	US	NSSBF	Advanced economy	MBS	1993	766 loans to SMEs
Qian and Strahan	2007	TJF	Incidence of collateral	AUS, HKG, IDN, IRE, ISR, MY, NZ, PK, SG, ZA, TLD, UK, ARG, BEL, BRA, CL, CO, FRA, GR, IND, IT, MEX, NL, PE, PH, PT, SP, TR, VE, AUS, GER, JP, KR, CH, TW, DK, FIN, NO, SE, CH, CZ, HU, PL	LPC; Worldscope	Developing economies/emerging markets and advanced economies	MBS/BBS	1994-2003	4,322 loans. Firm size not specified/conditioned

Appendix 3.1. – Empirical studies on "determinants" of collateral *(Continuation)*

Author	Year	Journal [a]	Approach to Collateral	Home Markets [b]	Data Source [c]	Economic Class. [d]	Financial Structure [e]	Time Frame	Sample (Observations)
Ortiz-Molina and Penas	2008	SBE	Incidence of collateral; incidence of BC; incidence of PC	US	NSSBF	Advanced economy	MBS	1993	995 loans to SMEs
Ono and Uesugi	2009	JMCB	Incidence of BC; Incidence of PC	JP	SFE	Advanced economy	BBS	2002	1,702 loans to SMEs
Steijvers and Voordeckers	2009	FBR	Incidence of BC; Incidence of PC	US	NSSBF	Advanced economy	MBS	1993	443 loans to SMEs
Han et al.	2009	JBFA	Incidence of collateral	US	NSSBF	Advanced economy	MBS	1998	796 loans to SMEs
Hernández-Cánovas and Martínez-Solano	2010	SBE	Incidence of collateral (categories) Incidence of PC	SP	EOSMEs; SABI	Advanced economy	BBS	1999–2000	182 SMEs
Liberti and Mian	2010	TJF	Collateral spread	ARG, CL, HKG, IND, KR, MY, PK, ROU, SG, SK, SA, LKA, TW, TR	Set of credit file coming from SME lending division of a large multinational bank	Developing economies/emerging markets and advanced economies	MBS/BBS	2002–2004	8,414 loans for SMEs.
Menkhoff et al.	2006	JBF	Incidence of collateral; collateral-to-loan ratio	TLD	Set of credit files coming from nine banks	Developing economies/emerging markets	MBS	2000–2001	208 loans to SMEs Vs. 208 loans to Larger firms

Appendix 3.1. – Empirical studies on "determinants" of collateral *(Continuation)*

Author	Year	Journal [a]	Approach to Collateral	Home Markets [b]	Data Source [c]	Economic Class. [d]	Financial Structure [e]	Time Frame	Sample (Observations)
Voordeckers and Steijvers	2006	JBF	Degree of collateral	BEL	Set of credit files coming from one bank	Advanced economy	BBS	2000–2003	234 loans to SMEs
Brick and Palia	2007	JFI	Incidence of BC; Incidence of PC	US	NSSBF	Advanced economy	MBS	1993	766 loans to SMEs
Qian and Strahan	2007	TJF	Incidence of collateral	AUS, HKG, IDN, IRE, ISR, MY, NZ, PK, SG, ZA, TLD, UK, ARG, BEL, BRA, CL, CO, FRA, GR, IND, IT, MEX, NL, PE, PH, PT, SP, TR, VE, AUS, GER, JP, KR, CH, TW, DK, FIN, NO, SE, CH, CZ, HU, PL	LPC; Worldscope	Developing economies/emerging markets and advanced economies	MBS/BBS	1994–2003	4,322 loans. Firm size not specified/conditioned
Ortiz-Molina and Penas	2008	SBE	Incidence of collateral; incidence of BC; incidence of PC	US	NSSBF	Advanced economy	MBS	1993	995 loans to SMEs
Ono and Uesugi	2009	JMCB	Incidence of BC; Incidence of PC	JP	SFE	Advanced economy	BBS	2002	1,702 loans to SMEs
Steijvers and Voordeckers	2009	FBR	Incidence of BC; Incidence of PC	US	NSSBF	Advanced economy	MBS	1993	443 loans to SMEs
Han et al.	2009	JBFA	Incidence of collateral	US	NSSBF	Advanced economy	MBS	1998	796 loans to SMEs

Appendix 3.1. – Empirical studies on "determinants" of collateral *(Continuation)*

Author	Year	Journal [a]	Approach to Collateral	Home Markets [b]	Data Source [c]	Economic Class. [d]	Financial Structure [e]	Time Frame	Sample (Observations)
Hernández-Cánovas and Martínez-Solano	2010	SBE	Incidence of collateral (categories) Incidence of PC	SP	EOSMEs; SABI	Advanced economy	BBS	1999–2000	182 SMEs
Liberti and Mian	2010	TJF	Collateral spread	ARG, CL, HKG, IND, KR, MY, PK, ROU, SG, SK, SA, LKA, TW, TR	Set of credit file coming from SME lending division of a large multinational bank	Developing economies/emerging markets and advanced economies	MBS/BBS	2002–2004	8,414 loans for SMEs.
Steijvers et al.	2010	SBE	Incidence of collateral Incidence of PC; incidence of BC	US	NSSBF	Advanced economy	MBS	1998	2,525 loans to SMEs
Berger et al.	2011a	JFI	Incidence of collateral	US	STBL;SSBCS	Advanced economy	MBS	1993–1997	13,973 loans to SMEs
Berger et al.	2011b	JFE	Incidence of collateral	BOL	CIRC	Developing economy/emerging market	MBS	1998–2003	32,286 loans. Firm size not specified/conditioned.
Menkhoff et al.	2012	JBF	Incidence of collateral	TLD	Household Survey	Developing economy/emerging market	MBS	2007	2,186 loans to households

Appendix 3.1. – Empirical studies on "determinants" of collateral *(Continuation)*

Author	Year	Journal [a]	Approach to Collateral	Home Markets [b]	Data Source [c]	Economic Class. [d]	Financial Structure [e]	Time Frame	Sample (Observations)
Ono et al.	2012	JJIE	Incidence of PC; incidence of BC	JP	SFE;FID	Advanced economy	BBS	2001–2005	543 loans to SMEs (to test BC incidence) 766 loans to SMEs (to test PC incidence)
Chen et al.	2013	JBF	Collateral fraction	CN	CSMAR	Developing economy/emerging market	MBS	2001–2006	5,358 firms. Firm size not specified/conditioned.
Hainz et al.	2013	JFSR	Incidence of collateral	DZ, AO, ARG, AUS, AT, BEL, BD, BOL, BRA, BG, CAM, CL, CN, CO, CRT, CZ, DK, EC, EGY, FIN, FR, GER, GH, GR, GT, HKG, HU, IND, IDN, IRE, IR, IL, IT, CI, JAM, JP, KAZ, KR, LT, MY, MEX, MA, NL, NO, NZ, OM, PK, PAN, PG, PER, PH, PL, PT, ROU, RU, SA, SG, SI, SK, ZA, SP, LK, SE, TLD, TW, TR, VK, VE, VN	Dealscan	Developing economies/emerging markets and advanced economies	MBS/BBS	2000–2005	4,931 bank loans
Peltoniemi and Vieru	2013	JSBM	Incidence of PC; collateral-to-liabilities ratio;	FIN	Set of credit file coming from the major bank	Advanced economy	BBS	1995–2001	1,189 loans to SMEs
Hanedar et al.	2014b	JBF	Incidence of collateral; collateral-to-loan ratio	EECA	BEEPS; WBDI; EBRD	Developing economies/emerging markets	MBS/BBS	2002, 2005	14,349 loans to SMEs
Gama and Duarte	2015	WSEAS	Incidence of BC incidence of PC	UK	SMEF	Advanced economy	BBS	2008	326 loans to SMEs

Appendix 3.2. - Sample distribution by firm size

This table report the full data by firm size. The stratification criteria for the size dummies are the number of full-time employees.

Stratification by Size	Description	Observations	% Full Sample	% SMEs
LARGE	Dummy variable that takes the value 1 if the firm has more than 250 full employees and 0 if otherwise	1,108	9.45	
SMEs	Dummy variable that takes the value 1 if the firm has more than 250 full employees and 0 if otherwise	10,620	90.55	
MEDIUM	Dummy variable that takes the value 1 if the firm has more than 49 full employees and less than 251 and 0 if otherwise	3,265		30.74
SMALL	Dummy variable that takes the value 1 if the firm has more than 9 full employees and less than 50 and 0 if otherwise	4,841		45.58
MICRO	Dummy variable that takes the value 1 if the firm has less than 10 full employees and 0 if otherwise	2,514		23.67

Appendix 3.3. - Number of loans included by year and country

This table reports an overview of the number of loans included in the final set of observations. The survey includes firms surveyed over three different years (i.e., 2007, 2008, and 2009). Data from Kosovo are not included given the missing values for the country-level information.

	SMEs (Global)			SMEs (Final Sample)		
Country	**2007**	**2008**	**2009**	**2007**	**2008**	**2009**
Albania	120	53	0	45	16	0
Belarus	0	236	0	0	84	0
Georgia	0	354	0	0	108	0
Tajikistan	0	344	0	0	73	0
Turkey	0	1,010	0	0	467	0
Ukraine	0	758	0	0	137	0
Uzbakistan	0	336	0	0	0	0
Russia	0	522	540	0	147	88
Poland	0	176	323	0	68	42
Romania	0	495	0	0	167	0
Serbia	0	344	0	0	0	0
Kazakhstan	0	432	64	0	124	10
Moldova	0	279	52	0	107	7
Bosnia and Herzegovina	0	325	13	0	177	11
Azerbaijan	0	334	23	0	50	1
FYR Macedonia	0	331	5	0	157	2
Armenia	0	243	116	0	70	43
Kyrgyz Republic	0	169	55	0	26	4
Mongolia	0	206	128	0	115	57
Estonia	0	250	0	0	126	0
Czech Republic	0	70	160	0	21	52
Hungary	0	253	2	0	96	1
Latvia	0	240	0	0	129	0
Lithuania	0	147	106	0	69	47
Slovak Republic	0	239	9	0	75	0
Slovenia	0	130	106	0	87	77
Bulgaria	0	268	0	0	86	0
Croatia	44	51	45	26	33	24
Montenegro	0	88	26	0	46	5
Total	**166**	**8,683**	**1,773**	**71**	**2861**	**471**

Appendix 3.4. - Type of collateral – BEEPS

This table provides an overview of the type of assets provided to collateralize the loan. The table shows the answers to the survey question: "What type pf collateral was required?"

	Do Not Know		Yes		No	
	#	%	#	%	#	%
Land, buildings under ownership of	51	1.8	1,776	62.76	1,003	35.44
Machinery and equipment including	72	2.54	1,073	37.92	1,685	59.54
Accounts receivable and inventories	98	3.46	485	17.14	2,247	79.40
Personal assets of owner (e.g., house)	84	2.97	738	26.08	2,008	70.95
Other forms of collateral not included in the	119	4.20	383	13.53	2,328	82.26

Appendix 3.5 -Correlation matrix

This table provides the pairwise correlation matrix for the independent variables. [a,b,c] Denotes rho statistically significant at the 1% level, 5% level, and 10% level, respectively.

		1	2	3	4	5	6	7	8
Age	**1**	1							
Size	**2**	0.2318[a]	1						
Experience	**3**	0.2262[a]	0.0549[b]	1					
Ownership	**4**	-0.124[a]	-0.1383[a]	-0.1293[a]	1				
Overdue	**5**	0.0398[b]	-0.0306[c]	0.0052	-0.01	1			
Crime	**6**	0.037[b]	0.1038[a]	-0.0278	-0.0132	0.0101	1		
Quality	**7**	0.1316[a]	0.2844[a]	0.0841[a]	-0.1016[a]	-0.008	-0.0111	1	
TradeCredit	**8**	0.0746[a]	0.0428[b]	0.0795[a]	-0.0184	-0.0148	0.0347[c]	0.0887[a]	1
FinancialOpenness	**9**	0.0917[a]	0.1148[a]	0.1145[a]	-0.0591[a]	-0.0646[a]	-0.0105	0.1053[a]	0.0338 [c]
Ln(LoanSize + 1)	**10**	0.1513[a]	0.4555	0.0412	-0.0511[a]	-0.0532[a]	0.1227[a]	0.2512[a]	0.1131[a]
City	**11**	0.0204	0.0298[c]	0.0822	-0.1002[a]	0.015	-0.0147	0.092[a]	-0.0547[a]
Cr	**12**	-0.1076[a]	-0.0739[a]	-0.1971[a]	0.2011[a]	0.0053	0.0828[a]	-0.0911[a]	0.0545[a]
Brpc	**13**	0.0424	-0.0169	-0.0161	0.071[a]	-0.0058	0.0881[a]	0.0272	0.0552[a]
CreditInfo	**14**	0.0086	0.0623[a]	0.0664[a]	-0.0439[b]	-0.032[c]	0.0258	0.09[a]	0.0193
LegalRights	**15**	-0.0415[b]	-0.0284[c]	-0.0497[a]	0.023	-0.0295	0.0337[b]	0.0044	0.084[a]
Ln(GDPpcppp+1)	**16**	0.1562[a]	0.1082[a]	0.1291[a]	-0.0837[a]	-0.0253	0.1313[a]	0.1484[a]	0.3713[a]
		9	10	11	12	13	14	15	16
FinancialOpenness	**9**	1							
Ln(LoanSize + 1)	**10**	0.132a	1						
City	**11**	0.0887[a]	0.0262	1					
Cr	**12**	-0.2372[a]	-0.0089	-0.1917[a]	1				
Brpc	**13**	-0.0877[a]	0.0643[a]	-0.078[a]	0.0592[a]	1			
CreditInfo	**14**	0.0137	0.0421[b]	0.0196	-0.2055[a]	0.1094[a]	1		
LegalRights	**15**	-0.0252	0.0356	-0.0836[a]	0.2231[a]	-0.0735[a]	-0.2931[a]	1	
Ln(GDPpcppp+1)	**16**	0.1912[a]	0.2024[a]	-0.1231[a]	-0.2905[a]	0.1969[a]	0.3759[a]	-0.0822a	1

CHAPTER 4
Evidence of the discouraged demand for credit in less developed countries

Abstract

Using the fourth-round database of the Business Environment and Enterprise Performance Survey (2008/09 BEEPS), we examine the determinants of the credit discouragement in less developed countries in Eastern Europe and Central Asia. The results show that whereas firms' opaqueness, demographic factors, and distance between lender and borrower better explain the discouragement due to tough loan price and/or loan application procedures, firm risk and banking concentration explain the incidence of discouraged borrowers due to the fear of rationing. Innovator status, the legal protection of creditors and lenders in the event of default, and the coverage of information sharing instruments help explain discouragement in a transversal way.

Keywords: Discouraged borrowers; less developed countries; self-selection; SMEs

JEL classification: *G14; G15; G21*

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Resumo

Usando a base de dados do quarto *Business Environment and Enterprise Performance Survey* (2008/09 BEEPS), este estudo examina os determinantes do desencorajamento de crédito em países menos desenvolvidos da Europa Oriental e da Ásia Central. Os resultados mostram que, enquanto a rastreabilidade acerca da qualidade das empresas, os fatores demográficos, e a distância entre credor e mutuário explicam melhor o desencorajamento motivado pelo preço do empréstimo e/ou pela complexidade dos procedimentos de acesso ao crédito, o risco da empresa e concentração bancária explicam a incidência do desencorajamento de mutuários devido ao medo de racionamento do crédito. O estatuto inovador, a proteção jurídica dos credores e mutuários em caso de incumprimento, e a cobertura dos instrumentos de partilha de informação ajudam a explicar o desencorajamento de uma forma transversal.

Palavras-Chave: Mutuários desencorajados; Países menos desenvolvidos; PMEs
Classificação *JEL*: G14; G15; G21

4.1. Introduction

During the past decades, there has been increased interest from policy makers, regulators, and practitioners in the functioning of the financial markets that fund small businesses. In particular, there is concern that small businesses may face difficulties in accessing formal financing due to asymmetric information and risky nature. Much of this concern stems from the recognition that small businesses serve as an engine of economic growth and innovation. In most countries small businesses employ a large percentage of the private sector workforce, which increases the importance of their needs to policy makers and explains why governments worldwide have prompted supply-side initiatives such as loan guarantee schemes and seed capital funds (e.g. Levenson and Willard, 2000; Cressy, 2002). Considering the economic and social importance of the small business sector, questions about the particular nature of the private debt of small business finance are at the core of the research agenda (Ortiz-Molina and Penas, 2008).

Bank loans are the most widely used form of small and medium-sized enterprises (SMEs) financing (Berger and Udell, 1995), though these exchange relationships often suffer from market imperfections, such as information asymmetries. Information asymmetries occur because lenders lack reliable information regarding the default risk of the loan applicants. The mostly unlisted small businesses also tend to lack audited financial statements, so they have difficulties signalling their quality to financial institutions. Such information asymmetries can be so severe that they eventually lead to credit rationing (Stiglitz and Weiss, 1981). Lenders may reject part of firms' loan amount requests (i.e. type I rationing), simply turn down the credit (i.e. type II rationing; Steijvers and Voordeckers, 2009), or offer a menu of contracts that acts as a self-selection mechanism to distinguish good from bad borrowers (Bester, 1985). Alternatively, some firms do not apply for loans, even when they seek capital. These firms are the so-called 'discouraged borrowers'. The literature defines a discouraged borrower as 'a good firm requiring finance that chooses not to apply to the bank because it feels its application will be rejected' (Kon and Storey, 2003:47).

According to Kon and Storey (2003), one of the most important determinants of 'discouragement' is the unobservable quality of the borrower, which is, in principle, applicable to developed and less developed economies. Nevertheless, the majority of empirical studies are concentrated in developed economies (e.g. Chakravarty and Yilmazer, 2009, and Han et al., 2009, for the United States; Popov and Udell, 2010; Brown et al., 2011; and Popov and Ongena, 2011, for European markets) rather than in less developed countries, where the discouragement seems to be greater (e.g. Chakravarty and Xiang, 2013; Cole and Dietrich, 2012). These less developed countries, especially those in Eastern Europe and Central Asia, are a relevant sample to study because, since 2005, they experienced both strong credit market developments and considerable institutional changes, including the development of information sharing systems.

Historically, many reforms have been prompted by recessions or financial crises. The economies in Eastern Europe and Central Asia, the regions most affected by recent crises, have

been the most active reformers in the world, partly due to easier access to finance, which became more difficult after 2008. Since 2005, close to two-thirds of new credit bureaus were created by these economies and the coverage of credit information instruments increased dramatically, including an improvement in the lending environment by establishing centralized pledged registries and/or by improving the position of creditors in bankruptcy procedures (Doing Business Report [DBR], 2010). Private sector credit in less developed countries in this region climbed from 24.2% of the gross domestic product in 2005 to 46.5% at the end of 2009. The quality of lending, however, worsened considerably, with the ratio of non-performing loans to total gross loans in banks' portfolios rising from 3.3% in 2005 to 7.2% at the end of 2009[46]. Hence, we specifically examine the determinants of discouragement in less developed countries in Eastern Europe and Central Asia.

This paper contributes to the literature in two ways. First, we define as discouraged borrowers those borrowers who need banking credit but do not apply due to fear of being rejected/rationed and by tough explicit/implicit loan price or tough loan application procedures. Based on this definition, we capture several differences predicting the probability of being discouraged between discouragement types, extending knowledge on discouraged borrowers in loan dynamics. Second, we examine the conditions under which both high- and low-type discouraged borrowers exist in less developed countries. In these countries, application costs and screening errors, which lie at the heart of the discouragement concept, are, in principle, higher than in other banking marketplaces. Hence, based on a country-level analysis, this study explicitly measures the impact on the probability of being discouraged resulting from changes in the depth and coverage of public and private information sharing instruments. Additionally, we control the impact of the strength of the legal rights index in this probability, including improvements in the legal environment for secure lending, for example, by establishing centralized pledge registers or improving the position of creditors in bankruptcy procedures.

We use the fourth-round database of the Business Environment and Enterprise Performance Survey (2008/09 BEEPS), conducted from 2007 to 2009, which covers approximately 11,800 enterprises in 29 countries, including firms in both rural areas and large cities. Our data set comprises 10,571 SMEs with coherent information regarding discouragement status, including 2,207 firms that did not apply for loans during the last fiscal year although they needed them (i.e. discouraged borrowers), 4,084 firms that did not apply for loans because they did not need them (i.e. non-applicants), and 4,280 firms that applied for loans in the last fiscal year (i.e. loan applicants).[47] This data set covers the most recent contextual changes faced by several developed countries, such as the deterioration in access to finance, crime, or corruption, that may influence the number of discouraged borrowers.

[46] Public data available at the "World Bank Data Indicators"

[47] Among those firms, 16.17% (692) had their loan application rejected by lenders and 83.83% (3,588) of the loans requested were approved.

The results show that, whereas firms' opaqueness, demographic factors, and distance between lender and borrower better explain the discouragement due to tough loan prices and/or loan application procedures, firm risk and banking concentration explain the incidence of discouraged borrowers due to the fear of rationing. Innovator status, the legal protection of creditors and lenders in the event of default, and the coverage of information sharing instruments help to explain the discouragement in a transversal way.

The organization of this paper is as follows. Section 4.2 reviews the theoretical and empirical literature on discouraged borrowers. Section 4.3 describes the data, variables, and method. Section 4.4 discusses the empirical results. Section 4.5 presents the robustness test and Section 4.6 concludes the paper.

4.2. Empirical and theoretical background literature

Traditionally, academic studies on small business finance have concentrated much of their attention on firms that apply for funding and, specifically, on the problem of credit rationing (e.g. Stiglitz and Weiss, 1981; Bester, 1985; Chan and Kanatas, 1985; Besanko and Thakor, 1987; Bigsten et al., 2003). However, they often indicate low rates of loan rejection (e.g. Cosh and Hughes, 2003; Fraser, 2004) and it appears entirely plausible that the great majority of these firms were not creditworthy (Freel et al., 2012). For example, Levenson and Willard (2000) for the United States[48] and Freel et al. (2012) for the United Kingdom[49] find that the percentage of small businesses discouraged from applying for a bank loan is (almost) twice as high as the rate of rejected loans. Given their significant numbers in the population, discouraged borrowers cannot be thought of as mere random samples; therefore, they cannot be excluded from any formal analysis of the determinants of availability and/or the cost of capital (Chakravarty and Yilmazer, 2009). Hence, the discouragement may be a relevant phenomenon, even for firms that do not apply for credit, if the prospects for acceptance discourage firms that do not reach the stage where their loan applications might be accepted (Levenson and Willard, 2000). This is the problem of credit-constrained borrowers, which goes beyond the type I or II rationing problem. These borrowers are so-called discouraged borrowers.

Cavalluzzo et al. (2002) define a discouraged borrower as a business owner who avoids applying for credit for fear of being rejected, thus labelling the process as a 'prescreening and self-selection issue'.[50] Jappeli (1990) argues that omitting this group of borrowers could lead to biased estimates of the probability of borrowers being credit constrained, since the self-

[48] The authors used data provided by the 1988–1989 United States National Survey of Small Business Finance (US NSSBF).

[49] Their study was conducted based on data provided by the biannual survey of small business attitudes and opinions undertaken on behalf of the Federation of Small Business in the United Kingdom.

[50] In the labour market, a discouraged worker is defined as an individual who wants a job and is available for work but does not look for a job because he or she anticipates not getting one (e.g. Kodryzycki, 2000; Benati, 2001).

selection of applicants could induce intermediaries to adopt screening rules that differ from those that would prevail if discouraged borrowers were also to apply. Hence, if the extent of discouragement is indeed great or significantly larger than the extent of rejection, then addressing the fears of discouraged borrowers may be a more appropriate means of intervention than traditional supply-side mechanisms (Freel et al., 2012).

Studying the relevance of this topic, in the context of small business finance, Kon and Storey (2003) provided a heuristic framework modelling the application behavior of firms and loan granting decisions by banks in a pooling equilibrium involving both the discouragement and rejection of loan applications. According to the authors, one of the most important determinants of discouragement is the unobservable quality of the borrower. Ideally, lenders would like to encourage good borrowers and discourage bad borrowers, but they do not know or do not know exactly the borrower's quality due of information asymmetries (Berger and Udell, 1998). Hence, if the loan application is costly and banks possess imperfect screening instruments of loan applicants, good borrowers are discouraged from applying for a bank loan. Therefore, the authors hypothesize that the discouragement depends on three factors: screening errors, the scale of application costs, and the difference in interest rates between banks and other moneylenders.

For example, Diagne (1999)[51] shows that borrowers' decisions to apply for a loan are primarily determined by their expectations of the likely value of the credit limit. Chakravarty and Yilmazer (2009)[52] examine the impact of banking relationships on a small borrower's decision to apply for credit based on the likelihood of loan application acceptance and on the interest rate that the borrower can obtain if the application is approved. Consequently, borrowers with adverse expectations about the credit limit or loan price are self-selected, staying out of the credit markets even though they need a bank loan. This self-selection could also put aside good borrowers who are wrong in their expectations, since they might be able to obtain worthwhile loans at reasonable costs. Such borrowers are defined as 'falsely discouraged' (Diagne, 1999). Han et al. (2009)[53] suggest, however, that discouragement is an efficient self-rationing mechanism, because riskier borrowers are more likely to be discouraged. The authors find that riskier borrowers have a higher probability of discouragement that increases with longer financial relationships. Therefore, imperfect information lies at the heart of the concept of discouraged borrowers, which may depend on the business quality.

Empirically, the quality of small business is measured in several ways, such as by Dun and Bradstreet scores (e.g. Elsas and Krahnen, 2000; Han et al., 2009), by internal banking ratings, and from firms' financial ratios (e.g. Booth and Booth, 2006; Chakraborty and Hu, 2006;

[51] This study specifically addresses the discouragement problem in the household sector in the formal and informal markets in Malawi.

[52] Their study was conducted based on 1993, 1995, 1998, and 2003 data provided by the US NSSBF.

[53] This study was conducted using 1998 data from the US NSSBF.

Menkhoff et al., 2006). Other authors use bankruptcy events (e.g. Cavalluzzo et al., 2002; Jiménez et al., 2006) or overdue tax/utility payments (Hanedar et al., 2014) to measure firm risk. In addition, the attribution of public quality certifications to small enterprises means that banks view such enterprises as less likely to default on loans, influencing the incidence of discouraged borrowers (Kon and Storey, 2003). Firm age and firm size are also frequently used as proxies for firm viability (e.g. Avery et al., 1998). A positive relation between firm age/size and creditworthiness is derived by Jovanovic (1982) and, despite several other authors testing their non-monotonic relation as a proxy for firm risk (e.g. Jensen and McGuckin, 1997), Levenson and Willard (2000) suggest that external financing is directed toward the pool of older/larger firms that have a higher probability of repayment as a whole and relatively low screening costs. Furthermore, as a function of lifecycle, older/larger firms are likely to have a greater need for finance than their younger/smaller counterparts (e.g. Vos et al., 2007). Ceteris paribus, small firms are also likely to be seeking to raise small amounts of funding, which banks may be less willing to provide because they incur proportionately greater costs and hence yield lower profit margins (Treichel and Scott, 2006). Empirically, Cosh and Hughes (2003) show older/larger small businesses submitting more frequent credit applications and obtaining higher success rates. Other authors (e.g. Han et al., 2009; Freel et al., 2012; Chakravarty and Xiang, 2013) find that larger firms are less likely to be discouraged, as well as older firms (Chakravarty and Xiang, 2013).

Because small businesses are mainly non-listed firms, not followed by analysts and lacking audited financial statements, they often have difficulties signalling their qualities to financial institutions (Craig et al., 2007; Freel, 2007; Zambaldi et al., 2011). Moreover, these firms are not always willing to release any information, since it is time-consuming (costly) to do so (Berger and Frame, 2007). Hence, the acquisition of reliable information from small, opaque borrowers is a concern to lenders (Ang, 1991). Therefore, some authors (e.g. Godlewski and Weill, 2011; Chakravarty and Xiang, 2013) use businesses' annual financial statements by an external auditor to address the quality and transparency of information. Since the greater quality and availability of a firm's financial information reduce informational asymmetries, such public statements are expected to decrease the likelihood of being discouraged. Voordeckers and Steijvers (2006) use business trade credit ratios and Peterson and Rajan (1994) business cards and credit lines to measure the information transparency of a business. Trade credit can play an important role in the credit decision process of banks, because suppliers have private information about their customers (Biais and Gollier, 1997), which they can convey to the banks (Voordeckers and Steijvers, 2006; Gama and Van Auken, 2014). Peterson and Rajan (1994) and Han et al. (2009) argue that business credit card holders and users of lines of credit tend to be less informationally opaque because their creditworthiness is assessed in the external credit market.

Kon and Storey (2003) suggest that screening errors and application costs arising from information asymmetries are the main determinants of discouragement. Hence, one could argue that the discouraged are a function of pre-existing relationships with banks. According

to Han et al. (2009), banks can better collect information on borrowers by monitoring transactions on their current accounts, whereas this ability is limited among other types of lenders. Hence, seeking funding from banks, firms are likely to face lower application costs and lenders to commit lower screening errors. Since reliable information on small businesses is rare and costly, relationship lending is often considered the most appropriate lending technique for banks to collect soft information on small businesses (e.g. Degryse and Van Cayseele 2000; Baas and Schrooten, 2006; Zambaldi et al., 2011). Relationship lending should improve a bank's knowledge of the characteristics of both the firm and its projects (Boot and Thakor, 1994). The lender also learns more about the hidden attributes and actions of the borrower, thus reducing information asymmetries (Jiménez et al., 2006). This knowledge should lead to improving the availability (Petersen and Rajan, 1994) and reducing costs (Berger and Udell, 1995) of small business financing. Similarly, closer relationships should translate into ameliorated perceptions regarding the availability of debt and its price, contributing to mitigating the incidence of the discouragement (e.g. Chakravarty and Yilmazer, 2009; Chakravarty and Xiang, 2013). However, when the relationship is exclusive, a lender can take advantage of its monopolist position and require high borrowing costs, exerting its information monopoly and its ex post superior bargaining power, as in the so-called hold-up problem (Sharpe, 1991; Detragiache et al., 2000). Hence, multiple borrowing relationships provide the opportunity for competition between finance providers and avoid the possibility of rent extraction. This strand of literature suggests that lower borrowing concentration reduces borrowing costs because a sole lender can charge a premium by 'locking in' a small business (Degryse and Van Cayseele, 2000). Empirically, Han et al. (2009) and Chakravarty and Xiang (2013) find that the number of sources of financial services is negatively related with the incidence of discouragement. However, Cavalluzzo et al. (2002) report an opposite result.

Another important determinant of discouragement is the physical distance between the bank and the small business. Despite contradictory results provided by the empirical literature in regard to the influence of physical distance on lending terms (e.g. Hainz et al., 2003; Inderst and Mueller, 2007; Jiménez et al., 2009; Hanedar et al., 2014), it seems consensual that a non-local lender has an unfair disadvantage compared to local lenders regarding the collection of soft information on borrowers (Jiménez et al., 2009). Hence, the costs of gathering and processing site-specific soft information about potential borrowers increase with distance (Petersen and Rajan, 2002). Likewise, we anticipate that the application costs should increase with distance, which could suggest that businesses located closer to the bank have a lower tendency of becoming a discouraged borrower.[54] Additionally, some authors (e.g. Cavalluzzo et al., 2002;[55] Han et al., 2009; Chakravarty and Xiang, 2013) assume that the discouragement is

[54] However, foreign banks may be more reluctant than domestic banks to lend to opaque firms (i.e. small and young firms) but poach depositors and safe borrowers from domestic financial intermediaries while remaining unwilling to lend to local entrepreneurial firms (Detragiache et al., 2008).

[55] This study was conducted using 1993 data from the US NSSBF.

affected by the degree of concentration in local banking markets. According to Brown et al. (2011), the degree of difficulty in accessing a loan could increase with the level of bank market concentration. Hence, we could expect banking concentration to be positively related to discouragement.

While it is consensual that increasing the informational flows between small businesses and lenders decreases screening errors and application costs, there is no empirical evidence of these effects on the likelihood of being discouraged. The theory suggests that sharing information between banks and borrowers increases the volume of lending (e.g. Pagano and Jappeli, 1993; Brown et al., 2011). Empirically, some authors show that the depth of information sharing instruments extends the credit to new, previously unfunded firms (e.g. Hanedar et al., 2014) and its coverage impacts the explicit and/or implicit loan price (e.g. Djankov et al., 2007; Qian and Strahan, 2007; Godlewski and Weill, 2011). Accordingly, if information sharing instruments are important in facilitating access to finance, particularly for small businesses (Djankov et al., 2007), we could expect that they increase the confidence of borrowers in applying for bank loans (Brown et al., 2011), reducing the incidence of discouraged borrowers.

Finally, recent literature shows that credit constraints may depend on entrepreneurial and demographic characteristics. For example, there is a large literature on the extent to which female-owned business are discriminated against in credit markets, especially in the small business context (e.g. Cavalluzzo et al., 2002; Vos et al., 2007). Likewise, some authors (e.g. Cavalluzzo et al., 2002; Han et al., 2009, Storey, 2004) find that the incidence of discouragement varies with owner/manager gender. Similarly, some studies explore the link between entrepreneurial experience and credit constraints (e.g. Cavalluzzo et al., 2002; Han et al., 2009). Westhead et al. (2005) suggest that portfolio entrepreneurs are characterized by their more diverse experiences in comparison to serial or novice peers. Hence, we anticipate that entrepreneurial experience likely decreases the incidence of discouragement.

In models of entrepreneurial finance prevailing in the small business context (Hart and Oulton, 1999), ownership structure is very important in predicting credit conditions. For example, traditional agency models predict that concentrated ownership and owner-management firms will lead to a minimum (or even zero) level of agency costs between owners and managers (Jensen and Meckling, 1976; Fama and Jensen, 1983). This model assumes that concentrated ownership is motivated and mainly concerned with the firm's long-term survival (Ang, 1992), which promotes the alignment of interests between lenders and firms, inducing a reduction of risk (Diamond, 1989). Some studies, however, contest the traditional agency view, arguing that agency costs in concentrated ownership could be even higher than in firms with fractional ownership due to possible negative effects of self-control and parental altruism on management efficiency (e.g. Schulze et al., 2001; Schulze et al., 2003). In line with this strand of literature, Cavalluzzo et al. (2002) and Han et al. (2009) find that family-owned firms have a higher probability of being discouraged. Finally, some authors extend the study of the relationship between entrepreneurial activity and credit constraints to dimensions such as

innovation (e.g. Freel, 2007; Freel et al., 2012) and the export profile of a business (e.g. Brown et al., 2011), concerned with demonstrating that differences in funding outcomes are attributable to the specific characteristic in question, rather than some other source of firm-level heterogeneity.

In summary, screening errors, application costs, and consequently the prevalence of discouragement are likely to be associated with the profile of the entrepreneur/business, the quality of the borrower, as well as the nature of relationship lending and the location of the business. Because our focus is to examine discouragement across a pool of small businesses operating in less developed countries, we expect that the scale of discouragement also depends on country-specific characteristics, such as the banking sector, credit environment, and macroeconomic characteristics.

4.3. Data, variables, and method

4.3.1. Data

The majority of studies around the topic of discouraged borrowers are undertaken within a single country with a relatively sophisticated small business financing marketplace (e.g. Levenson and Willard, 2000; Chakravarty and Yilmazer, 2009; Han et al., 2009; Freel et al., 2012, for the United States; Brown et al., 2011, for European markets), providing results that should not be extrapolated to less developed financial markets, where credit application costs and screening errors are greatly amplified (Kon and Storey 2003).

Contrary to previous studies, this paper investigates the problem of discouragement in less developed countries using a cross-country approach. Less developed countries, especially those in Eastern Europe and Central Asia, are a relevant sample to study because, since 2005, they experienced both strong credit market development and considerable institutional changes, including the development of information sharing systems. Hence, we use the fourth-round database of the 2008/09 BEEPS, conducted from 2007 to 2009, which covers approximately 11,800 enterprises in 29 countries, including firms in both rural areas and large cities. This survey examines the quality of the business environment as determined by a wide range of interactions between firms and the state that serve as input to the policy dialogue of countries in Central and Eastern Europe. The BEEPS is a joint initiative of the European Bank for Reconstruction and Development (EBRD) and the World Bank Group. The survey was first undertaken on behalf of the EBRD and the World Bank in 1999–2000, when it was administered to approximately 4,000 enterprises in 26 countries of Eastern Europe and Central Asia to assess the environment for private enterprise and business development. In the second round, the BEEPS was administered to approximately 6,500 enterprises in 27 countries in 2002. In the third round, in 2005, this survey included approximately 9,500 enterprises in 28 countries.

The 2008/09 BEEPS survey underwent several improvements from the previous round in 2005, offering numerous advantages compared with previous rounds. First, the new BEEPS allows for greater comparability of Europe and Central Asia countries with countries in other

regions. Second, this survey was restructured to make it compatible with the Enterprise Surveys of the World Bank's Enterprise Analysis Unit in order to collect feedback from enterprises in EBRD countries of operation on the state of the private sector, as well as to help in building a panel of enterprise data. Hence, contrary to previous rounds, this data set makes it possible to track changes in the business environment over time. Finally, this database covers the most recent contextual changes faced by several developed countries, such as the deterioration of access to finance, crime, or corruption, that can influence the number of discouraged borrowers.

To the best of our knowledge, only Brown et al. (2011) use similar data set (i.e. the third round of the BEEPS, 2005) to compare access to bank credit for firms in Eastern Europe and Western European countries, providing fresh evidence regarding the determinants of credit applying and borrowing discouragement. However, unlike our study, the authors adopt the firms which 'do not need bank loans' as the base outcome to test the determinants of discouragement, testing the binomial between non-applicants that simply do not need loans and non-applicants seeking loans. This approach hurts Jappeli's (1990) concept of discouraged borrowers and fails to provide guidelines for practitioners and policy makers about the incentives that should be tested and implemented to lead firms that actually need loans to effectively apply for them.[56]

To complement the BEEPS information, we also use the Bankscope database and indicators provided by the World Bank (i.e. World Bank Data Indicators [WBDI] and Doing Business Report [DBR]) as well as by the Global Financial Development Database (GFDD).

To reconcile the definition of SME with both the BEEPS definition and Organisation for Economic Co-operation and Development [OECD] conventions, we define SMEs to be firms with a maximum of 250 full-time employees.[57] Thus, the data set comprises 10,571 SMEs[58] with coherent information regarding discouragement status, including 2,207 (20.88%) firms that did not apply for loans during the last fiscal years although they needed them (i.e. discouraged borrowers), 4,084 (38.63%) firms that did not apply for loans because they did not need them (i.e. non-applicants), and 4,280 (40.49%) firms that applied for loans in the last fiscal year (i.e.

[56] Furthermore, in their study, Brown et al. (2011) aggregate small and larger firms, which may bias the results, considering that larger firms have easier access to other sources of finance, such as the stock market.

[57] The BEEPS definitions of enterprise sizes are as follows: small firms have two to 49 employees, medium firms have 50 to 249 employees, and large firms have 250 to 9,999 employees.

[58] The distribution of SMEs by country is as follows: Albania (1.52%), Armenia (3.35%), Azerbaijan (3.33%), Belarus (2.14%), Bosnia and Herzegovina (3.10%), Bulgaria (2.44%), Croatia (1.27%), Czech Republic (2.10%), Estonia (2.33%), Macedonia (3.15%), Georgia (3.22%), Hungary (2.41%), Kazakhstan (4.64%), Kosovo (2.35%), Kyrgyz Republic (2.10%), Latvia (2.26%), Lithuania (2.33%), Moldova (3.07%), Mongolia (3.15%), Montenegro (1.01%), Poland (4.33%), Romania (4.29%), Russia (9.75%), Serbia (3.10%), Slovak Republic (2.31%), Slovenia (2.22%), Tajikistan (3.21%), Turkey (9.33%), Ukraine (7.03%), and Uzbekistan (3.16%).

loan applicants).[59] See Appendix 4.1 for the definition of discouraged borrowers.[60] We find that the prevalence of discouraged borrowers is almost three times higher than that of rejected loans, representing an increase of 50% compared to the results of Levenson and Willard (2000) and Freel et al. (2012). Furthermore, the ratio of discouraged borrowers to loan seekers in our data set is 34%, which is higher (14.6%) than that reported by Freel et al. (2012). This result shows that the discouragement is a problematic issue in SME financing in less developed countries.

Since our goal is to analyse the problem of discouragement, we exclude from the analysis those firms that did not state a desire for credit (i.e. firms that indicated they did not apply for a loan because they had no need for credit). Thus, our final data set comprises 6,487 SMEs stating a desire for credit (i.e. loans seekers) among loan applicants and discouraged borrowers.

4.3.2. Variables

To examine the determinants of discouragement, we use the variable *DBorrower* as a dependent variable that equals one if the firm was discouraged from applying external funding and zero otherwise (i.e. if the firm applied for credit).[61] The independent variables are divided into six groups: characteristics of the business and entrepreneur/manager, the quality of the borrower, the nature of the relationship lending, application costs, characteristics of the banking sector, and characteristics of the credit environment and macroeconomic variables. These variables closely follow the literature on the credit constraints and financing obstacles of SMEs (e.g. Cavalluzzo et al., 2002; Beck et al., 2005; Chakravarty and Yilmazer, 2009). See Table 4.1. for the definitions of the variables.

[59] Among these firms, 692 (16.17%) had their loan application rejected and 3,588 (83.83%) had their loans approved.

[60] This study focuses on the responses to three questions of the BEEPS survey:

i) Referring to the last fiscal year, did this establishment apply for any loan or line of credit? *[yes; no]*

ii) What was the main reason this establishment did not apply for any loan or line of credit? *[no need for a loan; list of discouraging factors]*

iii) In the last fiscal year, did this establishment apply for any new loan or line of credit that was rejected? *[yes, no]*

[61] Discouraging factors are that the application procedures for loans are complex, interest rates are not favourable, collateral requirements are too high, the size of the loan and maturity are insufficient, informational payments are necessary to obtain bank loans, did not think it would be approved, and others (based on Chakravarty and Xiang, 2013).

Table 4.1. Variable definitions and sources

This table presents the variable definitions and sources of the study data. BEEPS stands for the Business Environment and Enterprise Performance Survey (2009); WBDI stands for the World Bank Data Indicators; and EBRD stands for the European Bank for Reconstruction and Development. The industry classification follows ISIC classification, revision 3.1.

Variable	Definition	Source
Identifying discouraged borrowers		
LSeeker	Demands for bank loans (0,1)	BEEPS
DBorrower	Discouraged borrower (0,1)	BEEPS
Characteristics of the business and entrepreneur/manager		
FAge	Age of the firm, measured in years	
FSize	Size of the firm, measured by the number of full-time employees	BEEPS
TradeCredit	Share of the firm's purchases of material inputs and services paid on	BEEPS
ExtAud	Firm has its annual financial statements checked and certified by an	BEEPS
Ownership	Share of the firm that is owned by the principal owner (%)	BEEPS
M_Woman	Top manager is a woman (0,1)	BEEPS
M_Exp	Top manager's experience, measured by the number of years of	BEEPS
Innovation	Firm introduced new products or services in the last three years (0,1)	BEEPS
Export	The sales that goes directly to exportation (%)	BEEPS
Quality of borrower		
Overdue	Firm has utility and/or tax payments that are overdue by more than 90 days (0,1)	BEEPS
Qualcert	Firm has an internationally recognized quality certification, such as ISO 9000 or ISO 9002 (0,1)	BEEPS
Nature of the relationship lending		
Overdraft	Firm has an overdraft facility (0,1)	
Application Costs		
City	Firm is located in the capital or in a city with a population over 1 million (0,1)	BEEPS
Characteristics of the banking sector		
Cr	Share of the assets of the three largest banks in the whole banking system's assets (%)	BANKSCOPE
Foreign	Share of the assets of foreign banks in the entire banking system's assets (%)	WBDI
Characteristics of the credit environment		
LegalRights	Strength of legal rights index (0 = weak to 12 = strong)	WBDI
CreditInfo	Depth of credit information index (0 = weak to 6 = strong)	DBR
Privcbr	Number of firms listed by a private credit bureau with current information on repayment history, unpaid debts, or credit outstanding (% of the adult population)	WBDI
Pubcreg	Number of firms listed by a public credit registry with current information on repayment history, unpaid debts, or credit outstanding (% of the adult population)	WBDI
Macroeconomic conditions		
GDPpcppp	Gross domestic product per capita based on purchasing power parity (constant 2005 international dollars)	WBDI
Loan application:		
Approved	Loan application (during the last fiscal year) was approved	BEEPS
Rejected	Loan application (during the last fiscal year) was rejected	BEEPS
Control Variables		
IND_GroupD	Firm operating in the sector of group D (i.e., manufacturing sector) (0,1)	BEEPS
IND_GroupF	Firm operating in the sector of group F (i.e., construction sector) (0,1)	BEEPS
IND_GroupGH	Firm operating in the sector of group G or H (i.e., service sector) (0,1)	BEEPS
IND_GroupI	Firm operating in the sector of group I (i.e., transport and storage sector) (0,1)	BEEPS
IND_GroupK	Firm operating in the sub-sector 72 of group K (i.e., informational technologies) (0,1)	BEEPS

Characteristics of the business and entrepreneur/manager include *Fage*, which is the firm's age measured in years (e.g. Freel et al., 2012); *FSize*, which is the firm size measured by the number of full-time employees (e.g. Han et al., 2009; Chakravarty and Xiang, 2013); *TradeCredit* (%), which is the share of a firm's purchases of material inputs and services paid on credit (e.g. Voordeckers and Steijvers, 2006); *ExtAud,* a binary variable that equals one if the firm has its annual financial statements checked and certified by an external auditor and zero otherwise (e.g. Chakravarty and Xiang, 2013); *Ownership* (%), the share of the firm that is owned by the principal owner (e.g. Cavalluzzo et al., 2012); *M_Woman,* a binary variable that equals one if the firm's top manager is female and zero otherwise (e.g. Han et al., 2009); *M_Exp,* the experience of the firm's top manager, measured by the number of years working in the sector[62] (e.g. Cavalluzzo et al., 2002); *Innovation,* a binary variable that equals one if the firm introduced new products or services in the last three years and zero otherwise (e.g. Freel, 2007); and *Export,* the percentage of sales (%) that goes directly to exportation (e.g. Brown et al., 2011).

The quality of the borrower is measured by the variables *Overdue* and *Qualcert,* where *Overdue* is a binary variable that equals one if the firm has utility payments that are overdue by more than 90 days and zero otherwise (e.g. Hanedar et al., 2014) and *Qualcert* is a binary variable that equals one if the firm has an internationally recognized quality certification, such as ISO 9000 or ISO 9002, and zero otherwise (e.g. Hanedar et al., 2014).

To measure the nature of the relationship lending, due to data limitations we employ only one variable, *Overdrafts,* which is a binary variable that equals one if the business has an overdraft facility and zero otherwise. We expect that banks better screen firms with contracted services/products such as overdraft facilities. Unfortunately, our data cannot help us to extend this analysis to the effect of the exclusive relation or the length of the relationship lending on the incidence of discouraged borrowers. The application costs are measured by the variable *City,* which is a binary variable that equals one if the firm is located in the capital or in a city with a population over 1 million and zero otherwise (e.g. Hanedar et al., 2014).[63]

To measure the characteristics of the banking sector, we employ variables related to market concentration. Hence, we define the variable *Cr,* which measures the share (%) of the assets of the three largest banks in the entire banking system's assets (e.g. Brown et al., 2011)

[62] Han et al. (2009) use the owner's information (e.g. owner's age, owner's college degree, and the owner's experience in the business). However, our survey does not report such information for the firm owner. Hence, we use the information for the firm's top manager. We should note that, usually, for small firms, the top manager is also the owner of the firm.

[63] Our data set does not report information about the distance between the firm and the primary institution. Alternatively, we use the variable *City* based on the assumption that big cities have a higher density of banks' branches, reducing the distance between borrowers and lenders, which increases the share of soft information. New informational technologies (Han, 2008) mainly directed at the treatment of hard information should also reduce application costs, even though we note that the dissemination of these technologies is more moderate in less developed countries.

and the variable *Foreign,* which corresponds to the share (%) of the assets of foreign banks in the whole banking system's assets.[64]

The characteristics of the credit environment include the variable *LegalRights*, a categorical variable that measure the strength of legal rights protecting creditors and borrowers, ranging from 0 (weak) to 12 (strong). We also include the depth of information sharing instruments, measured by *CreditInfo,* which is a categorical variable ranging from 0 (weak) to 6 (strong) (e.g. Hanedar et al., 2014), as well as their coverage, measured by *Privcbr,* which is the number of firms listed by a private credit bureau with current information on repayment history, unpaid debts, or credit outstanding as a percentage of the adult population, and by *Pubcreg,* the number of firms listed by a public credit registry with current information on repayment history, unpaid debts, or credit outstanding as a percentage of the adult population (e.g. Qian and Strahan, 2007).

Macroeconomic conditions are measured by *GDPpcppp,* that is, the gross domestic product per capita based on purchasing power parity (constant 2005 international dollars), which proxies for economic development (e.g. Godlewski and Weill., 2011). We include four industry dummies as control variables: *IND_GroupD* is a dummy variable that takes the value one if the firm sector is part of group D (i.e. the manufacturing sector);[65] *IND_GroupF* is a dummy variable that takes the value one if the firm sector is part of group F (i.e. the construction sector); *IND_GroupGH* is a dummy variable that takes the value one if the firm sector is part of group G or H (i.e. the service sector); *IND_GroupI* is a dummy variable that takes the value one if the firm sector is part of group I (i.e. the transport and storage sector); *IND_GroupK* is a dummy variable that takes the value one if the firm belongs to sub-sector 72 of group K (i.e. informational technologies) and zero otherwise. Appendix 4.2. reports the correlation matrix.

4.3.3. Method

To examine the conditions under which borrowers are discouraged from applying for a loan, this paper uses a binary probit model[66] (e.g. Freel et al., 2012) expressed as follows:

$$DBorrower_i = \alpha + \beta_1 \text{ Characteristics of the business and entrepreneur/manager}_i + \beta_2 \text{ Quality of borrower}_i + \beta_3 \text{ Nature of the relationship lending}_i + \beta_4 \text{ Application costs}_i + \beta_5$$

[64] During a period of financial crisis, credit constraints are expected to vary between national banks and foreign banks more exposed to the risk of contagion. Furthermore, a foreign-owned bank can be a distant lender. We thank the panel of the Fifth International Conference of the Financial Engineering and Banking Society for these comments.

[65] According to the International Standard Industrial Classification (ISIC), revision 3.1.

[66] According to the authors, the loss of nuance from using the binary probit model is relatively minor compared to using the logit model. For an overview regarding the logit versus the probit model, see Gujarati (1995).

Characteristics of the banking sector$_i$ + β_5 Characteristics of the credit environment$_i$ + β_5 Macroeconomic variables$_i$ + $\varepsilon_{i,}$

(Eq. 1)

where $\varepsilon_i \sim N(0, \sigma^2)$ for $i = 1,\ldots, N$.

The variable *DBorrower*$_{i,}$ is a binary variable that equals one if firm *i* was discouraged from applying for external funding and zero otherwise; β_i is the vector of parameters of the independent variables *X* to be estimated, and ε is the error term.

4.4. Results

4.4.1. Descriptive statistics

Table 4.2. reports the descriptive statistics. This table shows that more than half of the SMEs included in our data set are loans seekers (i.e. 6,487). Among these firms, 4,280 (66%) applied for a loan and 2,207 (34%) are classified as discouraged borrowers. On average, loan applicants are relatively young (i.e. 13 years old) and have 50 employees. The typical loan applicant pays more than 58% of its material inputs and services on credit and 46% are audited by an external entity. The large majority of firm shares belongs to a single person (i.e. the mean value of ownership concentration is 78%) and is managed by a man (80%) with 16 years of experience in the business. Loan applicants launched at least one innovation in the market in the last three years (56%), particularly oriented to domestic consumption (only 7.8% of outputs were exports), and 72% of these firms did not have a quality certification or were overdue on payments in the last three years (only 9% of loan applicants reported having been overdue on payments). Furthermore, loan seekers usually have overdraft facilities (57%) with a bank. The traditional loan applicant (i.e. 61%) operates in a small city or a rural area and operates in countries with satisfactory indices of legal rights (i.e. 6 out of 12) and depth of information sharing instruments (i.e. 4 out of 6) but with a low coverage level. Public (private) credit bureaus cover only 4% (20%) of the population.

A discouraged borrower is not much younger (i.e. 12 years old) but is smaller (i.e. 34 employees vs. 58 employees for applicants borrowers) and buys less on credit (i.e. 54% of its material inputs and services). Typically, discouraged borrowers are not externally audited (i.e. only 34% were audited). The ownership structure is more highly concentrated (i.e. 81%). Furthermore, the manager is less experienced (i.e. with 15 years). The firms are less innovative (i.e. only a minority of discouraged borrowers launched at least one innovation in the market in the last three years) and have a lower ratio of exportations (i.e. 4.61% vs. 9.44% of applicant borrowers). However, they have a similar incidence of overdue events (i.e. 8%) but a lower incidence of quality certifications (i.e. 16% vs. 28% for applicant borrowers). Additionally, the percentage of these firms with overdraft facilities is lower (i.e. 26% vs. 57% for applicant borrowers). The number of firms working in small cities is higher among discouraged borrowers (i.e. 66%) and the banking concentration is higher (57.40%). Finally, discouraged borrowers

operate in countries with lower indices of legal rights and less depth and lower coverage of information sharing instruments. Applicant borrowers face a rejection rate of 16%.[67]

Table 4.2. Descriptive statistics

This table reports the descriptive statistics of key variables.[a] In the empirical modelling, these variables are transformed into the natural logarithm of the real value plus the unit value.[b] These variables vary across countries.

			SMEs		
Variable	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
LSeeker	10571	0.61	0.49	0	1
DBorrower	6487	0.34	0.47	0	1
Fage[a]	10343	13.09	11.32	0	181
FSize[a]	10480	47.21	55.25	1	250
TradeCredit[a]	6440	60.44	32.34	0	100
ExtAud	10386	0.44	0.50	0	1
Ownership[a]	10040	79.21	26.60	1	100
M_Woman	10495	0.20	0.40	0	1
M_Exp[a]	10274	16.48	10.30	1	75
Innovation	10533	0.53	0.50	0	1
Export[a]	10536	7.46	21.45	0	100
Overdue	10497	0.07	0.26	0	1
Qualcert	10210	0.24	0.43	0	1
Overdrafts	9834	0.43	0.50	0	1
City	10571	0.40	0.49	0	1
Cr[a,b]	10323	56.27	18.15	31.81	100
Foreign[a,b]	9767	54.81	30.82	6.60	99.20
LegalRights[b]	10323	5.77	2.44	2	10
CreditInfo[b]	10323	4.17	1.55	0	6
Privcbr[a,b]	10088	20.41	24.52	0	91.90
Pubcreg[a,b]	10323	3.63	5.85	0	28.10
GDPpcppp[a,b]	10323	10885.00	5788.54	1660.86	27225.50
Rejected	4280	0.162	0.368	0	1
IND_GroupD	10571	0.44	0.50	0	1
IND_GroupF	10571	0.09	0.28	0	1
IND_GroupG	10571	0.42	0.49	0	1
IND_GroupI	10571	0.05	0.21	0	1
IND_GroupK	10571	0.01	0.10	0	1

[67] Recall that the percentage of discouraged borrowers in the sample is 34%.

Table 4.2. Descriptive statistics (Continuation)

This table reports the descriptive statistics of key variables in different groups.[a] In the empirical modelling, these variables are transformed into the natural logarithm of the real value plus the unit value.[b] These variables vary across countries.

	SMEs (NON-LOAN SEEKERS)					SMEs (LOAN SEEKERS)				
Variable	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
LSeeker	4084	-	-	-	-	6487	1.00	0.00	1	1
DBorrower	-	-	-	-	-	6487	0.34	0.47	0	1
Fage[a]	4012	13.01	11.20	0	163	6331	13.13	11.40	0	181
FSize[a]	4046	43.21	52.56	1	250	6434	49.72	56.75	1	250
TradeCredit[a]	2222	64.55	31.88	0	100	4218	58.28	32.37	0	100
ExtAud	4004	0.40	0.49	0	1	6382	0.46	0.50	0	1
Ownership[a]	3904	80.28	26.51	1	100	6136	78.52	26.63	1	100
M_Woman	4070	0.21	0.41	0	1	6425	0.19	0.40	0	1
M_Exp[a]	3962	16.79	10.57	1	66	6312	16.28	10.12	1	75
Innovation	4075	0.49	0.50	0	1	6458	0.56	0.50	0	1
Export[a]	4068	6.92	21.10	0	100	6468	7.80	21.66	0	100
Overdue	4056	0.05	0.21	0	1	6441	0.09	0.28	0	1
Qualcert	3982	0.24	0.43	0	1	6228	0.24	0.43	0	1
Overdrafts	3706	0.37	0.48	0	1	6128	0.47	0.50	0	1
City	4084	0.41	0.49	0	1	6487	0.39	0.49	0	1
Cr[a,b]	3914	56.43	17.36	31.81	100	6409	56.17	18.62	31.81	100
Foreign[a,b]	3681	56.51	31.57	6.60	99.20	6086	53.79	30.31	6.60	99.20
LegalRights[b]	3914	5.89	2.45	2	10	6409	5.70	2.43	2	10
CreditInfo[b]	3914	4.22	1.54	0	6	6409	4.14	1.56	0	6
Privcbr[a,b]	3821	20.42	23.58	0	91.90	6267	20.40	25.09	0	91.90
Pubcreg[a,b]	3914	3.25	5.05	0	28.10	6409	3.86	6.28	0	28.10
GDPpcppp[a,b]	3914	11370.02	5923.90	1660.86	27225.50	6409	10588.8	5684.43	1660.86	27225.50
Rejected	-	-	-	-	-	-	-	-	-	-
IND_GroupD	4084	0.41	0.49	0	1	6487	0.46	0.50	0	1
IND_GroupF	4084	0.08	0.28	0	1	6487	0.09	0.28	0	1
IND_GroupGH	4084	0.44	0.50	0	1	6487	0.40	0.49	0	1
IND_GroupI	4084	0.05	0.21	0	1	6487	0.05	0.21	0	1
IND_GroupK	4084	0.01	0.12	0	1	6487	0.01	0.08	0	1

Table 4.2. Descriptive statistics (continuation)

This table reports the descriptive statistics of key variables in different groups.[a] In the empirical modelling, these variables are transformed into the natural logarithm of the real value plus the unit value.[b] These variables vary across countries.

	APPLICANT BORROWERS					DISCOURAGED BORROWERS				
Variable	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
LSeeker	4280	1.00	0.00	1	1	2207	1.00	0.00	1	1
DBorrow	4280	0.00	0.00	0	0	2207	1.00	0.00	1	1
Fage[a]	4192	13.58	11.70	0	181	2139	12.25	10.74	0	181
FSize[a]	4253	57.96	60.34	1	250	2181	33.64	44.81	1	250
TradeCr	3097	59.90	31.78	0	100	1121	53.82	33.55	0	100
ExtAud	4214	0.53	0.50	0	1	2168	0.34	0.47	0	1
Ownersh	4060	77.04	26.99	2	100	2076	81.42	25.69	1	100
M_Woma	4255	0.18	0.38	0	1	2170	0.23	0.42	0	1
M_Exp[a]	4181	16.72	10.17	1	75	2131	15.41	9.97	1	58
Innovati	4262	0.60	0.49	0	1	2196	0.47	0.50	0	1
Export[a]	4268	9.44	23.49	0	100	2200	4.61	17.14	0	100
Overdue	4255	0.09	0.28	0	1	2186	0.08	0.28	0	1
Qualcert	4108	0.28	0.45	0	1	2120	0.16	0.37	0	1
Overdraf	4091	0.57	0.50	0	1	2037	0.26	0.26	0	1
City	4280	0.41	0.49	0	1	2207	0.34	0.48	0	1
Cr[a,b]	4251	55.54	18.96	31.81	100	2158	57.40	17.87	31.81	100
Foreign[a,]	4078	54.59	30.56	6.60	99.20	2008	52.17	29.75	6.60	99.20
LegalRig	4251	5.69	2.35	2	10	2158	5.71	2.59	2	10
CreditInf	4251	4.17	1.56	0	6	2158	4.08	1.55	0	6
Privcbr[a,]	4120	22.70	25.82	0	91.90	2147	16.00	22.98	0	91.90
Pubcreg[a]	4251	4.24	6.44	0	28.10	2158	3.11	5.87	0	27.60
GDPpcpp	4251	11137.20	5820.02	1660.86	27225.50	2158	9508.51	5243.47	1660.86	27225.50
Rejected	4280	0.162	0.368	0	1	-	-	-	-	-
IND_Gro	4280	0.46	0.50	0	1	2207	0.46	0.50	0	1
IND_Gro	4280	0.09	0.29	0	1	2207	0.08	0.27	0	1
IND_Gro	4280	0.39	0.49	0	1	2207	0.41	0.49	0	1
IND_Gro	4280	0.05	0.22	0	1	2207	0.04	0.20	0	1
IND_Gro	4280	0.01	0.08	0	1	2207	0.01	0.07	0	1

4.4.2. Univariate Tests

This section reports univariate tests comparing the characteristics of loan applicants and discouraged borrowers (Table 4.3.). The results confirm that discouraged borrowers are younger (*FAge*) and smaller (*FSize*) than loan applicants. Furthermore, discouraged borrowers have a lower ratio of operational inputs bought on credit (*TradeCredit*). These borrowers tend to be externally audited less often (*ExtAud*) and have a higher ownership concentration (*Ownership*). Additionally, they have a higher ratio of women as business managers (*M_Woman*), with less experience in the business (*M_Exp*). Moreover, loan applicants are more innovative (*Innovation*) and have an exportation volume twice as high as that of discouraged borrowers (*Export*). The incidence of quality certification is also higher among loan applicants (*Qualcert*). These borrowers are more likely to have overdraft facilities (*Overdrafts*) than discouraged borrowers are.

Table 4.3. Univariate tests

This table reports the results of the univariate tests of the key variables. The *Wilcoxon-Mann-Whitney* test is conducted for continuous variables at the mean and a z-test is applied to binary variables at the median. H_0: mean (y = 0) = mean (y = 1); difference = mean (y = 1) - mean (y = 0).

Variables	**Applicant Borrowers** (N=4,280)	**Discouraged Borrowers** (N=2,207)	***Mean Differences***	p-value
Characteristics of the business and entrepreneur/manager				
FAge	13.580	12.254	-1.326	0.000
FSize	57.965	33.638	-24.327	0.000
TradeCredi	59.896	53.822	-6.074	0.000
ExtAud	0.526	0.340	-0.186	0.000
Ownership	77.039	81.424	43.385	0.000
M_Woman	0.175	0.230	0.055	0.000
M_Exp	16.717	14.413	1.303	0.000
Innovation	0.604	0.468	-0.136	0.000
Export	9.442	4.609	-4.834	0.000
Quality of Borrower				0.000
Overdue	0.089	0.085	-0.004	0.550
Qualcert	0.278	0.158	-0.120	0.000
Nature of the relationship lending				
Overdrafts	0.570	0.264	-0.306	0.000
Applicatio				
City	0.413	0.345	-0.068	0.000
Characteristics of the banking sector				
Cr	55.542	57.395	1.853	0.000
Foreign	54.585	52.168	-2.417	0.002
Characteristics of the credit environment				
LegalRights	5.688	5.712	0.024	0.729
CreditInfo	4.174	4.082	-0.092	0.001
Privcbr	22.698	15.997	-6.701	0.000
Pubcreg	4.238	3.114	-1.124	0.000
Macroeconomic conditions				
GDPpcppp	11,137.200	9,508.513	-1,628.687	0.000

The results also suggest that the loan application costs are higher for discouraged borrowers (*City*). We find that, on average, discouraged borrowers operate in a more concentrated banking system environment (*Cr*). Univariate tests also indicate that loan applicants operate in a more favorable context in regards to the development of information sharing instruments (*CreditInfo*, *Privcbr,* and *Pubcreg*). Finally, the results suggest that loan applicants operate in countries with higher economic development. These results seem to confirm that informational traceability is the main determinant of discouraged borrowers, whereas the quality of borrowers (*Overdue*) and the legal context in which they operate (*LegalRights*) seem to be statistically insignificant in explaining discouragement. See the correlation matrix in Appendix 4.2.

4.4.3. Incidence of discouraged borrowers

Table 4.4. reports the estimations regarding the determinants of discouragement.[68] Since our data set includes several specific characteristics of the banking sector and credit environment variables, we estimate different specifications to avoid collinearity problems. Therefore specifications [1] and [2] discriminate among banking sector characteristics, specifications [3] to [6] discriminate among credit environment variables, and specification [7] includes the macroeconomic variable.

The estimations report negative coefficients of Ln(*FSize* + 1) (p-value < .01 in all specifications), *ExtAud* (p-value < .01 in all specifications), and Ln(*TradeCredit* + 1) (p-value < .05 in specification [5]; p-value < .01 in the remaining specifications). These results are in line with the theoretical framework, that is, confirming that less opaque firms have a lower probability of being discouraged from applying for credit. In line with Cavalluzzo et al. (2012) and Freel et al. (2012), firm age is unrelated to discouragement. Similarly, we do not find a statistically significant effect of business ownership concentration on the likelihood of being discouraged, contrary to the results of Han et al. (2009). Nonetheless, the results provide strong evidence regarding gender discrimination explaining the incidence of discouragement. The positive coefficients of *M_Woman* (p-value < .05 in specifications [2], [4], [6], and [7]; p-value < .1 in specifications [1], [3], and [5]) suggest that female managers tend to be more discouraged from applying for credit. The negative coefficients of Ln(*M_Exp* + 1) (p-value < .05 in all specifications) confirm that firms with experienced managers/entrepreneurs have a lower probability of being discouraged. These results seem to confirm that demographic factors (i.e. gender and experience) have greater importance in less developed countries to predict discouragement, in line with Chakravarty and Xian (2013).[69] This result can be justified by the

[68] The model specifications control for industry dummy variables. The results are not reported but are available upon request.

[69] Despite some authors (e.g. Jappeli, 1990; Cavalluzzo et al., 2002; Han et al., 2009; Freel et al., 2012) predicting that the discouragement problem varies across gender and the experience of entrepreneurs/managers, empirical evidence does not report a statistically significant likelihood of

privileged access to information of experienced managers/entrepreneurs and by the fight against gender discrimination started in the last decades in developed countries. The negative coefficients of *Innovation* (statistically significant in all specifications at the 1% level) and business exportations (Ln (*Export* + 1)) (p-value < .05 in specifications [1] to [3]; p-value < .1 in specifications [4] and [7]) confirm the results from univariate tests, that is, the likelihood of being discouraged from applying for a loan is lower for more innovative firms and firms operating in foreign markets.

The results reported in Table 4.4 show that the quality of the borrower (i.e. *Overdue* and *Qualcert*) is unrelated with the incidence of discouragement. This evidence seems to contradict the theory that discouragement is an efficient self-selecting mechanism, that is, riskier borrowers show high probabilities of discouragement (Han et al., 2009), which may suggest the prevalence of falsely discouraged borrowers (Diagne, 1999) among self-selected businesses operating in less developed countries. We check the robustness of this result in Section 4.4.

The results on the nature of the banking relationship confirm that overdraft facilities are negatively related with discouraged borrowers (p-value < .01 in all specifications). This result is compatible with the view that discouragement increases in the absence of a relationship between the borrower and the lender. Hence, we confirm that if banking relationships pre-exist (e.g. Chakravarty and Yilmazer, 2009; Han et al., 2009), the private information about the borrower reduces screening errors and application costs and, consequently, the incidence of discouraged borrowers.

Firms located in big cities (*City,* p-value < .05 in specifications [1] to [3]; p-value < .01 in the remaining specifications) have a lower likelihood of discouragement. This evidence confirms that the distance between the firm and a lender increases the screening and application costs, in line with Peterson and Rajan (2002). The positive coefficient of Ln(*Cr* + 1) (p-value < 0.05-specification [1]) confirms that the degree of difficulty in accessing a loan increases with the level of bank market concentration, in line with Brown et al. (2011).

Contrary to our expectations, the positive coefficient of *LegalRights* (p-value < 0.05, specification [3]) suggests that the strength of the legal protection of creditors and borrowers increases the number of discouraged borrowers (we further explore this result in Section 4.5.). The results also confirm that borrowers feel less discouraged from applying for a loan in countries with high coverage of public and private information sharing instruments ((Ln(*Privcbr* + 1), p-value < .01, specification [5]; Ln(*Pubreg* + 1); p-value < .01, specification [6]). These results are in line with our predictions. Nonetheless, we do not find that the depth of information sharing instruments (*CreditInfo,* specification [4]) influences the incidence of discouraged borrowers. These results suggest that policy makers should direct their efforts in increasing the coverage of information sharing instruments to reduce the incidence of

discouragement in developed countries. On the contrary, for developing countries, Chakravarty and Xian (2013) report significant effects of experience and gender as predictors of discouragement.

discouraged borrowers more than increasing the depth of these instruments, satisfactorily developed (for an overview of the differences detected between the coverage and depth of information sharing instruments across countries, see DBR, 2010). Furthermore, borrowers operating in more developed countries have a lower probability of being discouraged (*Ln*(*GDPpcppp* + 1,p-value < .01, specification [7]).

Table 4.4. Determinants of discouraged borrowers: Probit estimations

This table reports the results of the probit model. The dependent variable is *DBorrower*. We control for industry dummy variables. The results are not tabulated here but are available upon request from the author. The variable definitions are reported in Table 4.1. Standard errors are reported in parentheses. *** $p < .01$, ** $p < .05$, * $p < .1$.

	1	*2*	*3*	*4*	*5*	*6*	*7*
Characteristics of the business and entrepreneur/manager							
Ln(Fage+1)	0.051	0.033	0.035	0.041	0.083*	0.036	0.054
	(0.044)	(0.045)	(0.044)	(0.043)	(0.045)	(0.044)	(0.044)
Ln(FSize+1)	-0.231***	-0.226***	-0.229***	-0.232***	-0.245***	-0.242***	-0.235***
	(0.026)	(0.027)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
Ln(TradeCredit+1)	-0.093***	-0.086***	-0.096***	-0.083***	-0.070**	-0.074***	-0.075***
	(0.027)	(0.028)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
ExtAud	-0.196***	-0.210***	-0.190***	-0.182***	-0.210***	-0.157***	-0.180***
	(0.052)	(0.053)	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)
Ln(Ownership+1)	-0.082	-0.062	-0.071	-0.069	-0.045	-0.075	-0.070
	(0.051)	(0.053)	(0.051)	(0.051)	(0.052)	(0.051)	(0.051)
M_Woman	0.117*	0.148**	0.114*	0.121**	0.117*	0.119**	0.125**
	(0.060)	(0.062)	(0.061)	(0.060)	(0.061)	(0.061)	(0.060)
Ln(M_Exp+1)	-0.093**	-0.064	-0.099**	-0.098**	-0.090**	-0.087**	-0.091**
	(0.040)	(0.042)	(0.040)	(0.040)	(0.041)	(0.041)	(0.040)
Innovation	-0.152***	-0.143***	-0.154***	-0.148***	-0.141***	-0.149***	-0.141***
	(0.050)	(0.052)	(0.051)	(0.050)	(0.051)	(0.051)	(0.051)
Ln(Export+1)	-0.041**	-0.045**	-0.041**	-0.038*	-0.020	-0.030	-0.034*
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Quality of Borrower							
Overdue	-0.043	0.024	-0.034	-0.035	-0.026	-0.017	-0.041
	(0.086)	(0.089)	(0.086)	(0.086)	(0.087)	(0.086)	(0.086)
Qualcert	-0.058	-0.087	-0.061	-0.057	-0.022	-0.048	-0.044
	(0.064)	(0.066)	(0.064)	(0.064)	(0.065)	(0.064)	(0.064)
Nature of the relationship lending							
Overdrafts	-0.603***	-0.613***	-0.644***	-0.624***	-0.574***	-0.635***	-0.607***
	(0.051)	(0.051)	(0.051)	(0.050)	(0.052)	(0.050)	(0.051)
Application Costs							
City	-0.113**	-0.105**	-0.131**	-0.136***	-0.155***	-0.109**	-0.141***
	(0.052)	(0.052)	(0.051)	(0.051)	(0.052)	(0.052)	(0.051)
Characteristics of the banking sector							
Ln(Cr+1)	0.206**						
	(0.083)						
Ln(Foreign+1)		0.051					
		(0.037)					
Characteristics of the credit environment							
LegalRights			0.032***				
			(0.010)				
CreditInfo				-0.007			
				(0.016)			
Ln(Privcbr+1)					-0.072***		
					(0.017)		
Ln(Pubcreg+1)						-0.083***	
						(0.024)	
Macroeconomic Conditions							
Ln(GDPpcppp+1)							-0.098**
							(0.039)
Constant	0.944*	1.276***	1.640***	1.777***	1.585***	1.837***	2.577***
	(0.560)	(0.495)	(0.458)	(0.460)	(0.480)	(0.456)	(0.562)
#	3,475	3,413	3,475	3,475	3,344	3,475	3,475
Log-Likelihood	-1,738.02	-1,645.53	-1,736.41	-1,741.02	-1,691.36	-1,735.16	-1,737.95
LR chi^2	467.48	430.60	470.70	461.48	459.39	473.22	467.64
Prob > chi^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo-R^2	0.119	0.116	0.119	0.117	0.120	0.120	0.119

Table 4.5. reports the results of parsimonious model. The results broadly confirm the estimations of Table 4.4. Based on the parsimonious model and before proceeding to the robustness test section, we plot the estimated probabilities of being discouraged for nine hypothetical borrowers (with different levels of opacity, traceability, screening errors, and application costs) in a subsample analysis (by *FSize*, *ExtAud*, *Overdraft,* and *City*; see Appendices 4.3 to 4.6). These plots show how changes in i) banking concentration (*Cr,* see Appendix 4.3.), ii) strength of creditor and borrower protection in the event of default (*LegalRights,* see Appendix 4.4.), and iii) coverage of private/public information sharing instruments (*Privcbr,* see Appendix 4.5.; *Pubcreg,* see Appendix 4.6.) affect the probability of each business being discouraged as a function of firm-specific characteristics. These plots provide a representation regarding the marginal effects of the unitary variation (above the mean) of the market variables (i.e. *Cr, LegalRights, Privcbr, Pubcreg*) in terms of the probability of being discouraged. Hence, they provide interesting input for policy makers predicting the impact of contextual reforms on the likelihood of discouragement.

The plots reported in Appendices 4.3. to 4.6. broadly confirm that, for the mean values of the variables *Cr* (Appendix 4.3.), *LegalRights* (Appendix 4.4.), *Privcbr* (Appendix 4.5.), and *Pubcreg* (Appendix 4.6.), the estimated probability of being discouraged is higher among smaller firms, externally unaudited businesses, firms without overdraft facilities, and firms operating in a small city or rural area. Furthermore, Appendix 4.3 confirms that an increase in banking concentration increases the estimated probability of being discouraged, with the exception of the estimated probability for businesses operating in small cities or rural areas, which is negatively related to banking concentration. Interestingly, we find that the most notable marginal effects occur for business with overdrafts and borrowers located in big cities. We also find that, starting at a given point, these business would be more likely to be discouraged than others. This result seems to suggest that in a more highly concentrated banking market, those firms with a closer and more intense relationship with a bank are more likely to be discouraged from applying for a loan than distant borrowers. This is reasonable if we assume that these firms are more likely rely on banks as their primordial source of finance, becoming locked in by the superior bargaining power of the credit provider in a context of low competition (Sharpe, 1991; Detragiache et al., 2000). In turn, this bargaining power could discourage businesses from applying for new loans.

Appendix 4.4. also confirms the positive relation between the strength of legal rights and discouragement. Nonetheless, we find that this effect is very low, especially for businesses with overdrafts and firms operating in small cities or rural areas.

Appendices 4.5. and 4.6. broadly confirm that an increase in the coverage of private (*Privcbr*) and public (*Pubcreg*) information sharing instruments, respectively, decreases the estimated probability of being discouraged, independently of the nature of business quality traceability , screening errors, or application costs.

Table 4.5. Determinants of discouraged borrowers: Probit estimations (parsimonious model)

This table reports the results of the parsimonious probit model based on the estimations of Table 4.4. The dependent variable is *DBorrower*. We control for industry dummy variables. The results are not tabulated here but are available upon request from the author. The variable definitions are reported in Table 4.1. Standard errors are reported in parentheses. *** $p < .01$, ** $p < .05$, * $p < .1$.

	1	*2*	*3*	*4*	*5*
Characteristics of the business and					
Ln(FSize+1)	-0.213***	-0.213***	-0.223***	-0.225***	-0.216***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Ln(TradeCredit+1)	-0.068***	-0.072***	-0.046*	-0.048*	-0.053**
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
ExtAud	-0.188***	-0.184***	-0.196***	-0.150***	-0.174***
	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)
M_Woman	0.124**	0.119**	0.125**	0.122**	0.131**
	(0.058)	(0.058)	(0.059)	(0.058)	(0.058)
Ln(M_Exp+1)	-0.061*	-0.071**	-0.054	-0.058	-0.060*
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Innovation	-0.174***	-0.177***	-0.162***	-0.169***	-0.164***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
Ln(Export+1)	-0.048***	-0.049***	-0.028	-0.037**	-0.042**
	(0.018)	(0.018)	(0.019)	(0.019)	(0.018)
Nature of the relationship lending					
Overdrafts	-0.602***	-0.641***	-0.578***	-0.631***	-0.605***
	(0.048)	(0.048)	(0.049)	(0.048)	(0.048)
Application Costs					
City	-0.122**	-0.136***	-0.159***	-0.112**	-0.145***
	(0.049)	(0.048)	(0.049)	(0.049)	(0.048)
Characteristics of the banking sector					
Ln(Cr+1)	0.173**				
	(0.078)				
Characteristics of the credit environment					
LegalRights		0.032***			
		(0.010)			
Ln(Privcbr+1)			-0.056***		
			(0.016)		
Ln(Pubcreg+1)				-0.088***	
				(0.023)	
Macroeconomic conditions					
Ln(GDPpcppp+1)					-0.085**
					(0.036)
Constant	0.576	1.142***	1.286***	1.330***	2.023***
	(0.465)	(0.339)	(0.355)	(0.335)	(0.462)
#	3,808	3,808	3,808	3,808	3,808
Log-Likelihood	-1,922.60	-1,919.69	-1,877.37	-1,917.70	-1,922.35
LR chi^2	483.07	488.88	470.78	492.87	483.58
Prob > chi^2	0.000	0.000	0.000	0.000	0.000
Pseudo-R^2	0.112	0.113	0.111	0.114	0.112

4.5. Robustness tests

An increase in the legal protection of creditor rights has not been proven an instrument to reduce the incidence of discouraged borrowers. Instead, in countries with stronger creditor rights, the borrower is more likely to be discouraged from applying for a loan that they need. This result is not surprising if we assume that an increase in creditor/lender protection facilitates lending activity to SMEs on collateral basis. If we show that this assumption is true, we may expect collaterally constrained borrowers to be less encouraged to apply for a loan if they expect lenders will offer credit under a collateralized contract. To test such an assumption, we investigate the impact of *LegalRights* on the likelihood of the lender requesting collateral to accept the loan application. Based on BEEPS (2008/2009) information regarding loan applicants with ultimately approved loans, we built the variable *Collateral* (a binary variable that equals one if the lender requests collateral to approve the loan and zero otherwise).[70] Then we run a probit model on *Collateral* over *LegalRights* and the set of specific firm variables included in this study.[71] The probit model reports a positive coefficient for *LegalRights* (p-value < .05), suggesting that strong credit rights increase the reliance on collateral to extend bank loans. Interpreting this result, we must highlight that this test reports only information about firms with approved loan application, which therefore passed the lender's credit evaluation. Hence, it could be argued that the strength of legal rights positively affects the approval of loan requests.

To test this assumption, based on Hanedar et al. (2014), we investigate the impact of *CreditInfo* in extending credit. Hence, we built the variable *ProbRejected* (a binary variable that equals one if the firm reported access to finance as a severe problem and zero otherwise[72]), which is used as the dependent variable.[73] Then, we run a probit model on *ProbRejected* over *LegalRights* and the set of independent variables.[74] The probit model reports a negative coefficient for *LegalRights* (p-value < .05), confirming that credit access is less stringent for firms operating in countries with better credit protection laws. This result sheds more light on the relation between legal rights, credit rationing, and the incidence of discouraged borrowers,

[70] We built the final sample on the basis of answers to the following survey questions: 'At this time, does this establishment have a line of credit or loan from a financial institution?' [*Yes, No, Don't know*] and 'Referring only to this most recent loan or line of credit, did financing require collateral?' [*Yes, No, Don't know*]

[71] These estimations are not reported here but are available upon request.

[72] The question in the survey is as follows: 'Is access to finance, which includes availability and cost, interest rates, fees and collateral requirements, no obstacle, a minor obstacle, a moderate obstacle, a major obstacle or a very severe obstacle to the current operations of this establishment?'

[73] We assume that the difficulty accessing financing predicts in some way the likelihood of firms being discouraged from applying for a loan or having their loan applications rejected.

[74] The estimations are not tabulated here but are available upon request.

leading us to conclude that reliable credit protection laws decrease banks' reluctance in extending credit under terms that may discourage borrowers from applying for a loan, despite the fact that these terms increase the odds of accepted loan applications.

These results confirm that discouragement exists beyond the fear of rationing. In fact, Appendix 4.7. shows that the proportion of loans seekers that do not apply for a loan from fear that the loan application would be rejected/rationed in the global sample is lower than the proportion of borrowers discouraged by tough loan prices or application procedures. Hence, to test if our model fits well in explaining both discouragement due to fear of rationing and negative perceptions about loan prices or given the complexity of the loan application's procedures, we re-estimate the results reported in Table 4.4., splitting the sample into two types of discouraged borrowers. Hence, using a multinomial logit (ML) model (e.g. Brown et al., 2011),[75] we extend the test for the self-selection theory for three categories of discouragement. In this model let $DBorrower\_Reason_{ij}$ = 1 if the *i*th observation chooses alternative *j*, *j* = 1, 2, 3, which is treated as an unordered choice set.

In the situation of interest in this study, *i*, represents the firm and *j* represents the discouragement status. There are three choices, with probability π_{f1} (applicants, 65.98% of the sample), π_{f2} (the firm did not apply for a bank loan given its price or procedures, 30.46% of the sample), and π_{f3} (the firm did not apply for a bank loan due to fear of rationing, 3.56% of the sample) for individual *i*. This means that $\sum_{j=1}^{3} DBorrower\_Reason_{ij} = 1$ and $\sum_{j=1}^{3} \pi_{ij} = 1$ (Baltagi, 2002). As in the binary response model, we are interested in how changes in the elements of x (i.e. independent variables) affect the response probabilities π_{ij}, *j* = 1, 2, 3, ceteris paribus. Thus, for the generalized multinomial model (Pinder, 1996),

$$\pi_{ij} = \frac{\exp(\alpha_j + \beta_j X_i)}{\sum_{j=1}^{3} \exp(\alpha_j + \beta_j X_i)} \qquad \text{(Eq.2)}$$

The variable $DBorrower\_Reason_{ij}$ is a categorical variable that equals one if the firm ***i*** applied for external funding (i.e. applicant); two if the main reasons for discouragement were high interest rates, collateral, the complexity of application procedures, the necessity of making informational payments to obtain a bank loan, or other reasons that make the procedure the main reason for discouragement; or three if the main reason for discouragement was the fear of credit rationing[76] (e.g. Brown et al., 2011; Chakravarty and Xiang, 2013). The term *X* is the vector of independent variables and β_i is the vector of parameters to be estimated.

[75] Because of the need to evaluate multiple integrals of the normal distribution, the probit model for multiples choices has been found to be of rather limited use in this setting. The logit model for multiple choices (i.e. the ML model), in contrast, has been widely used in many fields, including economics, market research, and transportation engineering (Greene, 2003).

[76] Here, we define the fear of rationing as the fear of loan rejection or fear that the size of the loan and/or its maturity will be insufficient.

Table 4.6. Determinants of discouraged borrowers: ML estimations

The dependent variable in this table is *DBorrower_Reason*. The base outcome in the ML model is *Applied for Credit*. The left-hand column provides the determinants of discouragement due to tough loan prices or loan application procedures (i.e., *DBorrower_Reason* = *Price/Procedures*). The right hand-column provides the determinants of discouragement due to fear of rationing. We control for industry dummies. The results are not tabulated here but are available upon request. The variable definitions are reported in Table 4.1. Standard errors are reported in parentheses. *** $p < .01$, ** $p < .05$, * $p < .1$.

	1		*2*		*3*	
	Price/ Procedures	*Rationing*	*Price/ Procedures*	*Rationing*	*Price/ Procedures*	*Rationing*
Characteristics of the business and entrepreneur/manager						
Ln(Fage+1)	0.100	0.034	0.092	-0.180	0.081	-0.079
	(0.078)	(0.202)	(0.080)	(0.204)	(0.078)	(0.198)
Ln(FSize+1)	-0.382***	-0.572***	-0.381***	-0.507***	-0.379***	-0.563***
	(0.047)	(0.127)	(0.048)	(0.131)	(0.047)	(0.125)
Ln(TradeCredit+1)	-0.170***	0.078	-0.162***	0.124	-0.173***	0.059
	(0.047)	(0.150)	(0.047)	(0.151)	(0.047)	(0.145)
ExtAud	-0.356***	-0.206	-0.390***	-0.101	-0.351***	-0.153
	(0.093)	(0.245)	(0.095)	(0.255)	(0.092)	(0.243)
Ln(Ownership+1)	-0.142	-0.224	-0.100	-0.221	-0.130	-0.141
	(0.091)	(0.228)	(0.095)	(0.235)	(0.090)	(0.232)
M_Woman	0.180*	0.238	0.237**	0.299	0.178*	0.254
	(0.106)	(0.271)	(0.108)	(0.283)	(0.106)	(0.270)
Ln(M_Exp+1)	-0.149**	-0.199	-0.101	-0.160	-0.156**	-0.244
	(0.072)	(0.180)	(0.074)	(0.189)	(0.071)	(0.179)
Innovation	-0.215**	-0.716***	-0.194**	-0.705***	-0.220**	-0.719***
	(0.089)	(0.234)	(0.092)	(0.245)	(0.089)	(0.234)
Ln(Export+1)	-0.071**	-0.062	-0.074**	-0.097	-0.071**	-0.060
	(0.036)	(0.099)	(0.037)	(0.106)	(0.036)	(0.099)
Quality of Borrower						
Overdue	-0.182	0.552*	-0.076	0.737**	-0.174	0.646**
	(0.159)	(0.315)	(0.162)	(0.328)	(0.159)	(0.316)
Qualcert	-0.163	0.364	-0.201*	0.184	-0.165	0.331
	(0.117)	(0.291)	(0.121)	(0.309)	(0.117)	(0.290)
Nature of the relationship lending						
Overdrafts	-1.041***	-1.023***	-1.054***	-1.030***	-1.088***	-1.294***
	(0.092)	(0.259)	(0.093)	(0.261)	(0.092)	(0.257)
Application Costs						
City	-0.234**	0.114	-0.210**	0.063	-0.253***	-0.024
	(0.092)	(0.238)	(0.093)	(0.247)	(0.091)	(0.235)
Characteristics of the banking sector						
Ln(Cr+1)	0.221	1.515***				
	(0.145)	(0.398)				
Ln(Foreign+1)			0.049	0.294		
			(0.065)	(0.179)		
Characteristics of the credit environment						
LegalRights					0.038**	0.185***
					(0.018)	(0.049)
Constant	1.985**	-4.767**	2.300***	-13.039	2.713***	0.623
	(0.972)	(2.376)	(0.838)	(806.149)	(0.795)	(1.763)
#	3,475		3,314		3,475	
Log-Likelihood	-1,993.37		-1,880.18		-1,992.97	
LR chi^2	507.63		459.51		508.43	
Prob > chi^2	0.000		0.000		0.000	
Pseudo-R^2	0.113		0.110		0.113	

Table 4.6. Determinants of discouraged borrowers: ML estimations (continuation)

	4		*5*	
	Price/ Procedures	*Rationing*	*Price/ Procedures*	*Rationing*
Characteristics of the business and entrepreneur/manager				
Ln(Fage+1)	0.089	-0.039	0.153*	0.077
	(0.078)	(0.197)	(0.080)	(0.202)
Ln(FSize+1)	-0.383***	-0.573***	-0.403***	-0.602***
	(0.046)	(0.125)	(0.047)	(0.126)
Ln(TradeCredit+1)	-0.159***	0.141	-0.137***	0.176
	(0.047)	(0.145)	(0.047)	(0.148)
ExtAud	-0.342***	-0.054	-0.383***	-0.186
	(0.092)	(0.243)	(0.093)	(0.242)
Ln(Ownership+1)	-0.127	-0.147	-0.089	-0.086
	(0.090)	(0.231)	(0.091)	(0.235)
M_Woman	0.184*	0.295	0.175	0.286
	(0.106)	(0.269)	(0.107)	(0.271)
Ln(M_Exp+1)	-0.155**	-0.242	-0.140*	-0.207
	(0.071)	(0.178)	(0.072)	(0.180)
Innovation	-0.211**	-0.683***	-0.200**	-0.664***
	(0.089)	(0.232)	(0.090)	(0.233)
Ln(Export+1)	-0.068*	-0.049	-0.038	-0.005
	(0.036)	(0.099)	(0.036)	(0.099)
Quality of Borrower				
Overdue	-0.175	0.588*	-0.164	0.607*
	(0.159)	(0.314)	(0.160)	(0.316)
Qualcert	-0.164	0.358	-0.113	0.464
	(0.117)	(0.291)	(0.119)	(0.293)
Nature of the relationship lending				
Overdrafts	-1.064***	-1.185***	-0.986***	-0.974***
	(0.091)	(0.255)	(0.093)	(0.260)
Application Costs				
City	-0.259***	-0.025	-0.284***	-0.069
	(0.091)	(0.235)	(0.091)	(0.237)
Characteristics of the credit environment				
CreditInfo	-0.002	-0.105		
	(0.028)	(0.067)		
Ln(Privcbr+1)			-0.107***	-0.262***
			(0.030)	(0.077)
Ln(Pubcreg+1)				
Macroeconomic Conditions				
Ln(GDPpcppp+1)				
Constant	2.857***	1.681	2.525***	1.072
	(0.797)	(1.762)	(0.842)	(1.771)
#	3,475		3,344	
Log-Likelihood	-2,000.33		-1,948.81	
LR chi^2	493.70		493.15	
Prob > chi^2	0.000		0.000	
Pseudo-R^2	0.110		0.112	

Table 4.6. Determinants of discouraged borrowers: ML estimations (continuation)

	6		*7*	
	Price/ Procedures	*Rationing*	*Price/ Procedures*	*Rationing*
Characteristics of the business and entrepreneur/manager				
Ln(Fage+1)	0.082	-0.046	0.116	-0.035
	(0.078)	(0.196)	(0.078)	(0.197)
Ln(FSize+1)	-0.403***	-0.557***	-0.389***	-0.577***
	(0.047)	(0.126)	(0.047)	(0.125)
Ln(TradeCredit+1)	-0.139***	0.119	-0.147***	0.147
	(0.047)	(0.144)	(0.047)	(0.144)
ExtAud	-0.286***	-0.139	-0.340***	-0.085
	(0.093)	(0.244)	(0.092)	(0.241)
Ln(Ownership+1)	-0.141	-0.125	-0.131	-0.141
	(0.090)	(0.234)	(0.090)	(0.232)
M_Woman	0.180*	0.284	0.191*	0.290
	(0.106)	(0.270)	(0.106)	(0.269)
Ln(M_Exp+1)	-0.134*	-0.272	-0.141**	-0.237
	(0.072)	(0.178)	(0.072)	(0.178)
Innovation	-0.215**	-0.672***	-0.200**	-0.661***
	(0.089)	(0.232)	(0.089)	(0.232)
Ln(Export+1)	-0.052	-0.066	-0.061*	-0.046
	(0.036)	(0.100)	(0.036)	(0.100)
Quality of Borrower				
Overdue	-0.136	0.570*	-0.193	0.604*
	(0.159)	(0.315)	(0.159)	(0.314)
Qualcert	-0.148	0.326	-0.141	0.345
	(0.118)	(0.291)	(0.118)	(0.291)
Nature of the				
Overdrafts	-1.083***	-1.174***	-1.032***	-1.164***
	(0.091)	(0.255)	(0.092)	(0.258)
Application Costs				
City	-0.206**	-0.087	-0.269***	-0.036
	(0.092)	(0.239)	(0.091)	(0.235)
Characteristics of the credit environment				
CreditInfo				
Ln(Privcbr+1)				
Ln(Pubcreg+1)	-0.172***	0.143		
	(0.043)	(0.106)		
Macroeconomic conditions				
Ln(GDPpcppp+1)			-0.178***	-0.115
			(0.067)	(0.170)
Constant	3.031***	1.144	4.358***	2.246
	(0.791)	(1.752)	(0.973)	(2.242)
#	3,475		3,475	
Log-Likelihood	-1,991.71		-1,997.94	
LR chi^2	510.96		498.49	
Prob > chi^2	0.000		0.000	
Pseudo-R^2	0.114		0.111	

Table 4.6. reports the estimations of the ML model. There are three outcomes per firm in this model: *Applied for credit*; discouraged-*Price/Procedures*; and discouraged- *Rationing*. Our base outcome is *Applied for credit* (not tabulated). The coefficients in this table report the impact of each explanatory variable on the relative probability of being discouraged by tough loan *price,* application *procedures* complexity, and *fear of rationing*. The different specifications ([1] to [7]) control for banking sector characteristics, the credit environment, and macroeconomic conditions to avoid potential multicollinearity problems.

The results reported in the left-hand column of Table 4.6. (i.e. *DBorrower_Reason* = *Price/Procedures*) broadly confirm the estimations provided in Table 4.4., except for banking concentration (Ln(*Cr* + 1)), which does not relate to the probability of being discouraged by

tough loan prices or application procedures. Nonetheless, the right-hand column (i.e. *DBorrower_Reason* = *Rationing*) reports several differences with the estimations provided in Table 4.4.

Namely, only firm size (Ln(*FSize* + 1)) and innovator status (*Innovation*) remain statistically significant in explaining the incidence of discouraged borrowers. Furthermore, contrary to previous results, we confirm that the quality of the borrower is positively related to discouragement. We find that firms reporting being past overdue on payments (*Overdue*, p-value < .05 in specifications [2] to [4]; p-value < .1 in the remaining specifications) are more likely to be discouraged from applying for a loan. This result is in line with Han et al. (2009), indicating that discouragement is a self-rationing mechanism for high-risk borrowers only in the context of fear of rationing. We also find that the distance between a lender and borrowers (*City*) is not related to discouragement due to fear of rationing. The variables Ln(*Pubcreg* + 1) and Ln(*GDPpcppp* + 1) lose statistical significance in explaining this profile of discouraged borrowers. The positive coefficient of *LegalRights* (p-value < .01) seems to suggest the existence of falsely discouraged borrowers, since we confirm that, contrary to the expectations of these discouraged borrowers, the strength of creditor and borrower protection increases the likelihood of receiving a loan.

These results suggest that the determinants of discouragement vary across discouraged borrowers. Accordingly, we find that, whereas firm opaqueness, demographic factors (i.e. the gender and experience of the manager), and location better explain discouragement due to negative perceptions about loan price and/or loan application procedures, firm quality and banking concentration explains the incidence of discouraged borrowers due to fear of rationing. Innovator status, the legal protection of creditors and lenders in the event of default event, and the coverage of information sharing instruments help to explain discouragement in a transversal way.

4.6. Concluding Remarks

Using data from the 2007–2009 BEEPS, we examines the determinants of discouragement in less development countries. We use a probit model to analyse which factors better explain why borrowers are discouraged from applying for a bank loan when they seek capital. We define a business as a discouraged borrower if it does not apply for a loan for different reasons, such as tough loan prices or loan contract procedures or fear of rationing, that is, the scale of discouragement as a function of bank screening errors, application costs, and the difference in interest rates between the bank and other money lenders (Chakravarty and Xiang, 2013).

In addition, we use an ML model to compare the group of borrowers discouraged by tough loan prices or loan application procedures to those discouraged by a fear of rationing, considering the applicant status as the base outcome. The results show that whereas the firm's opaqueness, demographic factors (i.e. gender and owner experience), and distance between

borrower and lender better explain discouragement due to tough loan prices and/or loan application procedures, firm risk and banking concentration better explain the incidence of borrowers discouraged by the fear of rationing. Namely, the results indicate that a borrower discouraged by tough loan prices is more opaque, is managed by a less experienced woman, and operates far from the credit provider. Alternatively, a borrower discouraged by fear of rationing is riskier and operates in a more highly concentrated banking sector.

Additionally, the findings report that both types of discouraged borrowers are smaller and less innovative, and do not have a pre-existing relationship with the banks. Nonetheless, the results suggest that, in a more highly concentrated banking market, those firms with closer and more intense relationship with a bank are more likely to be discouraged from applying for a loan than distant borrowers. This finding is reasonable if we assume that those firms are more likely to rely on banks as their primordial source of finance, becoming locked in by the superior bargaining power of the credit provider in a context of low competition (e.g. Sharpe, 1991; Detragiache et al., 2000). In turn, this bargaining power could discourage the business from applying for new loans.

Furthermore, we find that the development of the credit environment have mixed effects on the probability of being discouraged. In particular, we find that the strength of the legal rights index relates positively with the likelihood of being discouraged, despite reducing the likelihood of type I and type II credit rationing. This could suggest the existence of falsely discouraged borrowers among businesses that do not apply for a loan due to fear of rationing. The positive relation between legal rights and discouragement due to tough loan prices (including tough interest rates and collateral requirements) can be justified by the positive relation between this index and the incidence of collateralized contracts, which may discourage assets constrained businesses from applying for a loan. On the other hand, we conclude that discouraged borrowers (broadly measured) operate in countries with poor coverage of public/private information sharing instruments. These results suggest that the discouragement may also act as an efficient mechanism to weed out low-type SMEs (in line with Han et al., 2009) or informationally opaque borrowers, operating in less developed countries, from applying, thus minimizing adverse selection and moral hazard problems. Additionally, the results consistently highlight that the dissemination of (public and private) information sharing mechanisms acts as a substitute for discouragement as a self-selection tool for opaque firms, providing comprehensive insights for policy makers.

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Appendices

Appendix 4.1. Identifying discouraged borrowers

This table summarizes the responses of firms to questions about credit needs in the 2008/2009 BEEPS. See also footnote 60.

	Is the firm a loan seeker?	Did the firm apply for a loan?	Did the firm apply for loans that were accepted?
SMEs *Obs.: 10,571*	Yes *Obs.: 6,487*	Yes *Obs.: 4,280*	Yes *Obs.: 3,588*
			No *Obs.: 692*
		No *Obs.: 2,207*	
	No *Obs.: 4,084*		

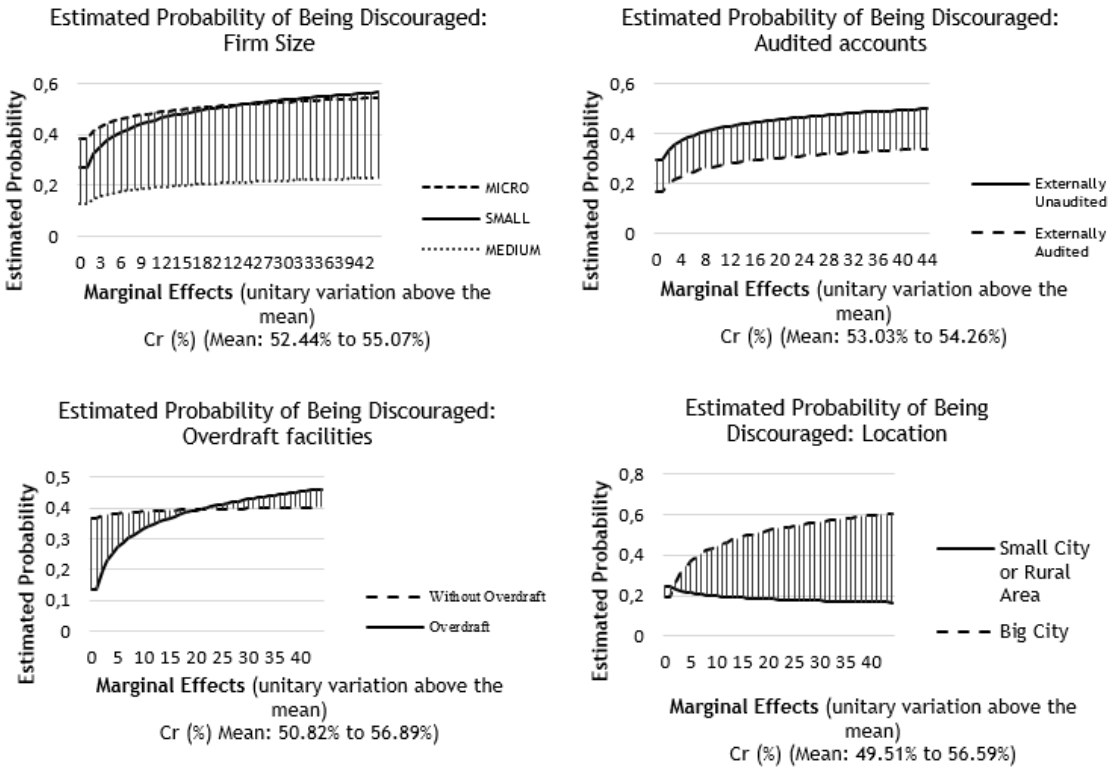
	Borrower Classification	
SMEs *Obs.: 10,571*	Loan Applicants *Obs.: 4,280*	Rejected *Obs.: 692*
		Accepted *Obs.: 3,588*
	Non-applicants *Obs.: 6,291*	Does not need loans *Obs.: 4,084*
		Discouraged *Obs.: 2,207*

Appendix 4.2 – Correlation matrix

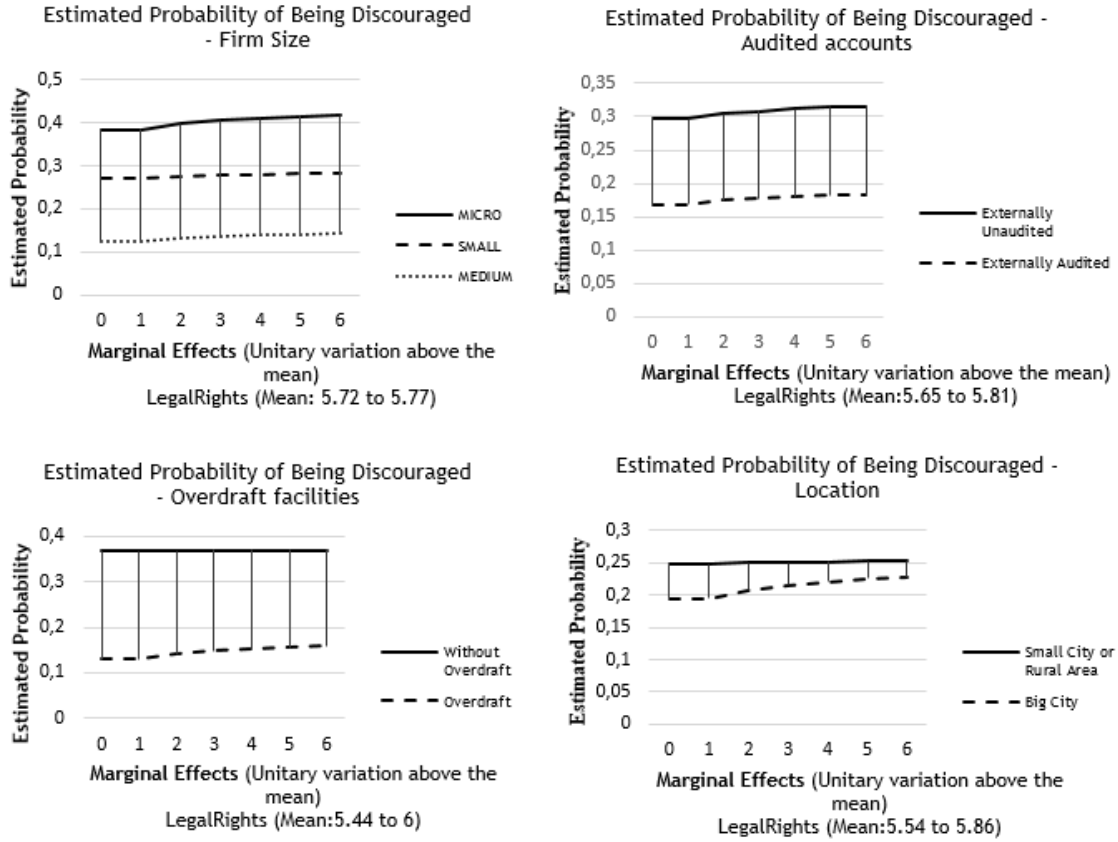
This table reports the pairwise correlation matrix. In the first row for each variable, we report the *rho*

		1	2	3	4	5	6	7	8	9	10
FAge	**1**	1.000									
FSize	**2**	0.212 0.000	1.000								
TradeCredit	**3**	0.067 0.000	0.065 0.000	1.000							
ExtAud	**4**	0.117 0.000	0.279 0.000	0.065 0.000	1.000						
Ownership	**5**	-0.142 0.000	-0.139 0.000	-0.047 0.000	-0.099 0.000	1.000					
M_Woman	**6**	-0.010 0.326	-0.089 0.000	0.025 0.047	-0.049 0.000	0.057 0.000	1.000				
M_Exp	**7**	0.254 0.000	0.057 0.000	0.087 0.000	0.043 0.000	-0.137 0.000	-0.030 0.002	1.000			
Innovation	**8**	0.025 0.012	0.078 0.000	-0.013 0.285	0.074 0.000	-0.025 0.012	0.000 0.966	-0.003 0.792	1.000		
Export	**9**	0.054 0.000	0.212 0.000	0.077 0.000	0.127 0.000	-0.055 0.000	-0.033 0.001	0.052 0.000	0.036 0.000	1.000	
Overdue	**10**	0.044 0.000	0.008 0.442	0.006 0.635	0.041 0.000	0.005 0.589	-0.021 0.029	-0.004 0.663	-0.018 0.065	-0.002 0.865	1.000
Qualcert	**11**	0.112 0.000	0.273 0.000	0.095 0.000	0.216 0.000	-0.093 0.000	-0.064 0.000	0.058 0.000	0.087 0.000	0.176 0.000	-0.006 0.525
Overdraft	**12**	0.055 0.000	0.054 0.000	0.031 0.016	0.043 0.000	-0.031 0.002	-0.031 0.002	0.041 0.000	0.066 0.000	0.041 0.000	-0.040 0.000
City	**13**	0.057 0.000	0.142 0.000	0.046 0.000	0.109 0.000	-0.050 0.000	-0.053 0.000	0.087 0.000	0.099 0.000	0.092 0.000	-0.013 0.193
Brpc	**14**	0.004 0.680	0.036 0.000	-0.070 0.000	0.072 0.000	-0.077 0.000	-0.021 0.029	0.046 0.000	0.038 0.000	0.004 0.698	0.000 0.975
Cr	**15**	0.032 0.002	-0.003 0.759	-0.017 0.170	0.052 0.000	0.027 0.007	0.039 0.000	0.012 0.233	0.001 0.925	0.021 0.038	-0.032 0.002
Foreign	**16**	-0.145 0.000	-0.046 0.000	0.116 0.000	0.064 0.000	0.147 0.000	0.045 0.000	-0.149 0.000	-0.001 0.903	-0.002 0.859	0.013 0.195
LegalRights	**17**	0.064 0.000	-0.009 0.373	0.192 0.000	0.076 0.000	0.096 0.000	0.044 0.000	0.012 0.249	0.012 0.246	0.071 0.000	-0.029 0.005
CreditInfo	**18**	0.031 0.002	-0.012 0.235	0.166 0.000	0.016 0.105	0.050 0.000	0.059 0.000	0.019 0.059	0.016 0.097	0.045 0.000	-0.003 0.756
Pubcreg	**19**	0.050 0.000	0.039 0.000	0.013 0.313	0.078 0.000	-0.017 0.096	-0.018 0.065	0.060 0.000	-0.023 0.022	0.019 0.059	-0.037 0.000
Privcbr	**20**	0.206 0.000	0.045 0.000	0.147 0.000	0.037 0.000	0.036 0.000	-0.019 0.061	0.136 0.000	0.050 0.000	0.065 0.000	0.054 0.000
GDPpcppp	**21**	0.003 0.757	-0.012 0.240	0.023 0.070	0.154 0.000	-0.056 0.000	-0.005 0.588	0.066 0.000	0.009 0.355	0.073 0.000	0.058 0.000
		11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Qualcert	**11**	1.000									
Overdraft	**12**	0.021 0.035	1.000								
City	**13**	0.140 0.000	0.124 0.000	1.000							
Brpc	**14**	0.100 0.000	0.028 0.005	0.060 0.000	1.000						
Cr	**15**	0.034 0.001	-0.010 0.307	-0.062 0.000	-0.040 0.000	1.000					
Foreign	**16**	-0.076 0.000	-0.118 0.000	-0.158 0.000	-0.128 0.000	-0.004 0.661	1.000				
LegalRights	**17**	0.054 0.000	0.023 0.023	0.029 0.006	-0.170 0.000	0.363 0.000	0.237 0.000	1.000			
CreditInfo	**18**	0.029 0.004	-0.099 0.000	0.090 0.000	-0.080 0.000	-0.202 0.000	0.120 0.000	0.530 0.000	1.000		
Pubcreg	**19**	0.097 0.000	0.008 0.404	0.033 0.001	0.009 0.371	0.143 0.000	-0.233 0.000	0.186 0.000	-0.224 0.000	1.000	
Privcbr	**20**	0.120 0.000	0.091 0.000	0.187 0.000	-0.058 0.000	0.033 0.001	-0.337 0.000	0.270 0.000	0.112 0.000	0.298 0.000	1.000
GDPpcppp	**21**	0.064 0.000	-0.155 0.000	0.044 0.000	0.203 0.000	0.188 0.000	0.179 0.000	-0.144 0.000	-0.021 0.037	0.037 0.000	-0.132 0.000

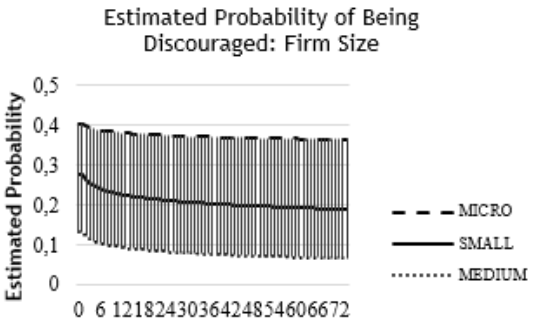
Appendix 4.3. Incremental variances of the estimated probability of being discouraged for a unit change of *Cr* above the mean

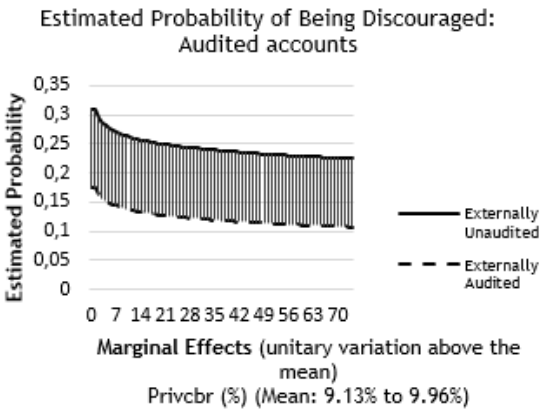


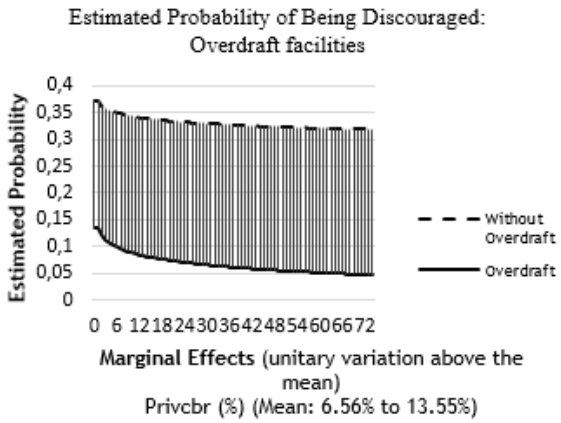
Appendix 4.4. Incremental variances of the estimated probability of being discouraged for a unit change in *LegalRights* above the mean

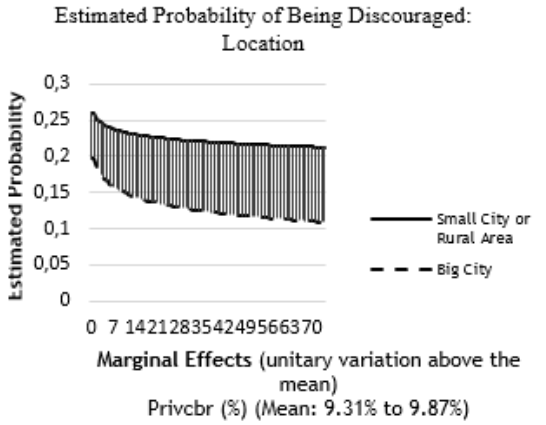


Appendix 4.5. Incremental variances in the estimated probability of being discouraged for a unit change of *Privcbr* above the mean

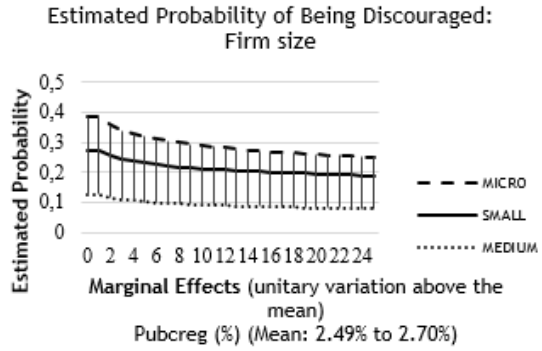


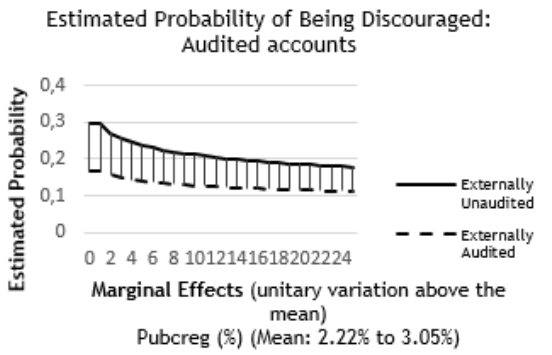


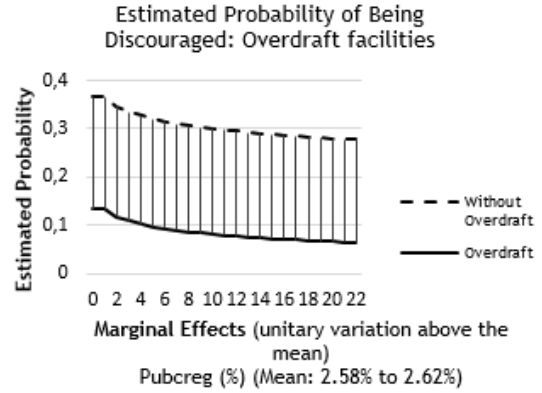


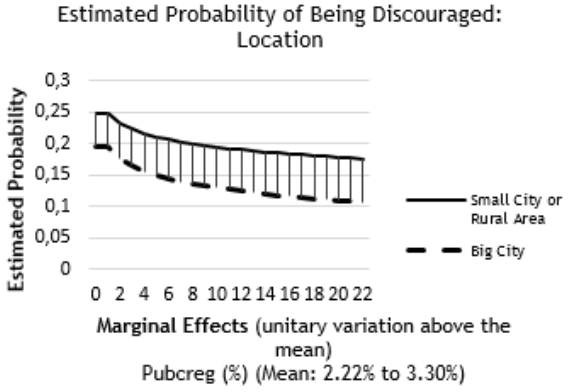


Appendix 4.6. Incremental variances of the estimated probability of being discouraged for a unit change of *Pubcreg* above the mean

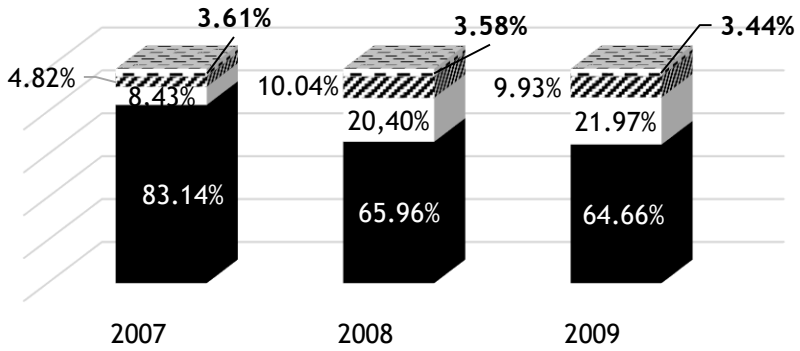








Appendix 4.7. Identifying discouraged borrowers - Stratification



- Discouraged by fear of rationing
- Discouraged given the complexity of loan application procedures
- Discouraged given the loan price
- Loan Applicants