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Competition and financial constraints: A two-sided story ☆

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ABSTRACT

This paper examines the relation between competitive pressure and financial constraints using firm-level survey data from 27 emerging economies of Eastern Europe and Central Asia for the years 2005 and 2009. In the empirical analysis, we disentangle the impact of product market competition on the demand and supply of credit. Our results support the hypothesis that competitive pressure on borrowers affects both sides of the credit market. We find that in industries with greater competitive pressure firms' demand for credit is typically higher but a greater proportion of firms are discouraged from loan application due to greater cost of credit. Interestingly, we find the detrimental effect of competitive pressure on credit access breaks down when firms are audited, when they can pledge collateral and when they engage in export activities. These results point to the role of competitive pressure in the lenders' information set when limited information is available.

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1. Introduction

Starting with the seminal work of Akerlof (1970) on asymmetric information, and that of Stiglitz and Weiss (1981) on credit rationing, a large body of the financial literature has shown that financial frictions can lead to credit market failures with distortions in the price mechanism. In a frictionless economy, the flow of funds would move from the least profitable project to the project with the highest net present value (NPV). In contrast, in the presence of asymmetric information, other firms' characteristics become important to determine if a project is viable and whether the firm would be able to obtain the necessary financing. Given the presence of information frictions, external funding is typically more expensive than internal funding, and factors like firm size, net worth and cash flow become of great importance.[1] A large body of the empirical literature has investigated whether large firms are less financially constrained than small and medium enterprises (SMEs).[2] A robust finding of this literature is that asymmetric information is especially detrimental for SMEs' access to credit, as these firms have generally low cash flow and net worth. In addition, new enterprises' lack of credit history and SMEs' insufficient collateral make it difficult for lenders to assess the creditworthiness of these firms and to mitigate their default risk. This often results in restricted access to credit (Beck and Demirguc-Kunt, 2006; Beck et al., 2011; Berger and Udell, 2006). This line of research has also shown that the development of a country's legal system and the depth of its financial market are important determinants of a firm's access to finance.[3] A survey of chief financial officers in the U.S., Europe, and Asia shows that asymmetric information may impose financial frictions even on creditworthy firms, forcing them to abandon valuable investment opportunities and to implement deep spending cuts (Campello et al., 2011).

A separate strand of the literature focuses on the level of competition in banking as a possible determinant of a firm's ability to access external finance; on this point the evidence is mixed. Petersen and Rajan (1994, 1995) find that higher concentration leads to easier access to credit. Based on survey data from 74 countries, Beck et al. (2004) find that in more concentrated credit markets, firms of all sizes face higher financing obstacles and the impact of concentration decreases with firm size. Combining multi-year, firm-level surveys with panel data for 53 countries, Love and Pería (2015) find that the link between access to finance and banking competition crucially depends on the institutional and economic environment. Finally, Zarutskie (2006) and Rice and Strahan (2010) both exploit the U.S. banking deregulation as a quasi-natural experiment with different results; while the former finds that banking competition discourages creditors from lending to young firms and more generally to firms with scarce credit history, the latter show that with more competition in the banking sector, small firms are more likely to borrow at lower rates.

Starting from this premise, the aim of this paper is to provide an answer to one question that has so far received little attention in the literature: whether there exists a relationship between a firm's ability to recruit external funds and the competitiveness of the economic environment in which it operates. This research question is particularly of interest in the context of emerging economies undergoing a process of market liberalization, through the removal of barriers to foreign and domestic competition. In an Arrow–Debreu setting with complete information, investors can perfectly predict the profitability of firms in a newly liberalized market, and the financial system would amplify the efficiency gains of the liberalization process. This is because the least efficient firms would have a lower probability of survival and a more restricted access to credit. On the contrary, in the presence of information asymmetries, the allocation of credit across firms might not reflect their efficiency, but rather their ability to pledge collateralizable assets. In the presence of information asymmetries, the financial

[1] The seminal work of Myers and Majluf (1984) shows how adverse selection in the credit market may generate a pecking order in a firms' financing choice with retained earnings favored over debt and debt over equity financing.

[2] Levine (2005) provides a comprehensive review of the empirical and theoretical evidence on the link between finance and growth.

[3] See e.g. Beck et al. (2005), Beck et al. (2008), Demirgüç-Kunt and Maksimovic (2002) and Demirgüç-Kunt and Maksimovic (1998).

market might not necessarily facilitate the allocation of resources toward the most productive firm, hence hampering the expected efficiency gains of the liberalization process.

The relationship between market structure and firms' finance can be driven by the interplay of both demand and supply factors. On the demand side, firms operating in a competitive industry may have greater need for external funding to innovate and to escape Schumpeterian selection. In addition, firms exposed to greater competition generally have lower markup and profits, which may generate insufficient retained earnings to internally finance current expenses and investment. On the supply side, lenders may attach a greater risk of default to firms that are more exposed to domestic and foreign competition. More specifically, firms operating in industries with fiercer competition have less pledgeable income and lower collateral.[4] The hypothesis that the competitive environment is a relevant factor for financial intermediaries' decisions to extend credit finds anecdotal support in the practices of the major rating agencies. An example is provided by the following excerpt from Fitch Ratings China (2012): "Industries that are in decline, highly competitive, capital intensive, cyclical or volatile are inherently riskier than stable industries with few competitors, high barriers to entry, national rather than international competition and predictable demand level". The effects of competition on lenders' behavior may be exacerbated in an environment where it is difficult or expensive to assess individual firms' prospects and where lenders rely more extensively on industry-level information such as openness to new competitors or the rate of technological change.

This study examines the relation between competition and credit access on a sample of firms operating in countries where incomplete protection of creditors' rights and the recent entry of foreign banks exacerbate information asymmetry between lenders and borrowers. We contribute to the literature in a number of ways. First, we provide evidence that a firm exposed to greater competitive pressure is more likely to report serious financial constraints. Second, we disentangle the differential impact of competitive pressure on a firm's need for credit and on the probability of getting a loan. Third, we examine the role of dissipative signals such as certification, collateral and export status in mitigating the effect of competitive pressure on firms' access to credit.[5] Our analysis is conducted on survey data from the Business Environment and Enterprise Performance Surveys (BEEPS), which covers 27,000 manufacturing and services firms from 27 transition economies of Eastern Europe and Central Asia.

The countries covered by BEEPS offer the ideal environment to study the relation between competition and financial constraints because the industrial transformation and the integration of these economies in international trade have largely occurred in the presence of less advanced financial systems and weaker institutions. Although foreign banks control a large proportion of the banking sector, the extension of credit to small and medium enterprises has been generally held back by slower institutional reform in the protection of creditors' rights and in the creation of credit registries (EBRD, 2006). As a result, during the last decade these economies have experienced substantial variations in the intensity of competitive pressure, while all presented insufficient access to credit, especially for SMEs. As suggested by Carlin et al. (2004), the main advantage of studying transition economies is that their competitive environment has been largely shaped by exogenous policies implemented during the early stages of the liberalization process. Hence, these economies approximate the desirable features of a large scale natural experiment, ideal to test the effects of competition on firm behavior. Since our study refers to later stages of the transition process, the 'natural experiment argument' might have been somehow weakened by the endogenous evolution of the competitive environment within industries, but it is still reasonable to assume that financial factors did not play a major role in shaping the competitive pressure at the industry level.

In addition, the inclusion of specific questions that allow us to distinguish between a firm's need and access to external financing makes BEEPS a unique resource to study financial constraints. These data have previously been used to investigate the relationship between access to credit and information sharing. For instance, Brown et al. (2009, 2011) study the role of inter-bank information sharing

[4] In the presence of transaction costs and incomplete contracts, the role of collateral has been highlighted by the theoretical literature on contract theory (e.g. Aghion and Howitt, 1992).

[5] The dissipative signal terminology is borrowed from Tirole (2006, p. 249).

and firm access to finance, and Popov and Udell (2012) study the sensitivity of credit supply to financial frictions arising from the institutional environment in which banks operate. Our work is closely related to the study of Valta (2012). In that study, the author infers a causal relationship between product market competition and cost of credit. Our paper is also tangential to the literature on how a firm's optimal financial structure is affected by industry-level factors. For instance Chava and Jarrow (2004) and Huang and Lee (2013) show that default and credit risks are affected by industries' characteristics.

The reminder of the paper proceeds as follows. Section 2 describes the data and presents some suggestive evidence of a relationship between competitive pressure and financial constraints. Section 3 outlines a two-stage model to separate the role of credit demand and supply. Section 4 explores the hypothesis that the relationship between financial constraints and competitive pressure is moderated by a firms' ability to signal its creditworthiness. Section 5 describes a series of robustness checks. Section 6 concludes.

2. Data and preliminary analysis

The analysis is conducted on data from the Business Environment and Enterprise Performance Surveys (BEEPS), which covers the transition economies of Eastern Europe and Central Asia.[6] BEEPS data were collected through face-to-face interviews with the executives of the sampled firms. BEEPS include a rich set of information about firms' characteristics such as origin, ownership structure, number of employees, sales in the previous fiscal year, age, and export status that can be used to control for firm-level heterogeneity in cross-sectional models. The key variables of interest are based on the survey questions concerning firms' access to credit and the need for external financing. The wording of these questions change across survey waves; hence, we decide to use only the 2005 and 2009 waves of BEEPS to increase the comparability of these information across waves.

Our dataset includes 19,136 observations from 27 countries, where the number of firms from each country is proportional to the size of the economy.[7] Table 1 breaks down the dataset by survey wave, country, firm's age and size. Firms with less than 20 employees constitute the largest size group accounting for over the 45% of the sample. Most of the firms in the sample (i.e., 85%) are relatively young as they have been operating for less than 20 years at the date of the interview. Hence, our sample over-represents small and young companies that are more likely to face binding financial constraints.

One of the variables that are both present in the 2005 and the 2009 waves of BEEPS measures the extent to which access to external financing is considered as an obstacle for a firm's current operations and future growth. We rename this categorical variable *Access*. It takes values ranging from 1 to 4, where the lowest and the highest values respectively indicate the least and most serious financial constraints.[8] Despite the measurement error due to the subjective evaluation of the interviewees, this self-reported measure of financial constraints is useful to identify firms that have difficult access to credit. BEEPS also includes a set of indicators that capture different aspects of the competitive environment: *CostDom* and *CostFor* respectively measure the importance of domestic and foreign competition on firms' decisions to reduce production costs. *ProdDom* and *ProdFor* gauge competitors' influence on firms' efforts to develop new goods and services. These variables take four possible values ranging from 1 to 4, where 4 corresponds to the highest level of competitive pressure on the firm.[9]

[6] This survey is a joint initiative of the European Bank of Reconstruction and Development (EBRD) and of the World Bank Group, and it was implemented to assess the barriers encountered by firms. The first wave of surveys was conducted in 1999/2000 and the fourth and last one in 2008/2009. The survey questionnaire changed over time, and not all the variables are comparable across waves.

[7] The survey sample in BEEPS is stratified by country, industry and region to enhance its representativeness across multiple dimensions. In our sample, only the 15% of firms was interviewed in both years, hence we decided to exploit the cross-section rather the panel dimension.

[8] Table A1 in the Appendix reports the wording of the relevant questions and the coding of the possible answers.

[9] Table A3 in the Appendix shows the distribution of firms with different legal status, size and age across different categories of the variables *Access*, *CostDom*, and *CostFor*. Over the whole sample, about 48% of firms report that access to finance is a moderate (*Access* = 3) or a serious (*Access* = 4) obstacle to their current operations and growth. In addition, over the 60% of firms identify domestic competition as a fairly important (*CostDom* = 3) or very important (*CostDom* = 4) factor in inducing further reductions of the production costs. Competitive pressure on production costs appears to be relatively stronger on private, smaller, and younger enterprises. In contrast, foreign competition appears to be a less important factor in driving down production costs with less than 50% of firms reporting this to be a fairly important (*CostFor* = 3) of very important (*CostDom* = 4) factor.

Table 1
Breakdown of sample by country, survey wave, firm age and size.

	Survey wave		Age			Size		
	2005	2009	Young	Mid-age	Mature	Small	Medium	Large
Albania	204	54	27	215	16	143	88	27
Armenia	351	374	114	513	98	408	219	98
Azerbaijan	350	380	58	528	144	323	271	136
Belarus	325	273	59	431	108	254	200	144
Bosnia	200	261	33	364	164	240	191	130
Bulgaria	300	288	21	473	94	318	163	107
Croatia	236	104	7	248	85	182	85	73
Czech Republic	343	250	47	497	49	307	156	130
Estonia	219	273	21	426	45	233	148	111
FYROM	200	366	49	403	114	264	191	111
Georgia	200	373	59	439	75	292	197	84
Hungary	610	291	58	739	104	428	286	187
Kazakhstan	585	544	159	897	73	433	419	277
Kyrgyz	202	235	23	322	92	183	167	87
Latvia	205	271	33	408	35	222	126	128
Lithuania	205	276	34	394	53	211	150	120
Moldova	350	363	70	592	51	292	261	160
Montenegro	18	116	8	110	15	71	43	19
Poland	975	533	69	1062	377	821	369	240
Romania	600	541	63	973	105	439	387	315
Russia	601	1251	167	1371	319	531	537	537
Serbia	282	388	55	421	195	300	178	193
Slovakia	220	275	45	402	48	224	143	127
Slovenia	223	76	13	341	145	240	129	130
Tajikistan	200	360	91	356	113	248	220	92
Ukraine	594	851	150	1048	247	655	467	323
Uzbekistan	300	366	46	470	150	302	213	151
Total	9098	10,038	1579	14,443	3114	8564	6004	4237

Note: The table reports the number of firms falling within different country-age, and country-size cells. Young, Mid-age and Mature refer to firms that were created up to 5 years, between 5 and 20 years, and over 20 years before the survey date, respectively. Small, Medium and Large refer respectively to firms with a number of permanent employees that is less or equal to 20, greater than 20 but smaller than 100, and greater than 100.

Table 2
Explained variance of the main variables.

	Access	CostDom	CostFor	ProdDom	ProdFor
Country	0.039	0.061	0.070	0.058	0.063
Time	0.012	0.002	0.000	0.004	0.000
Industry (ISIC 3-digit)	0.014	0.013	0.071	0.012	0.070
Country-time	0.076	0.071	0.083	0.067	0.074
Industry-time	0.024	0.017	0.078	0.018	0.073

Note: The table reports the adjusted $R2$s obtained by regressing each variable in columns on different sets of dummy variables corresponding to the dimensions of the database reported in rows.

Our dataset is multidimensional as it includes firms from different countries, industries, and surveyed in two different years. It is therefore necessary to understand which single dimension explains most of the variations in the self-reported indicators of access to credit and competitive pressure. Table 2 reports the adjusted $R2$ obtained by regressing the indicators of financial access and competition on different sets of dummies capturing respectively country, time, industry, and country–time fixed effects.[10]

[10] Industries are defined at the 3-digit level of ISIC aggregation.

The cross-country dimension explains individually the greatest share of the variance in *Access* (3.9%), *CostDom* (6.1%), *CostFor* (7%), *ProdDom* (5.8%), and *ProdFor* (6.3%). Country–time fixed effects have a more explanatory power than country fixed effects as the *R*2s of the regressions with this set of dummies are significantly larger. This evidence suggests that between 2005 and 2009, firms in different countries experienced a different evolution of the competitive and the financial environment.

However, none of the dimensions reported in Table 2 individually explains more than 8.5% of the variance of the variables of interests, confirming that firm-level variations dwarf differences across countries, time, and industries. The limited importance of the cross-country dimension suggests that country-level policies or macroeconomic factors may have had a very different impact on access to finance and on the competitive pressure of individual firms. Instead, the relatively small contribution of industry dummies may suggest that 3-digit ISIC industries are not disaggregated enough to capture most of the technological aspects that affect financial constraints (e.g., dependence from external finance), or the fact that these aggregations imperfectly identify groups of firms competing among each others. The predominant firm-level component in the variation of these variables, confirms that firm-level measures of financial constraints and competition capture more fine-grained aspects than are missed by adopting industry-level measures.[11]

The self-reported indicators of domestic competition *CostDom* and *ProdDom* have a strong pairwise correlation in the sample (0.71), and the same happens for the indicators of foreign competition *CostFor* and *ProdFor* (0.81). These strong correlations anticipate some difficulties in separately identifying the effects of competitive pressure on costs and products in econometric models. Therefore, this information is aggregated to create two indices of domestic and foreign competition that are used when high collinearity inflates the variance of the estimates:

$$CompDom = \frac{(CostDom + ProdDom) - 2}{8 - 2}$$

$$CompFor = \frac{(CostFor + ProdFor) - 2}{8 - 2}$$

These indicators range from 0 and 1, where higher values are associated with 'tougher' competitive environments, where firms need both to reduce costs and innovate products to survive on the market.

3. Empirical analysis

The objectives of this section are twofold; first, we test whether firms operating in a tougher competitive environment are more financially constrained; second, we investigate whether this relationship is driven by the demand or by the supply of credit.

3.1. Competitive pressure and perceived financial constraints

We start our empirical analysis by investigating the relationship between self-reported measures of financial constraints and competitive pressure. To do so, we estimate Ordered Probit regressions on the categorical variable *Access*. Each regression includes a set of firm-level variables controlling for age, size, volume of sales, and export status. We also control for different types of firms by including separate dummies for privatized state-owned enterprises, firms that were private since their establishment, private subsidiaries of a formerly state-owned enterprises, joint ventures with foreign partners and for state-owned firms. All regressions include country-year and industry fixed effects; these dummies

[11] The tradeoff implicit in the use of firm-level variables based on survey questions is that part of their variation is due to the noise introduced by interviewees' subjective evaluation, or to the effect of firm-level factors affecting managers' perception of financial constraints and competition. When using these indicators in regression analysis, it is therefore necessary to control for firm-level characteristics that are associated with higher probability to report more or less intense competition and financial constraints.

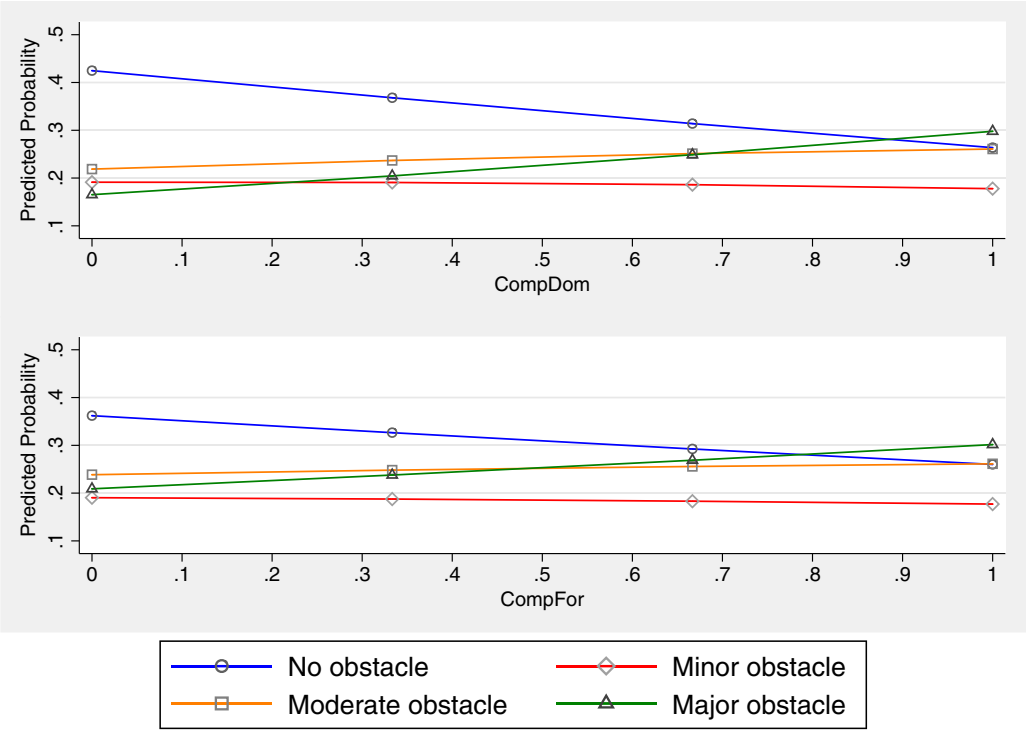

Fig. 1. Predicted probabilities of reporting different values of *Access*.
Notes: Conditional probabilities are estimated on the basis of the coefficients reported in column (1) of Table A4 in the Appendix. Probabilities are calculated for SME, private from the start-up, with individual local ownership and that do not export directly. Each line refers to plots the probability of reporting a particular severity of financial constraint conditional on a particular level of competitive pressure. The financial constraint variable is *Access* that evaluates the extent to which access to credit is an obstacle for firms' growth and current operations.

account for time invariant or slow changing country and sector characteristics, such as political regime and quality of institutions. Naive regressions suggest that, after controlling for a standard set of firm-level observable factors and fixed-effects, the toughness of the competitive environment is positively correlated with a firm's probability of facing financial constraints.

The upper panel of Fig. 1 plots the predicted probabilities associated to each level of *Access* (y-axis) conditional on domestic competitive pressure (x-axis). More specifically, conditional probabilities are obtained by plotting the marginal effects estimated by Ordered Probit on *Access*.[12] *Ceteris paribus*, the higher is the perceived level of competition, the higher is the probability that a firm reports access to finance as a major obstacle; specifically we see that the probability to report a *Major obstacle* increases from less than 20% to 30% when moving from the lowest to the highest level of competitive pressure. This shift is paralleled by a reduction from 40% to less than 30% in the probability associated with the *No obstacle* response. Moreover, we see that the proportion of firms reporting *Moderate obstacle* increases from about 20% to almost 30%; this result supports the idea that a higher proportion of credit constrained firms can be found in highly competitive markets. A similar pattern emerges in the lower panel graph, where *Access* is conditioned on *CompFor*. The comparison of the two graphs reveals that firms' access to credit declines faster in *CompDom* than in *CompFor*.

[12] Table A4 in the Appendix shows the regression output.

This preliminary analysis supports the hypothesis that tougher competition is associated with more serious financial constraints. Moreover, the data suggest that a firm's probability to be financially constrained tends to be especially affected by the level of domestic competition. Exposure to foreign competition is instead more important among larger firms with more internal resources that operate in foreign markets (e.g., Greenaway et al., 2007). These companies are possibly less affected by financial constraints than small companies operating mostly on the domestic market. Although, the cross-sectional nature of the analysis does not allow us to establish a direction of causality, these results hint at a strong relation between competition and financial constraints.

3.2. Demand or supply?

This section aims to disentangle the demand and supply factors that account for the positive and significant correlation between self-reported measures of competition and financial constraints that we reported in the previous section. More specifically, we test whether greater competitive pressure increases the need for credit, or whether it worsens access to finance.

In order to identify financially constrained firms, we first establish whether a firm needs credit from a financial institution. Neither the 2005 nor the 2009 questionnaires include a specific question on a firm's credit need. However, this information can be inferred from the answers to a series of other questions. We define those firms with a need for credit to be either those firms with a loan or those who applied for a loan. In the 2005 questionnaire, we identify firms with a loan as those answering positively to a question on whether they had to pledge collateral for their most recent loan (question *q*46*a*), while in the 2009 questionnaire, firms were directly asked whether they had a loan (question *k*8).

We then identify firms which are credit rationed. The first group is composed by firms that applied for a loan but that have been *Rejected* (question *q*47*a* in 2005 and *k*18*a* in 2009); the second set includes firms needing a loan but that did not apply because they were *Discouraged*. *Discouraged* firms are identified as those reporting one of the following reasons for not applying for a loan: the interest rate is too high, they do not expect to obtain a loan, the size or the maturity of the loan offered would be insufficient, they do not have sufficient collateral to pledge (question *k*17). If loan applications are costly and if the probability of obtaining a loan at favorable conditions is low, firms may decide not to apply for loans as a rational response to observed restrictions in the supply of credit (Jappelli, 1990). Thus, discouraged borrowers should be considered financially constrained.

Fig. 2 splits the sample according to our classification. In the regression analysis this classification is operationalized by introducing a series of dummy variables taking value one when a firm needs credit (*Need*), when a firm has a loan (*Loan*), when a firm unsuccessfully applied for a loan (*Rejected*), and when a firm was discouraged from applying for a loan by supply side factors (*Discouraged*). As suggested by Fig. 2, the dummy variables *Loan*, *Discouraged*, and *Rejected* can take value one only among those firms that we classify as in need of a loan. If competitive pressure affects credit demand, the selection into the estimation samples for the regressions on *Loan*, *Rejected*, and *Discouraged* is likely to be endogenous with respect to the key independent variables. As a consequence, the non-randomness of the sample would bias the estimates of the coefficients of interest.

Consistent estimates can be obtained by implementing Heckman probit models. These models are estimated by the maximum likelihood method, and they address sample selection by regressing simultaneously the 'selection' equation on the dichotomous variable *Need*, and the probit equation on the outcome of interest (i.e., either *Loan*, *Discouraged*, or *Rejected*) while allowing for correlation in the errors of the two equations. This approach allows us to identify the impact of competitive pressure on a firm's probability to have a loan, or to be financially constrained. This empirical strategy fits our main objective of disentangling the effect of competitive pressure on the demand and on the supply of credit.

In order to identify the different coefficient of the competition variables in the two equations, we need to select a set of variables that are excluded from the *outcome* equation but included in the *selection* equation. These variables should be selected among the factors that are related to a firm's credit needs but not to the supply of credit. We identify four variables that are likely to satisfy the

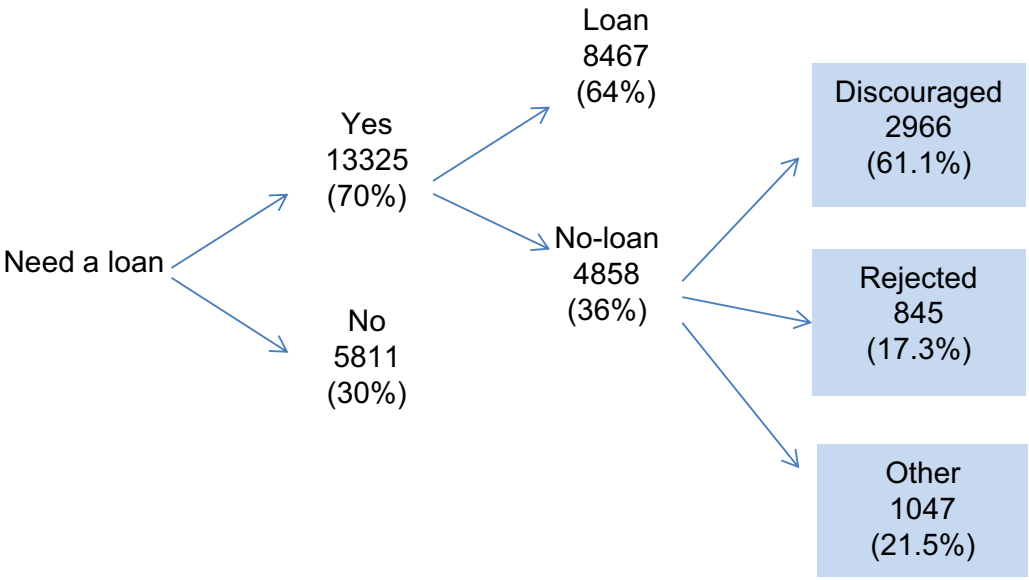

Fig. 2. Breakdown of the sample of firms by credit status.
Notes: Each node of the figure reports the number of firms providing the answer to the survey question and the percentage of respondents over the population of firms in the previous node. "Rejected" and "Discouraged" are highlighted as these nodes includes all firms that we consider as "Rationed".

exclusion restriction: *OverTax* and *OverUtil* take value one if the firm has overdue tax payments or overdue utility bills, respectively.[13] It is reasonable to assume that these two variables are positively related to negative idiosyncratic shocks to a firm cash flow, which increase a firm's demand for short-term credit. When a firm has an overdue payment, it is more likely to require some sort of short-term financing to face the wage-bill or just to continue normal operations. Nevertheless, a firm's overdue payments are not expected to affect the supply of credit, since this information is not easily acquired by financial institutions in opaque systems.[14]

Two additional variables excluded from the second-stage equation of the Heckman model relate to a firm's resort to trade credit or trade debit. The firms surveyed in the BEEPS are asked what percentage of their total annual sales is paid for before the delivery and also the percentage of total annual sales paid after delivery.[15]. Based on these information, *TradeDebit* takes value zero if the firm did not sell any item on debt in the last fiscal year; in our sample, about 48% of the firms report that they were paid either on or after delivery. Similarly, *TradeDebit* takes value one when the firm has provided some trade credit, here about 65% of firms report to provide customers with this form of finance. The literature has extensively shown that trade credit/debit is an important source for financing, and they are particularly attractive for financially constrained firms, even though trade credit is relative more expensive than short-term bank financing (Petersen and Rajan, 1997).[16] Thus, trade credit/debit is directly linked with a firm's shortage of liquidity and a firm's demand for credit.

[13] See Appendix for the wording of survey questions and response codes.
[14] A similar instrument is also used by Gorodnichenko and Schnitzer (2013).
[15] The wording of survey questions and the response codes are reported in the Appendix.
[16] Estimates by Petersen and Rajan (1997) suggest that the cost of trade credit is equivalent to a 40 per cent real interest rate. See also Atanasova (2007).

Results are presented in Table 3.[17] Overall, we find that the excluded variables are significantly correlated to the demand of credit; this provides support to our hypothesis that firms which are in need for liquidity can be identified by using overdue payments and supply credit. We proxy firm's size by sales, and we find that the coefficient on this variable is positive in the second stage equation; this is consistent with the hypotheses that large establishments have greater need for credit and are less likely to be either discouraged or rejected. The dummy variable *Audit* takes value one if the firm has been audited by an external agency in the last twelve months. As expected, a firm that is subject to external auditing has greater probability to secure a loan and lower probability to be discouraged. The variable is not statistically significant at the usual level of confidence in the regression on *Rejected*, but this is likely to be caused by the low number of firms reporting this outcome.

The estimates reported in columns 2 to 4 provide clear support to the hypothesis that domestic competition negatively affects the supply of credit, as we find a negative coefficient of *CompDom* in the regression on *Loan* and a positive coefficient in the regression on *Discouraged*, both of which are highly statistically significant. The results on rejection are statistically insignificant. This is likely the result of the small number of firms in this sub-sample; specifically only the 6% of firms declaring a need for loan are then declaring to be rejected by a credit institution. On the contrary, foreign competition appears related to a firm's greater need for financing but not with a firm's probability of having a loan, being discouraged or rejected. Indeed, the coefficient on *CompFor* is positive and significant in first-stage regressions on *Need*, but is insignificant in second-stage regressions. A possible explanation is that firms engaged in international trade are more exposed to foreign competition and hence a higher value is reported for this variable. These firms may indeed have higher need for external financing to cover the greater costs of foreign operations while having a relatively sounder financial situation that improve their access to credit. Alternatively, it is possible that competition in foreign markets is also more difficult to observe and therefore is less likely to be part of investors' information set.

4. The role of dissipative signals

Borrowing firms can mitigate information asymmetries by signaling their prospects to creditors. The aim of this section is to test whether the negative relationship between competition and access to credit still holds when borrowers provide signals of good performance and sound financial structure. More specifically, we test the effectiveness of three signaling devices: certification, export status, and collateral.

4.1. The role of certification

Theory suggests that a good borrower has an incentive to mitigate the investors' informational disadvantage arising from informational asymmetries. One possible solution to overcome the adverse selection is by increasing the information flow between the lender and the borrower. For example, the borrower may signal its creditworthiness by seeking external auditing generating hard information on a company's finances. The use of *hard information* as a solution to the asymmetric information problem could be particularly relevant in transitional economies where there may be a lack of transparency in company reporting and accounting standards, and lenders may be more risk averse (Brown et al., 2011). Consistently, it has been shown at the cross-country level that there is an inverse relationship between bank information sharing and access to finance (Brown et al., 2009, 2011). On the lenders' side, financial intermediaries can base their lending decisions entirely on the firms' creditworthiness rather than having to rely on sectoral information.

To test this hypothesis, we introduce in the specification of the Heckman Probit models an interaction between the variable of competition and the dummy *Audit* that takes value one if the firm had

[17] Results are qualitatively similar when *CompDom* and *CompFor* are simultaneously included in the model. Given the degree of correlation between the two forms of competition, we prefer to include these regressors separately.

Table 3
Competition, credit demand and supply.

	Loan or line of credit				Discouraged				Rejected			
	Domestic		Foreign		Domestic		Foreign		Domestic		Foreign	
Dependent:	Loan 2nd stage	Need 1st stage	Loan 2nd stage	Need 1st stage	Discouraged 2nd stage	Need 1st stage	Discouraged 2nd stage	Need 1st stage	Reject 2nd stage	Need 1st stage	Reject 2nd stage	Need 1st stage
Competition												
CompDom	–0.146***	0.293***			0.158***	0.298***			–0.109	0.301***		
	(0.050)	(0.050)			(0.060)	(0.05)			(0.090)	(0.050)		
CompFor			–0.054	0.203***			0.035	0.207***			0.036	0.209***
			(0.04)	(0.040)			(0.05)	(0.04)			(0.080)	(0.040)
Controls												
Sales	0.182***	0.069***	0.183***	0.065***	–0.206***	0.071***	–0.206***	0.067***	–0.047***	0.074***	–0.047***	0.070***
	(0.020)	(0.010)	(0.020)	(0.010)	0.020)	(0.010)	(0.020)	(0.010)	(0.020)	(0.010)	(0.020)	(0.010)
Excluded												
OverUtil		0.300***		0.263***		0.316***		0.278***		0.326***		0.290***
		(0.090)		(0.090)		(0.100)		(0.100)		(0.100)		(0.100)
OverTax		0.273***		0.292***		0.309***		0.327***		0.364***		0.380***
		(0.060)		(0.070)		(0.060)		(0.070)		(0.070)		(0.070)
TradeDebit		0.116***		0.113***		0.114***		0.112***		0.113***		0.110***
		(0.020)		(0.020)		(0.020)		(0.030)		(0.030)		(0.030)
TradeCredit		0.317***		0.324***		0.298***		0.308***		0.268***		0.283***
		(0.030)		(0.030)		(0.030)		(0.030)		(0.030)		(0.030)
ρ	–0.744		–0.730		0.484		0.442		–0.468		–0.439	
ρ (p-value)	0.000		0.000		0.003		0.015		0.023		0.042	
Obs.	12,844		12,466		12,844		12,466		12,844		12,466	
Censored	3610		3476		3610		3476		3610		3476	

Note: The table reports estimates from maximum likelihood Heckman Probit models on firms demand for credit (1st stages) and credit supply (2nd stages). Results are reported for three different models with the same 1st stage dependent variable expressing demand for credit (*Need*), that is a dummy = 1 if the firms need credit, but different 2nd stage dependent variables for credit supply: *Loan*, that is a dummy = 1 for firms that have a loan (columns 2–5), *Disc*, that is a dummy = 1 for firms that do not apply for a loan because discouraged (columns 6–9), *Reject*, that is a dummy = 1 for firms that apply for a loan but are rejected (columns 10–13). For each of these models, we run a specification investigating the impact of domestic competition (*CompDom*), and a specification looking at the impact of foreign competition (*CompFor*). For the interest of space we report only some of the firm-level controls included in both 1st and 2nd stage equations. Unreported controls include firms' current and 3-year before size (dummies for medium and large companies), age, legal status (dummies for SOE, JV foreign, and domestically owned private), country-year and industry (ISIC 3-digit) specific fixed effect. The set of regressors under the heading 'Excluded' are included only in the 1st stage demand equations. This includes: *OverUtil* and *OverTax* that are dummies for firms' overdue payments for utility bills and taxation, *TradeDebit* and *TradeCredit* that are respectively the amount of credit received by the company from suppliers and extended to consumers. The set of excluded instruments includes also the unreported dummies *denovo*, *jointv*, *prisoe*, *subsoe* that denote a firm's legal origin at the moment of its establishment, country-year and industry (ISIC 3-digit) fixed effect. ρ is the coefficient of correlation between the first- and the second-stage errors. S.E. are clusters at country-year level. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

its annual financial statements checked and certified by an external auditor during the previous fiscal year. Estimation results are reported in Table 4. The interaction coefficient in second-stage regressions is always negative and significant. This suggests that for audited firms, the level of domestic and foreign competition is irrelevant and does not determine access to credit. This evidence is consistent with the idea that lenders do not have to rely on *soft information*, such as the level of competition, when *hard information*, such as auditing, is available. The estimated coefficients of the controls and the exclusion restrictions are qualitatively and quantitatively similar to those estimated in Table 3.

4.2. International firms and financial constraints

In this section, we exploit a firm's export status to test whether the negative correlation between competitive pressure and access to credit is related to lenders' concerns about the sustainability of the borrower's debt in a tough domestic environment. A recent trade literature focusing on firms' heterogeneity has stressed how export status provides a strong signal about companies' current and future ability to survive in the domestic market, since only more capable firms select into exporting (e.g., Melitz, 2003; Melitz and Ottaviano, 2008). Hence, our hypothesis is that a firm's export status mitigates the detrimental effect of competitive pressure on access to credit *only if* this relation is explained by the higher probability of default for firms operating in competitive industries. We utilize export status as a signal of a firm's creditworthiness to better characterize the nexus between competition and financial constraints.

The starting point for this analysis is the Heckman selection model described in Section 3.2. Two modifications are now introduced on the right-hand side of the model to account for firm's export position. First, we include a dummy to capture a firm's export status (*exp3*); this takes value of 1 for those firms that exported part of their output directly three years before the survey date, and value 0 otherwise.[18] The major advantage of using a lagged variable for export is that it is less likely to be simultaneously determined by the probability to be discouraged (or rejected) in regressions. Indeed, our dependent variables, *Loan*, *Discouraged*, and *Rejected* refer to credit events occurred in the fiscal year before the survey date, while *exp3* refers to the export status of the firm three years before the survey date. Second, the variables capturing domestic and foreign competitive pressure (*CompDom* and *CompFor*, respectively) are included in the model interacted with *exp*3 and with $NOexp3 = 1 - exp3$. Hence, the coefficients of the terms $CompDom \times exp3$ and $CompFor \times exp3$ capture the correlation between competition and credit rationing for those firms that exported three years before the survey date. On the contrary, the coefficients on $CompDom \times NOexp3$ and $CompFor \times NOexp3$ capture the same correlation for non-exporters. By allowing the coefficients of *CompDom* and *CompFor* to differ between exporters and non-exporters, this design provides a test of whether export status improves credit access by providing a signal to financial intermediaries about firms' greater capacity to withstand competitive pressure.

The results from the two-step Heckman model are reported in Table 5. Second-stage regressions on *Loan*, *Discouraged*, and *Rejected* provide strong evidence that the positive relationship between competition, both domestic and foreign, and financial constraints holds for non-exporters but it does not hold for exporters. Therefore, export status is an effective strategy for firms that operate in competitive environments improving their access to financing.

4.3. The collateral channel

Extensive work has been conducted on the role of collateral as a key determinant of firms' borrowing capacity. For instance, Chan and Thakor (1987) show how borrowers who pledge collateral

[18] Out of 19,123 respondents, about 22% of firms report a value different from zero.

Table 4
Competition, credit demand and supply. Revealing information through auditing.

	Loan or line of credit				Discouraged			
	Domestic		Foreign		Domestic		Foreign	
	Loan 2nd stage	Need 1st stage	Loan 2nd stage	Need 1st stage	Discouraged 2nd stage	Need 1st stage	Discouraged 2nd stage	Need 1st stage
Competition								
CompDom	–0.251***	0.296***			0.239***	0.298***		
	(0.070)	(0.050)			(0.070)	(0.050)		
CompDom × Audit	0.243***				–0.205*			
	(0.090)				(0.110)			
CompFor			–0.138**	0.203***			0.100	0.206***
			(0.06)	(0.04)			(0.060)	(0.040)
CompFor × Audit			0.165*				–0.129	
			(0.09)				(0.090)	
Controls								
Sales	0.173***	0.068***	0.174***	0.064***	–0.198***	0.071***	–0.198***	0.067***
	(0.030)	(0.010)	(0.02)	(0.01)	(0.020)	(0.010)	(0.020)	(0.010)
Audit	0.004	0.022	0.091*	0.009	–0.051	0.014	–0.135*	0.007
	(0.070)	(0.030)	(0.05)	(0.03)	(0.080)	(0.030)	(0.060)	(0.030)
Excluded								
OverUtil		0.297***		0.259***		0.313***		0.275***
		(0.090)		(0.09)		(0.100)		(0.10)
OverTax		0.269***		0.288***		0.307***		0.325***
		(0.060)		(0.07)		(0.060)		(0.070)
TradeDebit		0.115***		0.112***		0.113***		0.112***
		(0.020)		(0.02)		(0.020)		(0.030)
TradeCredit		0.315***		0.324***		0.298***		0.308***
		(0.030)		(0.03)		(0.030)		(0.030)
ρ	–0.765		–0.757		0.490		0.449	
ρ (p-value)	0.000		0.000		0.004		0.015	
Obs.	12,844		12,466		12,844		12,466	
Censored	3610		3476		3610		3476	

Note: The table reports estimates from maximum likelihood Heckman Probit models on firms demand for credit (1st stages) and credit supply (2nd stages). Results are reported for three different models with the same 1st stage dependent variable expressing demand for credit (*Need*), that is a dummy = 1 if the firms need credit, but different 2nd stage dependent variables for credit supply: *Loan*, that is a dummy = 1 for firms that have a loan (columns 1–4), *Disc*, that is a dummy = 1 for firms that do not apply for a loan because discouraged (columns 5–8), *Reject*, that is a dummy = 1 for firms that apply for a loan but are rejected (columns 9–12). *Audit* takes the value of 1 if the firm has been audited during the last year. For the interest of space, we report only some of the firm-level controls included in both 1st and 2nd stage equations. Unreported controls include firms' current and 3-year before size (dummies for medium and large companies), age, legal status (dummies for SOE, JV foreign, domestically owned private). The set of regressors under the heading 'Excluded' are included only in the 1st stage demand equations. This includes: *OverUtil* and *OverTax* that are dummies for firms' overdue payments for utility bills and taxation, *TradeDebit* and *TradeCredit* that are respectively the amount of credit received by the company from suppliers and extended to consumers. The set of excluded instruments include also the unreported dummies *denovo*, *jointv*, *prisoe*, *subsoe* that denote a firm's legal origin at the moment of its establishment, country-year and industry (ISIC 3-digit) fixed effect. ρ is the coefficient of correlation between the first- and the second-stage errors. S.E. are clusters at country-year level. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Table 5
Exporters vs non non-exporters.

	Loan or line of credit				Discouraged				Rejected			
	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage
Competition												
CompDom × exp3	–0.038	0.259***			–0.016	0.260***			–0.249**	0.226***		
	(0.100)	(0.090)			(0.120)	(0.090)			(0.120)	(0.090)		
CompDom × NOexp3	–0.171***	0.319***			0.195***	0.325***			–0.061	0.350***		
	(0.060)	(0.060)			(0.060)	(0.060)			(0.110)	(0.050)		
CompFor × exp3			0.042	0.115			–0.056	0.111			–0.007	0.118
			(0.080)	(0.080)			(0.090)	(0.080)			(0.13)	(0.080)
CompFor × NOexp3			–0.118***	0.200***			0.092	0.205**			0.022	0.239***
			(0.050)	(0.050)			(0.060)	(0.050)			(0.07)	(0.050)
exp3	0.032	0.211***	0.053	0.170***	0.028	0.215***	–0.056	0.176***	0.149	0.273***	0.070	0.197***
	(0.090)	(0.070)	(0.080)	(0.060)	(0.110)	(0.070)	(0.090)	(0.060)	(0.100)	(0.070)	(0.080)	(0.060)
Controls												
Sales	0.170***	0.063***	0.172***	0.060***	–0.195***	0.065***	–0.195***	0.063***	–0.052***	0.069***	–0.053***	0.067
	(0.020)	(0.010)	(0.020)	(0.010)	(0.020)	(0.010)	(0.020)	(0.010)	(0.020)	(0.010)	(0.020)	(0.010)
Audit	0.154***	0.015	0.149***	0.010	–0.179***	0.015	–0.181***	0.009	0.068	0.010	0.068	0.003
	(0.040)	(0.030)	(0.040)	(0.030)	(0.040)	(0.030)	(0.050)	(0.030)	(0.050)	(0.030)	(0.050)	(0.030)
Excluded												
Overutil		0.301***		0.262***		0.318***		0.278***		0.336***		0.300***
		(0.090)		(0.090)		(0.100)		(0.100)		(0.100)		(0.100)
Overtax		0.269***		0.287***		0.307***		0.325***		0.376***		0.392***
		(0.060)		(0.070)		(0.060)		(0.070)		(0.070)		(0.070)
Tradedebit		0.108***		0.108***		0.108***		0.108***		0.096***		0.095***
		(0.020)		(0.020)		(0.020)		(0.030)		(0.030)		(0.030)
Tradecredit		0.310***		0.322***		0.293		0.306***		0.282***		0.297***
		(0.030)		(0.030)		(0.030)		(0.030)		(0.030)		(0.030)
Obs.	12,844		12,466		12,844		12,466		12,909		12,532	
Censored	3610		3476		3610		3476		3628		3494	
ρ	–0.760		–0.751		0.485		0.447		–0.407		–0.339	
ρ (p-value)	0.000		0.000		0.003		0.015		0.059		0.069	

Note: The table reports estimates from maximum likelihood Heckman Probit models on firms demand for credit (1st stages) and credit supply (2nd stages). Results are reported for three different models with the same 1st stage dependent variable expressing demand for credit (*Need*), that is a dummy = 1 if the firms need credit, but different 2nd stage dependent variables for credit supply: *Loan*, that is a dummy = 1 for firms that have a loan (columns 2–5), *Disc*, that is a dummy = 1 for firms that do not apply for a loan because discouraged (columns 6–9), *Reject*, that is a dummy = 1 for firms that apply for a loan but are rejected (columns 10–13). *exp3* assumes the value of 1 for those firms that exported part of their output directly three years before the survey date. *NOexp3* is equal to 1 – *exp3*. For the interest of space, we report only some of the firm-level controls included in both 1sth and 2nd stage equations. Unreported controls include firms' current and 3-year before size (dummies for medium and large companies), age, legal status (dummies for SOE, JV foreign, domestically owned private). The set of regressors under the heading 'Excluded' are included only in the 1st stage demand equations. This includes: *OverUtil* and *OverTax* that are dummies for firms' overdue payments for utility bills and taxation, *TradeDebit* and *TradeCredit* that are respectively the amount of credit received by the company from suppliers and extended to consumers. The set of excluded instruments include also the unreported dummies *denovo*, *jointv*, *prisoe*, *subsoe* that denote a firm's legal origin at the moment of its establishment, country-year and industry (ISIC 3-digit) fixed effect. ρ is the coefficient of correlation between the first- and the second-stage errors. S.E. are clusters at country-year level. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Table 6
Reasons for being *Discouraged*.

	Freq.	Percent
Application procedures are to complex	1086	29.11
Interest rates are not favorable	1275	34.17
Collateral requirements are too high	714	19.14
Size of loan or maturity are insufficient	113	3.03
It is necessary to make informal payment	54	1.45
Did not think it would be approved	162	4.34
Other	325	8.71
No response	2	0.05
Total	3731	100

Note: This table refers to question *k*17 in the BEEPS panel dataset.

are less subject to moral hazard; by sharing part of the risk, borrowers are prevented from increasing their expected return against lenders' interests. In addition, when lenders cannot identify *ex-ante* the risk embodied in borrowers' projects, collateral can be used as a device through which safer borrowers signal their nature to financial intermediaries (Manove et al., 2001). Starting from this premise, this section investigates whether a collateral channel exists, through which competitive pressure translates into more difficult access to credit. In other words, we test whether firms in more competitive industries are required to pledge more collateral to access affordable credit. Indeed, a collateral channel may explain the positive relationship between competitive pressure and discouragement from loan application.

We first describe the reasons for discouragement from loan application, as reported by firms' representatives when answering question *k*17.[19] Table 5 shows the number of firms reporting each of the possible reasons to be discouraged as a proportion of the respondents. The three main causes of discouragement are high interest rates (34.1%), complexity of application procedures (29%), and high collateral requirements (19.1%). While there is not any theoretical foundation to expect that domestic competitive pressure induces banks to adopt more complex procedures for loan applications, the link between competitive pressure, high interest rates, and collateral requirement can be rationalized with the argument that firms in highly competitive industries are riskier borrowers because they face greater probability of failure and greater uncertainty over future return. The positive relation between cost of credit and competition is supported by the results previously reported in Section 3.2, whereas the relation between collateral requirement and competitive pressure remains to be tested (Table 6).

The variable *Collateral* (i.e., collateral requirement as a proportion of the loan value, question *k*15) is regressed on *CompDom* and *CompFor* and on the set of firm-level controls previously used in the augmented model on *Access*.[20] However, since the values of *Collateral* are observed only for those firms that obtain credit, it is still necessary to correct for selection bias. As for before the first stage of the regression takes into consideration whether a firm needs external financing. The first-stage regression on *Need* maintains the same specification as previously used in section 3.2.

First, the model is estimated on the whole sample; Table 7 reports the first set of results.[21] When the model is estimated on the whole sample, firms exposed to the most intense level of domestic competition, *CompDom*, are found pledging collateral that covers on average 11.4% more of the loan value than firms exposed to the lowest level of domestic competition. In line with the previous evidence, we find that a firm's size and auditing enter positively in the first stage of the regression.

We then explore the role of the collateral by taking advantage both of the cross-firm and the cross-country dimensions of our dataset.[22] Table 8 reports estimates obtained by running the regressions on different samples. Because strong legal right enforcement is a prerequisite for a creditor's ability

[19] Answers to this question have been provided in both survey waves.
[20] As reported in column 1 of Table A4. See Appendix for the BEEPS question on collateral.
[21] The results show a large coefficient since the dependent variable is the value of the collateral required as a percentage of the value of the loan or line of credit.
[22] The analysis in this section ignores the role of foreign competition, given that it was found to be statistically insignificant in the previous sections.

Table 7
Collateral channel.

	Domestic		Foreign	
	Collateral 2nd stage	Need 1st stage	Collateral 2nd stage	Need 1st stage
Competition				
CompDom	11.431***	0.129***		
	(3.620)	(0.040)		
CompFor			4.302	0.105***
			(3.300)	(0.040)
Controls				
Sales	–1.279	0.183***	–1.415	0.282***
	–(1.420)	(0.010)	(1.440)	–0.02
Audit	–1.899	0.136***	–2.059	0.120***
	(2.55)	(0.030)	(2.58)	–0.03
Excluded				
Overutil		0.216***		0.194***
		(–0.070)		–0.070
Overtax		0.135***		0.147**
		(–0.070)		–0.070
Tradedebit		0.137***		0.131***
		(0.030)		(0.030)
Tradecredit		0.329***		0.331***
		(0.030)		(0.030)
λ	–14.012		–14.348	
S.E.	9.202		9.508	
Obs.	12,267		11,910	
Censored	6698		6452	

Note: The table reports estimates from two-step Heckman models on firms demand for credit (1st stages) and collateral value as % of the loan amount (2nd stages). The table reports separately estimates from models investigating the impact of domestic and foreign competition. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

to seize the collateral in case of a firm's default, we first run separate regressions for firms operating in countries with relatively stronger or weaker legal rights enforcement. Legal right enforcement is measured using the *Strength of legal rights index (0–10)* from the World Bank Doing Business Database. We classify countries with a value of the index above the sample median of 6 as those having a relatively higher score. We then estimate separate regressions for firms operating in countries adhering to the European Union. Lastly, we estimate separate models on the samples of smaller and larger firms. We find that domestic competition is associated with higher collateral requirements in countries with stronger legal right enforcement *(Legalrightsindex* > *6)*. This result is consistent with the argument made in the literature according to which the use of collateral is common only in those countries where creditors' rights are sufficiently protected to ensure that collateralized assets can be eventually seized by lenders (EBRD, 2006). Similar results are instead obtained for countries within or outside the EU. On the contrary, firm size is found to mediate the relationship between competition and collateral requirements, as we find that competitive pressure is associated with greater collateral requirements only among small companies.

The positive correlation between *CompDom* and *Collateral* supports the hypothesis that financial constraints are more severe when competition is intense. On one hand, financial institutions may require more collateral to accept loan applications from firms that operate in more competitive industries. On the other hand, even if investors do not impose minimum levels, entrepreneurs may still need to pledge relatively more collateral to obtain affordable credit. This process configures a vicious cycle for small firms; they are more dependent on debt financing for growth but at the same time they are also more vulnerable to competitive pressure than larger incumbents.[23] As a consequence, when banks

[23] This evidence is consistent with the model of Cooley and Quadrini (2001) where financial frictions higher mortality of young and small firms.

Table 8
Collateral channel heterogeneity.

	Legal > 6		Legal < 6		EU = 0		EU = 1		Size = 1		Size = 3	
	Collateral 2nd stage	Need 1st stage	Collateral 2nd stage	Need 1st stage	Collateral 2nd stage	Need 1st stage	Collateral 2nd stage	Need 1st stage	Collateral 2nd stage	Need 1st stage	Collateral 2nd stage	Need 1st stage
Competition												
CompDom	17.153***	0.096*	3.662	0.228***	9.967**	0.167***	13.416**	0.061	11.978*	0.001	8.423	0.187**
	(4.790)	(0.050)	(6.420)	(0.070)	(4.930)	(0.050)	(5.320)	(0.070)	(6.400)	(0.060)	(6.18)	(0.087)
Controls												
Sales	–2.000	0.162***	0.280	0.224***	–0.671	0.188***	–3.148	0.178***	4.993*	0.189	–2.073	0.154
	(1.800)	(0.01)	(2.59)	(0.02)	(1.890)	(0.010)	(2.110)	(0.02)	(2.840)	(0.020)	(2.08)	(0.02)
Audit	2.237	0.123***	–8.059*	0.085*	0.188***	0.113***	–0.040	0.164***	–2.673	0.141***	–4.273	0.270***
	(3.420)	(0.04)	(4.28)	(0.050)	(0.01)	(0.040)	(3.940)	(0.050)	(4.740)	(0.040)	(5.44)	(0.070)
Excluded												
Overutil		0.132		0.417***		0.103		0.359***		0.209*		0.107
		(0.090)		(0.130)		(0.090)		(0.110)		(0.110)		(0.140)
Overtax		0.102		0.212*		0.241***		–0.003		0.013		0.166
		(0.080)		(0.120)		(0.090)		(0.100)		(0.100)		(0.130)
Tradedebit		0.146***		0.141***		0.111***		0.187***		0.063		0.210***
		(0.040)		(0.050)		(0.040)		(0.040)		(0.040)		(0.060)
Tradecredit		0.350***		0.258***		0.336***		0.315***		0.369***		0.272***
		(0.040)		(0.050)		(0.040)		(0.050)		(0.040)		(0.070)
λ	–19.470		–8.872		–12.299		–28.416		12.372		–3.487	
S.E.	12.478		14.304		11.734		13.849		15.956		19.356	
Obs.	6674		4136		7200		5067		5718		2682	
Censored	3671		2158		4126		2572		3791		994	

Note: This table reports estimates from two-step Heckman selection models on firms demand for credit (1st stages) and collateral value as % of the loan amount (2nd stages). The table reports estimates obtained on separate sub-samples of the dataset. *Legal* > 6 and *Legal* < 6 are respectively samples of firms from countries below or above the median value of the World Bank Doing Business index of legal protection of property rights. *EU* = 1 and *EU* = 0 are respectively samples of firms from countries that are members and non-members of the European Union. *Size* = 1 and *Size* = 3 are samples including small and large firms only. For a description of the model specification refer to the notes of Table 3.
Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

Table 9
Estimates for 2005 and 2009.

		Loan		Discouraged		Collateral	
		2005	2009	2005	2009	2005	2009
CompDom	2nd stage	–0.143*	–0.148**	0.169*	0.140*	5.990	15.594***
	1st stage	0.396***	0.275***	0.311***	0.279	0.132**	0.124**
CompFor	2nd stage	–.026	–0.093*	0.022	0.050	–1.901	10.338**
	1st stage	0.263***	0.133***	0.268***	0.138***	0.165	0.038

Note: Refer to Table 3 for specifications in columns 2 to 4 and Table 7 for columns 5–6. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

sign debt contracts with small firms whose survival is threatened by competitors, they require higher interest rates or more collateral to insure themselves against borrowers' greater risk of default.

5. Robustness checks

All analyses have been conducted on a dataset that pools together observations for the years 2005 and 2009. To control for year-specific effects, we included a dummy variable taking value 1 in 2009 as a control. Arguably this strategy is insufficient to capture structural shifts in the parameters across the two periods. For instance, it is possible that a deterioration in credit supply during 2009 generates very different parameters from those describing credit relationships in 2005. It is therefore necessary to validate our results by repeating the analysis on individual year sub-samples. We estimate the two-stage model on data from years 2005 and 2009 separately; Table 9 reports the results.[24] In the two individual years, the relationship between the intensity of product market competition and credit demand and supply is qualitatively and quantitatively similar to those obtained on the pooled sample and reported in Table 3.

Because previous research highlights the role of banking competition on access to credit (e.g., Beck et al., 2004), it is possible that the results may be affected by variations in credit market competition. To account for this factor, we include further country-time specific controls on the right-hand side of the model. First, we introduce the Boone Index and the Banking Concentration Ratio as standard measures of competition in the banking sector.[25] In addition, because banking competition in the countries that we study is largely due to the penetration of foreign financial intermediaries, we conduct robustness checks controlling for the percentage of foreign bank assets over total bank assets. For completeness we also run a specification with the introduction of the GDP growth. Table 10 reports the estimated parameter on *CompDom* and *CompFor* when these controls are included in regressions.

Our main message still holds and does not appear to be influenced by the structure of the banking system. The degree of product market competition positively affects a firm's demand for credit while increasing the probability encountering financial constraints.[26]

[24] Full set of results not reported here to preserve space, but available upon request.

[25] These indicators are obtained from the Global Financial Development Database. The Boone index measures the degree of competition in the banking market based on profit efficiency. It is calculated as the elasticity of profits to marginal costs. An increase in the Boone indicator implies a deterioration of the competitive conduct of financial intermediaries. Bank concentration is instead measured as the assets of three largest commercial banks as a share of total commercial banking assets. Total assets include total earning assets, cash and due from banks, foreclosed real estate, fixed assets, goodwill, other intangibles, current tax assets, deferred tax, discontinued operations and other assets.

[26] The coefficient on foreign bank assets is statistically significant at the 10% on the first set of results. Even if the coefficient has the expected sign, i.e. more foreign competition increases the probability of firms being able to access finance; the magnitude of the coefficient deters us from drawing strong economic conclusions.

Table 10
Robustness checks: controlling for credit market structure and economic growth across countries.

Country-year control	Competition	Need	Loan	Discouraged
Boone Index				
	CompDom	0.246***	–0.154***	0.178***
	CompFor	0.208***	0.045	–0.042
Banking concentration ratio				
	CompDom	0.246***	–0.147***	0.168***
	CompFor	0.208***	0.038	–0.034
Foreign bank assets				
	CompDom	0.236***	–0.167***	0.202***
	CompFor	0.205***	0.024	–0.005
GDP growth				
	CompDom	0.264***	–0.194***	0.222***
	CompFor	0.201***	–0.029	0.269***

Note: Refer to Table 3 for full specifications. *Boone* is measure of degree of banking competition calculated by the World Bank. It is computed as the elasticity of profits to marginal costs. An increase in the Boone indicator implies a deterioration of the competitive conduct of financial intermediaries. *Concentration* is measure of degree of competition in the banking sector calculated by the World Bank. Assets of five largest banks as a share of total commercial banking assets. Total assets include total earning assets, cash and due from banks, foreclosed real estate, fixed assets, goodwill, other intangibles, current tax assets, deferred tax, discontinued operations and other assets. *ForeignBankAssets* is defined as the percentage of the number of foreign owned banks to the number of the total banks in an economy. A foreign bank is a bank where 50% or more of its shares are owned by foreigners. The variable is from the World Bank's Global Financial Development database. *GDP* is the growth rate of GDP for each country in our sample. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

6. Conclusions

This paper investigates the hypothesis that in relatively underdeveloped financial systems, the competitive environment plays an important role in lenders' information set when deciding upon firms' cost and access to financing. More specifically, we investigate whether greater need for financing and tighter access to finance concur to worsen the financial constraints experienced by firms operating in tough markets.

Evidence from transition economies, where financial frictions are exacerbated by relatively underdeveloped legal systems, suggests that financial constraints are more serious in the presence of fiercer competitive pressure. By disentangling the impact of competition on the demand and supply of credit, we support the hypothesis that competitive pressure on borrowers affects both sides of the credit market; demand for credit is higher in competitive industries but a greater proportion of firms are discouraged from loan application because of high collateral requirements and high cost of credit. This result can be explained by the fact that firms under greater competitive pressure are perceived as riskier borrowers. Indeed, the relation between competition and financial constraints is relaxed for firms that have their financial statements audited and for exporters whose international activity is a strong signal of their survival prospects on the domestic market (Bridges and Guariglia, 2008). Moreover, the results in this paper emphasize that the collateral channel plays a prominent role in the link between competitive pressure faced by the firms and discouragement from loans application.

From a policy perspective, our results suggest that policy measures aimed to address firms' financial constraints should be particularly targeted to those industries with greater competitive pressure, and that export promotion policies may have desirable indirect effects on firms' access to financing. Lastly, from the point of view of transition economies, liberalization policies that deepen domestic and foreign competition should be accompanied or preceded by interventions to reduce the cost of credit and to increase credit supply for small and medium enterprises.

Appendix

Table A1
Values assumed by the categorical variables.

Variable	Wording of survey questions and answers' codes
Financial constraints	
Access	QUESTION: Can you tell me how problematic is access to financing (e.g., collateral required) or financing not available from banks for the operations and growth of your business? ANSWERS: 1-No obstacle, 2-Minor obstacle, 3-Moderate obstacle, 4-Major obstacle. ANSWERS: 1-No obstacle, 2-Minor obstacle, 3-Moderate obstacle, 4-Major obstacle.
Competition	
CostDom	QUESTION: How would you rate the importance of the pressure from domestic competitors on key decisions with respect to reducing the production costs of existing products or services? ANSWERS: 1-Not important, 2-Slightly important, 3-Fairly important, 4-Very important.
CostFor	QUESTION: How would you rate the importance of the pressure from foreign competitors on key decisions with respect to reducing the production costs of existing products or services? ANSWERS: 1-Not important, 2-Slightly important, 3-Fairly important, 4-Very important.
ProdDom	QUESTION: How would you rate the importance of the pressure from domestic competitors on key decisions with respect to developing new products services and markets? ANSWERS: 1-Not important, 2-Slightly important, 3-Fairly important, 4-Very important.
ProdFor	QUESTION: How would you rate the importance of the pressure from foreign competitors on key decisions with respect to developing new products services and markets? ANSWERS: 1-Not important, 2-Slightly important, 3-Fairly important, 4-Very important.
Exclusion restrictions	
Overutil	Does this establishment currently have any payments overdue by more than 90 days with each of the following: ANSWERS: 1-Yes, 2-No.
Overtax	Does this establishment currently have any payments overdue by more than 90 days with each of the following: ANSWERS: 1-Yes, 2-No.
TradeDebit	In fiscal year […], what percent of this establishment's total annual sales of its goods or services were: ANSWERS: Paid for before the delivery?
TradeCredit	In fiscal year […], what percent of this establishment's total annual sales of its goods or services were: ANSWERS: Paid for after the delivery?
Collateral	
Collateral	Referring only to this most recent line of credit or loan, what was the approximate value of the collateral required as a percentage of the value of the loan or line of credit? ANSWER: Value of collateral as percent of loan/line of credit value.
Exporters	
exp	What percentage of establishment's sales were: ANSWER: direct exports

Table A2
Questions for *Need*, *Loan*, *Discouraged* and *Rejected*.

BEEPS 2005	
q46a	"*Thinking of the most recent loan you obtained from a financial institution, did the financing require collateral?*"
q47a	"If your firm does not currently have a loan, what was the reason?"
q47b	"If your firm did not apply for a loan, what were the main reasons?"
BEEPS 2009	
k8	"*Does this establishment have a line of credit or a loan from a financial institutions?*"
k17	"*Which is the main reason for not applying for a loan or a line of credit?*"
k18a	"*In fiscal year 2007, did this establishment apply for any new loans or new lines of credit that were rejected?*"

Table A3
Breakdown of the sample by firm type.

	Access				CostDom				CostFor			
	1	2	3	4	1	2	3	4	1	2	3	4
Legal origin												
Former SOE	32.75	18.45	22.96	25.83	18.93	19.37	32.07	29.63	45.40	18.34	18.76	17.51
Private	32.24	18.81	24.88	24.08	15.51	19.39	33.34	31.76	45.55	19.97	18.85	15.63
Subs. SOE	31.69	19.48	27.01	21.82	16.02	19.64	32.56	31.78	44.95	17.55	18.88	18.62
JV foreign	40.41	19.41	22.12	18.06	23.23	22.12	29.87	24.78	28.00	21.33	26.44	24.22
Size												
Small	32.62	18.46	24.47	24.46	16.67	19.75	32.24	31.34	51.73	18.51	16.32	13.44
Medium	32.14	19.44	24.46	23.96	16.14	19.12	33.46	31.28	44.59	19.76	18.84	16.81
Large	35.49	18.16	23.77	22.58	19.86	18.80	31.88	29.46	35.14	20.31	23.80	20.75
Age												
Young	31.39	20.29	24.65	23.66	19.69	19.49	32.24	28.58	52.17	20.00	16.59	11.24
Mid-age	33.21	18.79	24.3	23.70	16.38	19.68	33.06	30.88	45.76	19.55	19.00	15.69
Mature	31.78	17.88	23.98	26.36	19.00	18.14	31.17	31.70	40.65	18.97	19.58	20.80
Total (%)	32.83	18.77	24.28	24.13	17.07	19.42	32.69	30.82	45.45	19.50	18.90	16.15

Note: This table reports the percentage of firms reporting different levels of Access, CostDom and CostFor, by legal origin, size, and age.

Table A4
Competitive intensity and reported level of *Access*.

	(1)	(2)	(3)
	Access	Access	Access
CompDom	0.562***		0.484***
	(0.030)		(0.040)
CompFor		0.394***	0.271***
		(0.030)	(0.040)

Note: This table reports estimates from Ordered Probit regressions on *Access*. Unreported controls include firms' current and 3-year before size (dummies for medium and large companies), age, legal status, volume of sales, (dummies for SOE, JV foreign, domestically owned private), country-year and industry (ISIC 3-digit) specific fixed effect. Robust standard errors are reported in parentheses. Significance levels: * $p < .1$, ** $p < .05$, *** $p < .01$.

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