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Credit rationing and firm exports: evidence from developing countries

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Abstract

We study the relationship between credit constraints and export behavior using a large and heterogeneous sample of firms from about 70 developing countries between 2003 and 2014, following an instrumental variable approach that uses firm-level instruments, and measuring credit constraints by means of each firm's self assessment of whether it is credit rationed. We find robust evidence of a negative, statistically and economically significant effect of financial constraints on both the probability that a firm exports (the extensive margin of exports) and the share of exports over total sales (the intensive margin of exports).

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1. Introduction and related literature

Credit availability can have first order effects on firms' internationalization. To study this issue, we analyze the relationship between credit constraints and export behavior in a large sample of firms from about 70 countries. We find evidence of a negative effect of financial constraints on both the probability that a firm exports (i.e., the extensive margin of exports) and the share of exports over total sales (i.e., the intensive margin of exports).

The intuition behind the mechanism linking financial constraints and exports hinges on the fact that to sell their products abroad firms must pay relevant upfront costs. These costs can be of two types: Chaney (2013) stresses the importance of sunk and fixed costs, such as those related to customs and regulatory compliance or those required for establishing a foreign distribution network; Manova (2013) emphasizes instead the fact that international transactions require a larger amount of time to execute and the time span between the payment of upfront costs and the subsequent cash flows from selling products abroad is typically longer than that characterizing activities in the domestic market. In both cases, these upfront costs increase the working capital requirements of exporting firms with respect to domestic ones, and in turn their demand for external finance. As a result, better access to external finance increases the ability of firms to access export markets, affecting both the decision of entry (i.e. the extensive margin) and the volume of exports (i.e. the intensive margin).

Building on the seminal theoretical contributions of Manova (2013) and Chaney (2013), a growing body of empirical literature has analyzed the impact of financial conditions on exports. What is meant by financial conditions is rather heterogeneous: it ranges from a country's financial development (e.g., Manova, 2008), to firms' balance sheet characteristics (e.g., Greenaway et al., 2007), to self assessments by firm on whether they are credit constrained (e.g., Minetti and Zhu, 2011, or Wang, 2015).

Depending on the characteristics of the sample analyzed, the empirical literature can be broadly divided into three main groups. The first group includes single-country, firm-level analyses. Starting from the seminal contribution by Greenaway et al. (2007), who study a large sample of UK manufacturing firms, many authors have replicated and extended their analysis, including: Feenstra et al. (2013), Manova et al. (2011), Egger and Kesina (2014)) for China; Bellone et al. (2010) and Stiebale (2011) for France; Buch et al. (2010) and Wagner (2012) for Germany; Minetti and Zhu (2011) and Secchi et al. (2014) for Italy. The second group comprises cross-country, industry-level analyses, such as Manova (2008 and 2013). Finally, the third group includes a few papers using cross-country, firm-level data: Berman and Hericourt (2010), who studies a sample of firms from 9 developing and emerging countries; Fauceglia (2015) who studies a larger sample of 18 developing countries; and Wang (2015), who studies a larger sample of 26 East European and Central Asian countries. All these studies use data from the World Bank Enterprise Survey (WBES), that provides firm-level information for a large number of different countries, including a self-assessment by the firm on whether it is credit constrained.

With some caveats, the overall picture that emerges from the empirical literature confirms the predictions of the theoretical models of Chaney (2013) and Manova (2013), providing convincing evidence of a negative effects of the presence of financial constraints on a firm's propensity to

export. This suggests that to improve their export performance, countries need to improve their financial environments.

An important issue that has been emphasized in this literature is that firms' financial constraints and their exports behavior are jointly determined. Indeed, theoretical models typically show that the relationship between internationalization and the availability of external finance does not go in a single direction, but it is bilateral. In fact, one of the first empirical analysis in this field of research, Greenaway et al. (2007), looks at whether firms' internationalization reduces their credit constraints, focusing on a causation that goes in the opposite direction with respect to most of the following literature.

The presence of potential endogeneity problems hints at studying the effect of firm-level credit constraints using an instrumental variable approach. Minetti and Zhu (2011), for example, use characteristics of the local area where a firm operates as instruments for the probability that a firm declares to be credit constrained. Similarly, Wang (2015) uses country-level characteristics of the legal framework in his cross-country analysis.

Our paper provides two original contributions to the literature. First, it studies a larger and more heterogeneous sample of firms from about 70 developing countries between 2003 and 2014 with respect to previous papers. Second, it follows an instrumental variable approach using firm-level instruments. In particular, we argue that firms that are allowed to pay for purchases of material inputs or services after delivery, as well as establishments that are part of a larger firm, are less likely to be credit constrained than others. Delayed payment might involve a positive shock on internal firm's cash flow, a substitution of external investment finance and therefore, a lower probability of being credit constrained. In addition, Dinh et al. (2010) show that sales credit has a positive effect on firm's growth. The result is that firms that receive delayed payment are less credit risky from the point of view of the bank which is more willing to provide credit. On the other hand, whether a firm has a single establishment or multiple ones matters for firm growth, especially in the manufacturing sector (Dunne et al., 1989; Dinh et al., 2010). Moreover, multiple establishments firms might be considered in the same way as firms that are part of a group, that can access internal financial resources, reducing the use of external financing. This adds to the fact that we do not measure credit constraints through balance sheet characteristics, but using a more reliable measure provided by each firm's self assessment of whether it is credit rationed. We find robust evidence that the impact of credit rationing of firms' exports, at both extensive and intensive margins, is statistically and economically significant.

The rest of the paper is organized as follows. Sections 2 and 3 describe the data used in the empirical analysis and the empirical methodology adopted, respectively. Results of the econometric analysis are presented in Section 4. Section 5 concludes.

2. Data and summary statistics

To test the hypothesis stated in previous section, we adopt firm-level data drawn from the World Bank Enterprise Survey (WBES) and collect the available data for a sample of 68 developing countries, over the period 2003-2014.[1] We end up with about 23,416 observations on 22,694 firms. This means that the database includes only a small panel component of about 700 firms. Our analysis relies primarily on the pooled 2003-2014 data since it is hard to detect robust relationship with a small panel of heterogeneous firms, especially when we use many control variables (Gorodnichenko and Schnitzer, 2013).[2]

The WBES survey data includes the necessary information to construct the firms export performance, in terms of extensive and intensive margin, the credit rationing from financial institutions, the additional firm level control variables and the instrumental variables required to deal with the endogeneity of credit rationing.

The dependent variables are constructed from the percentage of total exports over the establishment's sales. The *extensive margin of exports* is defined by a dummy variable equal to 1 whether firm exports (directly or indirectly) at time *t* and zero otherwise, whereas the *intensive margin of exports* is the share of total exports over sales at time *t*.

WEBS collects information on self-reported measures of access to finance: "At this time, does this establishment have a line of credit or a loan from a financial institution?", "Did this establishment apply for any loans or line of credit?" and "What was the main reason why this establishment did not apply for any line of credit or loan in fiscal year? (application procedures for loans or line of credit are complex, interest rates are not favorable, collateral requirements are too high, size of loan and maturity are insufficient, did not think it would be approved, other)". These measures of financial constraints capture the problems firm faces when trying to finance investment. The main explanatory variable is constructed on the basis of these information. *Credit rationing* is, indeed, a binary variable that equals 1 if firm *i* faced credit rationing and 0 otherwise at time *t*: credit rationing incurs either whether (i) firm *i* applied for a loan, but did not receive it (*bank rationing*) or when (ii) firm *i* did not apply for a loan because of too stringent collateral, interest rate too high, expectation to be denied (*self rationing*).[3]

To address the endogeneity of credit rationing, we adopt two sets of instrumental variables, considering that the probability of being rationed is likely to be determined by the extent of credit risk of a firm, other firm attributes, and the supply side of credit market. The first set of instruments is motivated by information on shocks to firms' cash flow and internal funds which may affect the probability of being financially constrained. The WBES collects information on whether or not firms are allowed to pay for purchases of material inputs or services after delivery, which is

[1] The sample includes: Afghanistan, Albania, Angola, Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Cameroon, Chile, China, Colombia, Croatia, Czech Republic, DRC, Ecuador, Egypt, El Salvador, Estonia, Georgia, Ghana, Guatemala, Honduras, Hungary, Kazakhstan, Kenya, Kosovo, Kyrgyzstan, Latvia, Lithuania, Macedonia, Malawi, Mali, Mexico, Moldova, Mongolia, Montenegro, Nepal, Nicaragua, Nigeria, Pakistan, Panama, Paraguay, Peru, Poland, Romania, Russia, Senegal, Serbia, Slovakia, Slovenia, South Africa, Tajikistan, Tanzania, Turkey, Uganda, Ukraine, Uruguay, Uzbekistan, Venezuela, Yemen, Zambia.

[2] For simplicity, we use the term firms throughout the paper, though the analysis is based on establishment data.

[3] This definition of credit rationing excludes firms that received a bank loan and firms that did not demand for a loan because of no need.

reported as a response to exogenous shocks in cash flow.[4] *Credit purchases* is a variable indicating the percentage of purchase of material inputs or services paid for after delivery. In particular, we create three dummies indicating the percentile of the distribution of this variable and we use them to instrument for credit rationing. Furthermore, we know whether the establishment is part of a large firm or it is an independent one.[5] We therefore include as instrumental variable a dummy indicating whether a firm is an independent, single establishment, or not (*multi-establishment*). In what follows, we provide evidence that these instruments are unlikely to affect exporting activities but instead are reliable measures of exogenous shocks to the firms' financial constraints.

The paper also includes a set of control variables suggested by the literature (see, for example, Bernand and Jensen (2004) and Gorodnichenko and Schnitzer (2013)). WBES collects several firm level characteristics that are likely to affect export performance. First, we control for firm *size*, measured by the number of permanent full time employees and managers. Large companies have more resource to invest in exports. *Labour productivity* is measured by the share of total annual sales over the number of employee and is largely accepted in the literature as a determinant of exports (Melitz, 2003). Another firm-level characteristic affecting export is *age*, measured by the number of years since firm foundation, capturing firm experience. The *share of temporary employees* is measured by the number of full-time temporary employees over the total employment. The *share of skilled workers* is the share of permanent full-time employees that were skilled production workers. *Competition in national market* is measured by a dummy variable equal to 1 whether the main market in which the firm sold its main product is the national one and zero in case it is local or international. *Capacity utilization* reflects the output produced as a proportion of the maximum output possible if using all facilities available.

In terms of export performances, about 35% of firms in our sample exports, directly or indirectly, to foreign markets, showing an average export share of about 15%. Credit rationed firms represent about 23% of our sample. About 47% of firms has credit on purchases and about 13% of establishments are part of a larger firm.

Table 1 presents some descriptive statistics distinguishing between credit constrained and unconstrained firms. Constrained firms are less likely to export (23% vs. 39%) and they export a lower percentage of total sales (10% vs. 16%). As shown by the *t*-test, these performances are significantly different between the two groups of firms. Constrained firms are also smaller (58 vs 132 employees), slightly younger (19 vs 22 years), less likely to compete in national markets (6% less than unconstrained firms), with a lower capacity utilization (3% less than the unconstrained firms) and with a smaller probability of being part of a large firm (10% vs 14%). Most of the firms in the sample are single establishments (90% and 86% in financially constrained and unconstrained firms, respectively), while 10% and 14% are part of multi-establishment entities. Moreover, in the subsample of constrained firms the probability of showing a low percentage of purchases paid for after delivery is higher than in the subsample of unconstrained ones (48% vs 33%). Considering the second percentile of *credit purchases*, we notice that the two subsamples show the same probability

[4] The relative question is the following "What percentage, as a proportion of the value of total annual purchases of material inputs or services were paid for after delivery?".
[5] The WBES collects answers to the following question: "Establishment is part of a large firm?". The alternatives are: 1 if the answer is "yes" and 2 if the establishment is a firm on its own.

(31% vs 30%), while for very high percentage of credit purchases the probability is higher in the unconstrained group (22% vs 36%).

Table 2 presents the bilateral correlations. As expected, margins of trade are highly and positively correlated (0.69). Moreover, both margins are positively correlated with the number of employees (0.2) and the firm experience (0.15) meaning that larger and older firms are more likely to export and to export a higher percentage of sales than small and younger firms. Labour productivity slightly correlates with export performance (0.01), confirming also results reported in Table 1. Interestingly, the dummy variable for firms that are credit constrained shows a negative correlation with extensive and intensive margin of exports (-0.14 and -0.10), confirming our expectations that financially constrained firms export less. Credit rationing is also negatively correlated with firm size and age meaning that larger and younger firms are less likely of being credit constrained. Concerning our instrumental variables, the correlations show that the probability of credit rationing is lower for high percentages of purchases paid for after delivery and for those establishments that are part of a larger firm.

While descriptive statistics and bilateral correlations provide some preliminary evidence consistent with the hypothesis that credit constrained firms face stronger impediments to their export activity, they may indeed be due to some spurious effects. For example, smaller firms are at the same time more likely to be credit constrained and have a lower degree of internationalization. To control for these effects, as it is customary we now move to a more rigorous econometric analysis.

3. Empirical methodology

The empirical methodology adopted in this paper mirrors the one described in Minetti and Zhu (2011). We first examine the effect of credit constraints on the extensive margin of exports, that is, the probability of exporting. Under the assumption that ε_i is a normally distributed random error with zero mean and unit variance, the probability that firm *i* exports can be written as:

$$\begin{aligned}\Pr(Export_{ikct}=1) &= \Pr(\alpha_1+\beta_1 CR_{ikct}+\gamma_1 Z_{ikct}+\nu_k+\lambda_c+\eta_t+\varepsilon_{ikct}>0)\\ &= \Phi(\alpha_1+\beta_1 CR_{ikct}+\gamma_1 Z_{ikct}+\nu_k+\lambda_c+\eta_t)\end{aligned} \quad (1)$$

where *i* indexes for firm, *k* for sector of economic activity, *c* for country and *t* for year. In specification (1) the dependent variable $Export_{ikct}$ is equal to 1 if firm *i* exported at time *t* and zero otherwise. Our key explanatory variable, CR_{ikct} is a binary variable that equals 1 if firm *i* faced credit rationing and 0 otherwise at time *t*, as specified in previous section.

To deal with the omitted variable issue, we include Z_{ikct}, which is a vector of controls for firm characteristics that may affect exports: size, productivity, age, share of temporary and skilled workers, competition in national market and productive capacity. In addition, we include three sets of fixed effects: ν_k captures differences in relative prices that may result from differing sectoral factor prices or demand conditions, λ_c captures time invariant country-level characteristics, η_t

captures time shocks.[6] ε_{ikct} captures the unobserved firm attributes and any other unknown factor that may also affect exports.

As predicted by the literature (Manova, 2012; Chaney, 2013), when a firm faces credit rationing it may not have enough liquidity to cover the cost of entering a foreign market and may be less likely to export: we expect $\beta_1<0$. However, when estimating equation (1), credit rationing may be endogenous. The endogeneity arises from the possible correlation between the unobserved determinants of firm's export participation decision and the unobserved determinants of credit rationing (Minetti and Zhu, 2011).

We aim to find that with the help of firm-specific instruments described in the previous section we can successfully identify the negative impact of financial constraints for firms in transition economies. Equation (1) is first estimated as a linear probability model (LPM) and then using a probit model with binary endogenous regressors. In general terms, in a LPM the probability of observing a 0 or 1 is treated as depending on one or more explanatory variables, whose coefficients are estimated using least squares. A drawback of this model is that the estimated coefficients can imply probabilities outside the interval [0;1]. However, the OLS estimation of the LPM is attractive because it consistently estimates the parameters in the linear projection of the dependent variable on the explanatory variables (Wooldridge (2010), p. 563). A probit model is instead a binary classification model estimated using a maximum likelihood function. To deal with the endogeneity issue, we adopt a two-stage least squares regression model and an IV probit model.

The impact of credit rationing on the intensive margin of exports is estimated by the following equation:

$$y_i = \alpha_1 + \beta_1 CR_{ikct} + \gamma_1 Z_{ikct} + \nu_k + \lambda_c + \eta_t + \varepsilon_{ikct} \quad (2)$$

where y_i is the share of direct and indirect exports over total sales and other variables are defined as above. Equation (2) is estimated as a linear and tobit model, using instrumental variables for credit rationing. The dependent variable in equation (2) is a doubly truncated random variable: its values vary between 0 and 1 by definition. Moreover, this variable often takes the value of zero. A generally used approach to dealing with the problem of censored samples is the Tobit model. This model uses all the available information from the explanatory variables, including those for which the dependent variable is zero.

4. Empirical results

4.1 The extensive margin of exports and credit rationing

In this section, we present the results obtained estimating equation (1) on the extensive margin of exports. Estimated coefficients and standard errors are reported in Table 3. Our baseline sample includes 23,416 observations.

[6] As robustness checks, we also consider interaction fixed effects: μ_{ct} and δ_{kt} are country-time and sector-time dummies, picking up time varying determinants at country and industry level, respectively.

Columns 1 and 2 present the results of our investigation as to whether credit constrained firms are more or less likely to export than those that are not constrained in external financial resources. They report the results obtained estimating linear probability and probit models on the dummy for exports, including credit rationing and controlling for many firm-level characteristics. Coefficients of both estimation methods show the same signs and significance. We find that our variable of interest, *credit rationing*, has the expected negative coefficient in both specifications (-0.026 and -0.099, respectively) and is statistically significant at the 5% level. Consistent with previous literature, we do find that credit rationing binds the decision of export in foreign markets at firm-level. In terms of economic significance, marginal effects reported in column 3 reveal that, other individual characteristics being equal (for instance, size, age, productivity), the probability that a credit constrained firm exports is 2.7% lower than that of an unconstrained firm.

Some interesting findings concern our control variables. Our results reveal that larger, more productive and firm with a higher share of temporary workers are more likely to export. Looking at their marginal effect, the most influential characteristic is firm size, that helps to increase the export probability by about 13%. These results are consistent with most part of the literature showing that larger firms have more resources to face international activities.[9] On the other hand, firms whose main market of competition is the national one and those with a high share of skilled workers reduce their probability of exporting by 3.6% and 2.5%, respectively. Firm experience and capacity utilization seem instead irrelevant for the decision of exporting.

The R^2 in both specifications reveal that our explanatory variables account for about 30% of the variability of exporting probability, considering sector, country and year fixed effects.

The diagnostic tests (not reported) reveal that endogeneity of *credit rationing* is indeed an issue in our model. For this reason, we present the results obtained estimating equation (1) by the 2SLS and IV probit model. We use a dummy variable indicating whether the establishment is part of a larger firm and three dummies indicating the percentile of the distribution of the percentage of purchases paid for after delivery as instruments to *credit rationing*. In the first stage, we report the coefficients of our instruments on the endogenous variable, including other firm-level characteristics. In the second stage, we report the coefficient of our endogenous variable, instrumented in the first stage, again controlling for individual characteristics. These results are reported in columns 4-7, while marginal effects of the IV probit model are reported in column 8.

The first stage results of both linear and probit models (columns 5 and 7) reveal that being an establishment part of a larger firm exerts a negative impact on the probability of being credit constrained. This comes from the opportunity of relying on resources that are not external to the firm. Similarly, excluding the dummy for low levels of purchases paid for after delivery, we get a negative impact of the dummy for very high levels of sales credit on credit constraints.[10] Looking at the second stages results (columns 4 and 6), we get negative coefficients for credit rationing (-0.795 and -2.553, for 2SLS and IV probit, respectively) significant at the 1% level in both cases. This evidence confirm that a credit rationed firm is less likely to export than a firm that can rely on

[9] A positive relationship between firm size and export propensity has long been generally accepted (Wagner, 1995; Majocchi *et al*., 2005).
[10] The impacts of medium and low levels on credit rationing of sales credit are not statistically significant.

external resources to finance exporting activities. Testing the validity of instruments, we notice that they are quite good predictors of the endogenous variable for several reasons: (i) the Hansen test of overidentifying restrictions reveals that we cannot reject the joint null hypothesis that the instruments are valid instruments, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation and (ii) the *F*-statistic for the first stage of the instrumental variable linear model is 22.21, a value well above 10 meaning that our instruments are correlated with the endogenous regressors, but not weakly.

4.2 The intensive margin of exports and credit rationing

In this section, we present the results obtained estimating equation (2) on the intensive margin of exports. Estimated coefficients and standard errors are reported in Table 4. Our baseline sample includes 23,404 observations.

Column 1 reports the results obtained estimating the OLS model where the dependent variable is the share of exports over total sales, and the set of regressors including the dummy for credit rationing and a number of firm-level characteristics as controls. The coefficient of credit rationing is negative (-0.01) and significantly different from zero at the 10% level, confirming a negative effect of credit constraints also on the intensive margin of exports. Consistent with the trade literature and previous results on extensive margin, we find that larger and more productive are more likely to export, whereas firm experience and competition in national markets have negative effects on export intensity. Differently from the extensive margin, firms with a higher share of skilled workers export a lower percentage of sales. Similar to the extensive margin, the share of temporary workers positively affects the export decision. Finally, firm's age reduces the incidence of exports on total sales. These results are confirmed by the Tobit model in columns 2 and 3, that takes into account the fact that the dependent variable is censored between zero and 1. In terms of marginal effects, credit rationing reduces the share of exports by 4.9%.

As in the analysis of the extensive margin, there are reasons to believe that credit rationing is endogenous with respect to the share of exports over total sales. In columns 4 and 6 we report therefore the results of the 2SLS and IV Tobit estimates obtained instrumenting credit rationing by firm-level characteristics. The specification presented in columns 4 and 6 includes the level of each single instrument. In both specifications, the sign of the coefficient of the credit rationing dummy is negative and the impact is statistically significant. In addition, the coefficients of all other control variables are broadly unchanged. Finally, the *F*-statistic for the first stage regression and the Hansen test of overidentifying restrictions (22.36 and 0.7, respectively) confirm also in this case that our empirical model is correctly specified.

4.3 Sample splits

Tables 5-6 present the results of some sample splits. Table 5 presents the results of the impact of credit rationing on firms' export performance, distinguishing between small-medium and large firms, depending on the level of sales.

The striking result is that credit constraints have a significant impact on the probability of exporting (columns 1-4) in the case of small-medium firms (-1.028). For large firms credit rationing does not seem to be binding, even though the coefficient shows a negative sign (-0.130). While the difference in the statistical significance of the coefficients estimated in the two samples can be due to the smaller sample size in the case of larger firms, the coefficient of the regression for the extensive margin is not only estimated with less precision, but it is also smaller in size. On the contrary, in the case of the intensive margin, the coefficients of small-medium firms and large firms are similar in size, although the one obtained from the sample of larger firms is also in this case estimated with less precision, and it is not statistically significant. Overall, these results suggest that credit market conditions have a strong impact on the export performance of small and medium firms, since they generally face larger funding difficulties and that for them the fixed costs of accessing foreign markets can have a higher incidence over total revenues. These results are partly consistent with the issue that financing obstacles are more growth-constraining for small firms and they prevent all firms from reaching their optimal size. Small firms indeed finance a smaller share of their investment and working capital with formal financial sources than large firms (Beck and Demirguc-Kunt, 2006). Dihn et al. (2010), for instance, find evidence that a low level of financial sector development affects the firm size distribution and therefore contributes to the phenomenon of the "missing middle" in developing countries. In other words, financing constraints play a significant part in explaining the failure of small firms in developing countries to grow into medium-size or large firms.

Finally, we distinguish between different reasons of credit rationing. As argued in section 2, the WEBS collects information on self-reported measures of access to finance, distinguishing between firms that applied for a loan, but did not receive it (*bank rationing*) and firms that did not apply for a loan because of too stringent collateral, interest rate too high, expectation to be denied (*self rationing*). Indeed, the results presented in Table 6 confirm that that the impact of credit constraints on exports for bank credit rationing is similar to that for firms that did not apply for a loan.

5. Conclusions

We have analyzed the relationship between credit constraints and export behavior in a large sample of firms from about 70 countries, finding evidence of a negative effect of financial constraints on both the probability that a firm exports (i.e., the extensive margin of exports) and the share of exports over total sales (i.e., the intensive margin of exports).

Our analysis provides additional support to the literature, with two additional contributions. First, it studies a larger and more heterogeneous sample of firms than previous analyses. Second, it follows an instrumental variable approach using firm-level instruments. In addition, our evidence is based on a reliable measure of credit constraints provided by each firm's self assessment of its conditions.

The results of our multi-country firm level analysis show that credit constraints have a significant and sizeable effect on firms' export performance, even controlling for other firms characteristics and possible reverse causality. This confirms the results of influential country level analyses (e.g., Minetti and Zhu, 2011, and Feenstra et al., 2014), confirming that sound economic policies helping firm's access to credit can provide an important contribution to a country's export performance.

Table 1 – Descriptive statistics

	CR = 1				CR = 0					
Variable	**mean**	**sd**	**min**	**max**	**mean**	**sd**	**min**	**max**	**ttest**	
dummy export	0.23	0.4	0	1	0.39	0.49	0	1	23.56	***
export share	0.1	0.2	0	1	0.16	0.30	0	1	16.55	***
permanent full-time employees	58	176	0	3,000	132	454	0	26,000	2.33	***
labour productivity	14	64.3	0	455	13.8	85.1	0	493	-0.01	
firm age	19	16	1	146	22	18	1	210	12.55	***
share of temporary workers	0.12	0.2	0	1	0.10	0.20	0	1	-4.64	***
compete in national market	0.39	0.5	0	1	0.45	0.50	0	1	7.66	***
capacity utilization	0.71	0.2	0	1	0.74	0.22	0	1.05	8.06	***
share of skilled workers	0.54	0.3	0	1	0.49	0.27	0	1	-10.97	***
part establishment	0.1	0.3	0	1	0.14	0.35	0	1	8.64	***
du_1 credit purchases	0.48	0.5	0	1	0.33	0.47	0	1	-16.92	***
du_2 credit purchases	0.31	0.5	0	1	0.3	0.5	0	1	-0.49	
du_3 credit purchases	0.22	0.4	0	1	0.36	0.5	0	1	19.80	***

Notes: labour productivity is in billions.

Table 2 – Correlation matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	dummy export	1													
(2)	export share	0.69	1												
(3)	permanent full-time employees	0.20	0.17	1											
(4)	labour productivity	0.02	0.01	0.01	1										
(5)	firm age	0.15	0.01	0.19	0.05	1									
(6)	share of temporary workers	-0.01	-0.02	-0.04	0.01	-0.02	1								
(7)	compete in national market	0.03	-0.20	0.04	0.00	0.07	-0.03	1							
(8)	capacity utilization	0.06	0.06	0.07	0.00	-0.03	-0.06	0.04	1						
(9)	share of skilled workers	-0.03	0.06	0.01	0.00	-0.09	-0.07	-0.02	0.08	1					
(10)	CR	-0.14	-0.10	-0.08	0.00	-0.08	0.03	-0.05	-0.05	0.07	1				
(11)	part establishment	0.12	0.09	0.18	0.00	0.11	-0.01	0.04	0.06	-0.02	-0.05	1			
(12)	du_1 credit purchases	-0.14	-0.03	-0.04	-0.01	-0.13	0.01	-0.08	0.00	0.14	0.12	-0.04	1		
(13)	du_2 credit purchases	0.01	0.00	0.00	0.00	-0.01	0.01	0.05	0.01	0.01	0.00	-0.01	-0.50	1	
(14)	du_3 credit purchases	0.13	0.03	0.05	0.00	0.15	-0.01	0.03	-0.01	-0.14	-0.13	0.04	-0.53	-0.46	1

Table 3 – Extensive margin of exports and credit rationing

The table reports estimates of equation (1). Fixed effects for sector, country and year are included in all regressions. Interactions of fixed effects are not included. Robust standard errors are clustered by sector adopting the ISIC classification at 2-digits. *First stage F-stat. (p-value)* is the value of the *F* statistic (and p-value) for the hypothesis that instruments have jointly zero coefficients in the first stage regression. *Hansen test of overid. restrinctions (p-value)* is the value of the Hansen statistic (and *p*-value) for the overidentifying restriction test that excluded instruments are correctly excluded from the estimated equation. *Weak iden. Cragg-Donald F*-stat testing whether the excluded instruments are correlated with the endogenous estimators, but only weakly. ***, **, * denote significance at 0.01, 0.05 and 0.10 levels.

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	LPM		Probit				IV linear model				IV Probit					
			Coeff.		ME		Second stage		First stage		Second stage		First stage		ME	
credit rationing	-0.026	**	-0.099	**	-0.027	***	-0.795	***			-2.553	***			-2.553	***
	(0.01)		(0.04)		(0.01)		(0.11)				(0.70)				(0.70)	
permanent full-time employees (log)	0.138	***	0.464	***	0.126	***	0.107	***	-0.038	***	0.354	***	-0.038	***	0.354	***
	(0.01)		(0.02)		(0.00)		(0.01)		(0.00)		(0.03)		(0.00)		(0.03)	
labour productivity (log)	0.027	***	0.099	***	0.027	***	0.014	**	-0.015	***	0.059	***	-0.015	***	0.059	***
	(0.00)		(0.02)		(0.00)		(0.01)		(0.00)		(0.01)		(0.00)		(0.01)	
firm age (log)	-0.006		-0.018		-0.005		-0.010		-0.012	***	-0.030		-0.012	***	-0.030	
	(0.01)		(0.02)		(0.01)		(0.01)		(0.00)		(0.02)		(0.00)		(0.02)	
share of temporary workers	0.111	**	0.429	***	0.116	***	0.110	***	0.009		0.423	***	0.009		0.423	***
	(0.04)		(0.16)		(0.04)		(0.04)		(0.01)		(0.06)		(0.01)		(0.06)	
compete in national market	-0.047	**	-0.132	*	-0.036	*	-0.041	**	-0.001		-0.107	***	-0.001		-0.107	***
	(0.02)		(0.07)		(0.02)		(0.02)		(0.01)		(0.03)		(0.01)		(0.03)	
capacity utilization	0.012		0.037		0.010		-0.058	**	-0.086	***	-0.199	**	-0.086	***	-0.199	**
	(0.02)		(0.07)		(0.02)		(0.03)		(0.01)		(0.09)		(0.01)		(0.09)	
share of skilled workers	-0.021	**	-0.093	***	-0.025	***	0.030	***	0.055	***	0.078		0.055	***	0.078	
	(0.01)		(0.03)		(0.01)		(0.01)		(0.02)		(0.07)		(0.01)		(0.07)	
part establishment									-0.034	***			-0.034	***		
									(0.01)				(0.01)			
du_2 credit purchases									-0.008				-0.008			
									(0.01)				(0.01)			
du_3 credit purchases									-0.038	***			-0.038	***		
									(0.01)				(0.01)			
First stage *F*-stat (*p*-value)							22.21 (0.00)									
Overidentifying restrictions Hansen stat (*p*-value)							3.58 (0.17)									
Weak identification Cragg-Donald *F*-stat							13.45									
Observations	23,416		23,414				17,826				17,824					
R^2	0.3		0.26								0.17					

Table 4 – Intensive margin of exports and credit rationing

The table reports estimates of equation (2). Fixed effects for sector, country and year are included in all regressions. Interactions of fixed effects are not included. Robust standard errors are clustered by sector adopting the ISIC classification at 2-digits. *First stage F-stat. (p-value)* is the value of the *F* statistic (and p-value) for the hypothesis that instruments have jointly zero coefficients in the first stage regression. *Hansen test of overid. restrinctions (p-value)* is the value of the Hansen statistic (and p-value) for the overidentifying restriction test that excluded instruments are correctly excluded from the estimated equation. *Weak iden. Cragg-Donald F*-stat testing whether the excluded instruments are correlated with the endogenous estimators, but only weakly. ***, **, * denote significance at 0.01, 0.05 and 0.10 levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	Tobit		IV linear model		IV Tobit		
		Coeff.	ME	Second stage	First stage	Second stage	First stage	ME
credit rationing	-0.010 *	-0.049 **	-0.049 **	-0.234 **		-0.969 ***		-0.969 ***
	(0.01)	(0.02)	(0.02)	(0.11)		(0.31)		(0.31)
permanent full-time employees (log)	0.075 ***	0.215 ***	0.215 ***	0.063 ***	-0.038 ***	0.171 ***	-0.038 ***	0.171 ***
	(0.01)	(0.03)	(0.03)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)
labour productivity (log)	0.009 ***	0.042 ***	0.042 ***	0.006	-0.016 ***	0.027 ***	-0.016 ***	0.027 ***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)
firm age (log)	-0.032 ***	-0.059 ***	-0.059 ***	-0.031 ***	-0.012 ***	-0.058 ***	-0.012 ***	-0.058 ***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)
share of temporary workers	0.054 *	0.200 **	0.200 **	0.054 *	0.009	0.199 ***	0.009	0.199 ***
	(0.03)	(0.10)	(0.10)	(0.03)	(0.01)	(0.03)	(0.01)	(0.03)
compete in national market	-0.148 ***	-0.248 ***	-0.248 ***	-0.133 ***	0.000	-0.223 ***	0.000	-0.223 ***
	(0.02)	(0.04)	(0.04)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
capacity utilization	0.007	0.010	0.010	-0.020	-0.086 ***	-0.090 **	-0.086 ***	-0.090 **
	(0.01)	(0.04)	(0.04)	(0.02)	(0.01)	(0.04)	(0.01)	(0.04)
share of skilled workers	0.017 **	-0.010	-0.010	0.036 ***	0.055 ***	0.060 **	0.055 ***	0.060 **
	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.03)	(0.01)	(0.03)
multi-establishment					-0.034 ***		-0.034 ***	
					(0.01)		(0.01)	
du_2 credit purchases					-0.008		-0.008	
					(0.01)		(0.01)	
du_3 credit purchases					-0.038 ***		-0.038 ***	
					(0.01)		(0.01)	
First stage *F*-stat (*p*-value)				22.36 (0.00)				
Overidentifying restrictions Hansen stat (*p*-value)				0.7 (0.70)				
Weak identification Cragg-Donald *F*-stat				13.32				
Observations	23,404	23,404		17,819			17,819	
R^2	0.31	0.24					0.17	

Table 5 – Sample split by firm size

Columns (1)-(4) report estimates of equations (1) and columns (5)-(8) report estimates of equation (2), in both cases using LPM. Small-medium and large firms are defined depending on the level of sales. Fixed effects for sector, country and year are included in all regressions. Interactions of fixed effects are not included. Robust standard errors are clustered by sector adopting the ISIC classification at 2-digits. *First stage F-stat. (p-value)* is the value of the *F* statistic (and p-value) for the hypothesis that instruments have jointly zero coefficients in the first stage regression. *Hansen test of overid. restrinctions (p-value)* is the value of the Hansen statistic (and p-value) for the overidentifying restriction test that excluded instruments are correctly excluded from the estimated equation. *Weak iden. Cragg-Donald F*-stat testing whether the excluded instruments are correlated with the endogenous estimators, but only weakly. ***, **, * denote significance at 0.01, 0.05 and 0.10 levels.

	Extensive margin				**Intensive margin**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	small-medium firms		**large firms**		**small-medium firms**		**large firms**	
	IV linear model		IV linear model		IV linear model		IV linear model	
	Second stage	First stage	Second stage	First stage	Second stage	First stage	Second stage	First stage
credit rationing	-1.028 ***		-0.130		-0.352 ***		0.129	
	(0.19)		(0.19)		(0.12)		(0.18)	
permanent full-time employees (log)	0.098 ***	-0.031 ***	0.130 ***	-0.042 ***	0.060 ***	-0.031 ***	0.068 ***	-0.042 ***
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
labour productivity (log)	0.009	-0.013 ***	0.048 ***	-0.012 ***	0.002	-0.014 ***	0.019 ***	-0.012 ***
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
firm age (log)	-0.018 *	-0.015 **	0.001	-0.006	-0.027 ***	-0.015 **	-0.031 ***	-0.006
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
share of temporary workers	0.114 **	0.005	0.092 ***	0.014	0.064 **	0.005	0.033	0.015
	(0.05)	(0.01)	(0.03)	(0.01)	(0.03)	(0.01)	(0.03)	(0.01)
compete in national market	-0.044 **	-0.003	-0.039 *	-0.002	-0.108 ***	-0.003	-0.163 ***	-0.002
	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
capacity utilization	-0.081 **	-0.086 ***	-0.004	-0.085 ***	-0.026	-0.087 ***	-0.006	-0.085 ***
	(0.04)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
share of skilled workers	0.027	0.039	-0.011	0.072 ***	0.036 **	0.040	0.020	0.072 ***
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
multi-establishment		-0.046 ***		-0.015		-0.045 ***		-0.015
		(0.01)		(0.01)		(0.01)		(0.01)
du_2 credit purchases		0.002		-0.028 **		0.003		-0.028 **
		(0.01)		(0.01)		(0.01)		(0.01)
du_3 credit purchases		-0.029 ***		-0.053 ***		-0.029 ***		-0.053 ***
		(0.01)		(0.01)		(0.01)		(0.01)
First stage *F*-stat (*p*-value)	30.17 (0.00)		9.60 (0.00)		29.83 (0.00)		9.61 (0.00)	
Overidentifying restrictions Hansen stat (*p*-value)	3.90 (0.14)		3.66 (0.16)		1.65 (0.44)		3.00 (0.22)	
Weak identification Cragg-Donald *F*-stat	7.87		6.51		7.82		6.48	
Observations	10,866		6,960		10,861		6,958	

Table 6 – Sample split by reason of credit rationing

Columns (1)-(4) report estimates of equations (1) and columns (5)-(8) report estimates of equation (2), in both cases using LPM. *Bank rationing* includes the sub-sample of firms that applied for a loan, but did not receive it, while *self rationing* includes firms that did not apply for a loan because of too stringent collateral, interest rate too high, expectation to be denied. Fixed effects for sector, country and year are included in all regressions. Interactions of fixed effects are not included. Robust standard errors are clustered by sector adopting the ISIC classification at 2-digits. *First stage F-stat. (p-value)* is the value of the *F* statistic (and p-value) for the hypothesis that instruments have jointly zero coefficients in the first stage regression. *Hansen test of overid. restrinctions (p-value)* is the value of the Hansen statistic (and p-value) for the overidentifying restriction test that excluded instruments are correctly excluded from the estimated equation. *Weak iden. Cragg-Donald F*-stat testing whether the excluded instruments are correlated with the endogenous estimators, but only weakly. ***, **, * denote significance at 0.01, 0.05 and 0.10 levels.

	extensive margin				intensive margin			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	bank rationing		**self rationing**		**bank rationing**		**self rationing**	
	IV linear model		IV linear model		IV linear model		IV linear model	
	Second stage	First stage	Second stage	First stage	Second stage	First stage	Second stage	First stage
credit rationing	-1.583 **		-1.107 ***		-0.787 *		-0.289 **	
	(0.62)		(0.17)		(0.48)		(0.14)	
permanent full-time employees (log)	0.132 ***	-0.004 ***	0.100 ***	-0.034 ***	0.068 ***	-0.004 ***	0.062 ***	-0.033 ***
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
labour productivity (log)	0.028 ***	0.001	0.009	-0.016 ***	0.010 ***	0.001	0.005	-0.016 ***
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
firm age (log)	-0.011	-0.006 **	-0.007	-0.005	-0.033 ***	-0.006 **	-0.030 ***	-0.005
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
share of temporary workers	0.151 ***	0.031 ***	0.079 **	-0.022 ***	0.076 ***	0.031 ***	0.045 *	-0.022 ***
	(0.04)	(0.01)	(0.04)	(0.01)	(0.03)	(0.01)	(0.03)	(0.01)
compete in national market	-0.033 **	0.005	-0.047 **	-0.005	-0.130 ***	0.005	-0.135 ***	-0.005
	(0.02)	(0.00)	(0.02)	(0.01)	(0.02)	(0.00)	(0.02)	(0.01)
capacity utilization	-0.037	-0.030 **	-0.052 *	-0.056 ***	-0.024	-0.030 **	-0.016	-0.056 ***
	(0.04)	(0.01)	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
share of skilled workers	-0.018	-0.002	0.050 ***	0.057 ***	0.022 **	-0.002	0.040 ***	0.057 ***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
multi-establishment		-0.012 ***		-0.022 ***		-0.012 **		-0.022 ***
		(0.00)		(0.01)		(0.00)		(0.01)
du_2 credit purchases		0.003		-0.012		0.004		-0.012
		(0.00)		(0.01)		(0.00)		(0.01)
du_3 credit purchases		-0.004		-0.034 ***		-0.004		-0.034 ***
		(0.00)		(0.01)		(0.00)		(0.01)
First stage F-stat (*p*-value)	12.12 (0.00)		11.97 (0.00)		12.01 (0.00)		12.13 (0.00)	
Overidentifying restrictions Hansen stat (*p*-value)	5.97 (0.05)		2.67 (0.26)		0.713 (0.70)		1.83 (0.40)	
Weak identification Cragg-Donald *F*-stat	2.39		10.83		2.4		10.69	
Observations	17,826		17,826		17,819		17,819	

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