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Credit constraints and exports of SMEs in emerging and developing countries

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Abstract We study the relationship between credit constraints and exports using a large and heterogeneous sample of small- and medium-sized firms from 65 emerging and developing countries between 2003 and 2014. We measure credit constraints by means of each firm's self-assessment of whether it is credit-rationed, and we follow an instrumental variable approach that uses firm-level instruments to address the potential endogeneity of credit constraints with respect to export performance. 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) and the share of exports over total sales (the intensive margin). The impact on both margins of exports is stronger for small and young firms, and for those operating in countries where the financial system, the quality of institutions, and the overall level of economic freedom are less developed.

Keywords Export behavior · Export margins · Small business financing · Credit constraints

JEL Classification D22 · F10 · F14 · F23 · M21 · L26

1 Introduction

Increasing exports is probably one of the oldest growth strategies suggested by the business and economic literature, but entering foreign markets can be difficult, especially in the case of small and medium enterprises (SMEs): firms must pay significant fixed and sunk costs to sell their products abroad, such as those related to customs and regulatory compliance or those required for establishing a foreign distribution network, as well as sizeable variable costs, due to the longer amount of time required to finalize cross-border sales. Since these costs must be paid upfront, the working capital requirements of exporting firms are higher than those of firms selling only in the domestic market. As a result, exporting firms typically have a higher demand for external financing.

The literature on small business lending has provided ample evidence that young and small firms suffer much more than large and old firms from credit constraints, because they are more opaque and riskier, and often lack adequate internal and external collateral (Levenson and Willard 2000; Berger and Udell 2006; Beck and Demirguc-Kunt 2006; Shinkle and Kriauciunas 2010; LiPuma et al. 2013). This impacts on many dimensions of firms' activities. Becchetti and Trovato (2002), for example, show that credit-rationed firms have a lower

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rate of growth and Motta (2018) finds that SMEs that applied for bank loans but were rejected have lower levels of labor productivity.[1] Of course, this is even more the case if the investment to be financed is in the intangible capital that is required to access foreign markets. This issue is even more important for developing and emerging economies that often lack effective policies addressed to support international business activities of SMEs.

The relevance of financial issues to foster export-led growth policies has not gone unnoticed in the literature. Starting with the seminal paper of Kletzer and Bardhan (1987) and Beck (2002), and following with the more recent contributions of Manova (2012) and Chaney (2016), a number of authors, both in the business and economic literatures, have studied the link between finance and export. Still, additional analyses can be useful to strengthen the previous findings and draw a neater overall picture.

In this paper, we expand the available evidence along three dimensions. First, we analyze a larger sample than previous cross-country studies, including over 19,000 SMEs operating in 65 emerging and developing countries between 2003 and 2014, collected by the World Bank Enterprise Survey (WBES). Second, we use a measure of credit constraints based on each firm's self-assessment. Following a large strand of literature (see, for example, Levenson and Willard 2000, and Mol-Gómez-Vázquez et al. 2018), we define a firm to be credit constrained if it is denied a loan application or it is discouraged to apply because: the procedures are too complex, the required interest rate is not favorable, the collateral requirements are too high, the size of the loan or its maturity is insufficient, or simply the firm expects that the application would not be approved. Third, we address the issue that the relationship between credit rationing and firms' export performance may suffer from at least two major endogeneity problems. First, unobserved firm-level characteristics might influence both their ability to access external finance and their participation in foreign markets. For example, firms whose managers are members of an established international network might be better able to access both external finance and the export markets. Second, as argued by Minetti et al. (2017), the relationship may be due to reverse causation, since a firm's access to foreign markets might be seen as a positive signal that makes it easier to obtain external funding, reducing the problems of credit constraints. As we will describe better below, we address the endogeneity issues using two sets of firm-level instruments. Fourth, exploiting the high firm-level and country-level heterogeneity of our data, we document that the impact of credit constraints on firm's export performance is far from homogeneous and it is itself shaped by characteristics of the firms, such as size and age, and of the countries where they operate, such as their degree of financial development, the quality of their institutions and the overall level of economic freedom.

Our empirical results provide additional robust evidence that financially constrained firms have a lower probability of exporting (i.e., the extensive margin of exports), and, when they do so, their share of exports over total sales (i.e., the intensive margin of exports) is smaller. After controlling for individual attributes affecting the margins of exports, and for potential endogeneity, we estimate that the probability of penetrating foreign markets decreases by about 3% for credit rationed firms, and the share of sales exported decreases by about 17%.

These findings have important policy implications for emerging and developing countries, suggesting that removing credit constraints and improving financial, institutional, and economic conditions are crucial steps to foster export performance. It also provides important evidence at the firm level, suggesting that addressing financial problems impacts not only investments but also exports.

The rest of the paper is organized as follows. Sections 2 summarizes the existing international business and economic literature related to our analysis and presents the three main hypotheses that we put under empirical scrutiny. Section 3 discusses in detail how we approach two key methodological issues: the identification of credit constrained firms and endogeneity. Section 4 presents the data used in the empirical analysis and their descriptive statistics. Sections 5 and 6 discuss, respectively, the empirical methodology and the results obtained on the extensive and the intensive margin of trade. Section 7 presents the results of two robustness checks obtained by splitting the sample according to firm and country characteristics. Section 8 concludes.

[1] Kersten et al. (2017) provide an updated survey of this literature.

2 Previous literature and empirical hypotheses

Our paper relates to two broad strands of literature: the economic literature on international trade and the business literature on firm internationalization.[2]

From an economic theory perspective, a number of studies augment the standard model of international trade with heterogeneous firms of Melitz (2003) incorporating the idea that financial constraints represent an additional source of heterogeneity, that can help to account for differences in export behavior. A common prediction of these models is that the productivity level that is required to financially constrained firms to access foreign markets is higher than that for unconstrained firms because the former must also cover the higher costs of external finance. Building on this assumption, Manova (2012) studies how the degree of financial development of a country affects differently the export activity of firms operating in sectors with different dependence on external finance. Chaney (2016) concentrates instead on internal financing and argues that only those firms that have a sufficient level of liquidity are able to export. Feenstra et al. (2014) focus on the opposite relationship, studying the impact that the decision to export can have on the incentive compatibility constraint of a firm that borrows from a bank under imperfect information.

Building on these seminal theoretical contributions, a growing body of empirical literature has burgeoned in the economic field, analyzing the impact of financial conditions on exports, often distinguishing between the extensive margin and the intensive margin. At the same time, a parallel strand of business literature studies similar topics.

Papers in these two strands of literature can be classified according to different characteristics. An interesting one, from the perspective of our paper, relates to the type of data used in the empirical analysis. A first group of papers provides single-country, firm-level evidence. 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: Egger and Kesina (2014), Feenstra et al. (2014), and Manova et al. (2015) for China; Bellone et al. (2010) and Stiebale (2011) for France; Buch et al. (2010) and Wagner (2014) for Germany; and Minetti and Zhu (2011), Bartoli et al. (2014) and Secchi et al. (2016) for Italy. Bartoli et al. (2014), in particular, do not focus only on credit availability but also highlight the role of additional advisory services that bank can provide to firms planning to access foreign markets. Interestingly, they find that such provision is more effective if the main bank of the firm is itself international. Overall, despite the fact that countries analyzed differ significantly in the level of economic development, and that these studies use different measures of financial constraints and different econometric methods, they share the conclusion that financial frictions deter export market participation and, in some cases, reduce the share of exported sales and expand the time to entry foreign markets.

A second group of papers focuses on cross-country, industry-level data (Beck 2002; Becker et al. 2012; Manova 2008 and Manova 2012), finding results that are consistent with the firm-level evidence. In her seminal paper, Manova (2012) follows the methodology of Rajan and Zingales (1998) and shows that sectors that are more dependent on external finance have a better export performance in countries where the financial sector is more developed.

A third group includes few papers that use cross-country, firm-level data, mostly obtained from the WBES. In a seminal paper on developing economies, Berman and Héricourt (2010) study a sample of 5000 firms from nine countries, showing that productivity becomes increasingly important for exporting decisions (the extensive margin of trade) as financial constraints decrease. However, in their sample, neither the quantity exported (or the share of exports over total sales) nor the probability of remaining an exporter is affected by financial constraints, meaning that the role of financial constraints on margins of trade is concentrated at the time of entry. Exploring a larger sample of firms from 18 developing countries, Fauceglia (2015) provides evidence that firm's liquidity has a positive impact on the extensive margin of export, that is more pronounced for firms operating in less financially developed economies. However, both papers use a smaller sample of countries and firms than our analysis. Moreover, they measure credit constraints using the firm's availability of internal funds, whereas our focus is on the availability of external funding by banks. Studying a cross-section of firms from transition countries, Gashi et al. (2014) show that, in addition to human and technology-related factors, the

[2] Table 1 in the online supplementary material summarizes the findings and the methodologies of the contributions that are more closely related to our analysis.

focus of their analysis, also financial factors explain the export behavior of SMEs.

The overall message of these analyses is that better financial conditions improve firms' export performance (see also Wagner 2014, for a very effective tabular survey). This leads us to the first hypothesis studied in our paper:

> Hypothesis 1: self-assessed credit-rationed firms are less likely to export (the extensive margin of international trade) and, when they do so, they export a smaller amount of goods (the intensive margin of international trade).

In the literature on internationalization, there is a large consensus that larger and older firms are more likely to export. Indeed, larger firms are more likely to find it profitable to pay the fixed and sunk costs required to access foreign markets, and older firms are more likely to have paid them at least once in the past. At the same time, it is well known that small and young firms are more likely to be credit constrained. Although in our empirical model we include size and age among the determinants of a firm's export performance, it is also possible that these characteristics interact with the effect of credit constraints, for example moderating their negative impact on exports, as shown by Minetti and Zhu (2011). This leads us to the second hypothesis studied in our paper:

> Hypothesis 2: the negative impact of credit rationing on the extensive and intensive margins of international trade is smaller in the case of larger and older firms.

Finally, also related to our research is a large strand of literature that has shown how country-specific institutional characteristics influence entrepreneurship (Dimitratos et al. 2004; Aidis et al. 2012), SMEs' growth (Bowen and De Clercq 2008; Hashi and Krasniqi 2011; Krasniqi and Mustafa 2016; Krasniqi and Desai 2017), and exports (Anderson and Marcouiller 2002). While in our empirical model the influence of the institutional framework of the nation where firms are based on their export performance is controlled for by the inclusion of country dummies, it may also be the case that they also have a moderating effect on the impact of credit rationing. Other authors have found evidence of such moderating effect of institutional characteristics on the impact of firm-level features on their export performance (Shinkle and Kriauciunas 2010; LiPuma et al. 2013; Krasniqi and Desai 2017). This leads us to the third hypothesis studied in our paper:

> Hypothesis 3: the negative impact of credit rationing on the extensive and intensive margins of international trade can be smaller in countries that have better institutions and more developed financial markets.

3 Methodological issues

Appraising the impact of credit constraints on exports raises two methodological issues. First, how to identify financially constrained firms. Earlier contributions exploit the heterogeneous impact of financial shocks on firms with different degrees of dependence on external finance (Rajan and Zingales 1998). Manova (2008), for example, shows that episodes of equity market liberalization increase exports disproportionately more in sectors that require a higher share of outside finance or have fewer collateralizable assets. Other studies adopt instead firm-specific measures of financial constraints, obtained from balance-sheet ratios. Consistent with the large literature on financial constraints (Fazzari et al. 1988; Kaplan and Zingales 1997), the most used measures are liquidity and leverage ratios (Greenaway et al. 2007; Bellone et al. 2010; Egger and Kesina 2014; Fauceglia 2015), or synthetic indexes that collapse information from different firm-level characteristics, such as size, profitability and solvency (Musso and Schiavo 2008; Bellone et al. 2010; Silva 2011). Secchi et al. (2016) use the credit rating indices produced by banks and credit institutions. In our analysis we follow the approach of Minetti and Zhu (2011) and Wang (2016) and use the response to a business survey to identify firms that are credit rationed.

The second important issue, emphasized by many scholars, is that firms' financial constraints and export behavior are jointly determined. Indeed, the theoretical and empirical analysis of Feenstra et al. (2014) focuses in particular on how exports can increase profitability and therefore reduce credit constraints, and also the models by Manova (2012) and Chaney (2016) show that the causal relationship between internationalization

and the availability of external finance can go in both directions. To address this potential endogeneity problem, a number of authors have adopted an instrumental variable approach, relying on country- and sector-level measures of financial regulation or financial development as exogenous instruments for firms' credit constraints. Minetti and Zhu (2011) and Secchi et al. (2016), for example, use the data of Guiso et al. (2004) on the characteristics of local credit markets in Italy in 1936 as instruments for the probability that a firm declares to be credit constrained. Few papers use instead instruments at the firm level. Berman and Héricourt (2010) use lagged values of financial debt and cash flows, their measures of financial constraints, as instruments for contemporaneous values. Jinjarak and Wignaraja (2016) use the reply to a survey question in which each firm is asked whether it needs a loan or whether it has access to overdraft facilities as alternative instruments for the actual amount of bank loans and overdraft facilities. Reassuringly, all analyses using an instrumental variable approach tend to confirm that (exogenous) credit constraints have a negative impact on exports. In what follows, we propose a new set of firm-level instruments, described in Section 4 below.

4 Data and descriptive statistics

To test the hypothesis that credit constraints hinder exports, we exploit establishment-level data for about 19,000 firms from 65 emerging and developing countries over the period 2003–2014, collected within the WBES.[3] Our initial sample includes 19,394 observations on 19,222 firms, meaning that the database includes only a very small panel component, of about 172 firms. Our analysis relies therefore on the pooled 2003–2014 data, because it is extremely hard to detect robust relationships with a panel of just 172 firms from different sectors and countries, as also argued by Gorodnichenko and Schnitzer (2013) in their study on financial constraints and R&D activities. Distributions of firms between countries and years are reported in Tables 2 and 3 of the online supplementary material.

[3] Data are accessible at http://www.enterprisesurveys.org; for simplicity, since most firm in the sample have a single establishment, we use the term firms throughout the paper, though the analysis is based on establishment data.

The WBES survey includes information on the values of total sales and of total exports, allowing therefore to construct the two most common measures of firm export performance: the extensive and the intensive margins. Moreover, firms are required to answer a number of questions on their financial needs and on their relationships with banks and other credit institutions, that allow to construct a set of measures of self-assessed credit constraints. Finally, the survey includes additional firm-level characteristics that can be used as control variables and instruments to deal with the problem generated by the potential endogeneity of credit rationing with respect to firm's export status.

We define the extensive margin of exports as a dummy variable that takes the value of one if a firm exports (directly or indirectly, i.e., reaching foreign markets through an intermediary that subsequently exports its products) and zero otherwise. The intensive margin of exports is instead measured as the share of the total value of a firm's exports over its total sales. About 33% of firms in our sample are active exporters, with an average export share over total sales of about 13% (Table 1).

Our key explanatory variable is a dummy that takes the value of one if the firm is financially constrained, and zero otherwise. To build this dummy we exploit the answers to three questions of the WEBS survey: (1) "At this time, does this establishment have a line of credit or a loan from a financial institution?"; (2) "Did this establishment apply for any loans or line of credit?"; and (3) "What was the main reason why this establishment did not apply for any line of credit or loan in fiscal year?". Questions 1 and 2 allow only two possible answers: yes or no. Question 3 allows instead seven different answers: (a) "no need for a loan, establishment has sufficient capital"; (b) "application procedure for loans or lines of credit are complex"; (c) "interest rates are not favorable"; (d) "collateral requirements too high"; (e) "size of loan or maturity insufficient"; (f) "did not think it would be approved"; (g) "other." The answers to these questions allow to construct measures of the degree of financial constraints faced by each firm. Following the literature started by Jappelli (1990), we define a firm as credit constrained if it has no credit lines or loans from a financial institution and it either (i) applied for a loan, but did not obtain it, or (ii) did not apply for a loan because of one of the answers (b to g) to question 3 above. Credit rationed firms represent about 24% of our sample (Table 1).

Table 1 Descriptive statistics

	(1)				(2)				(3)				(4)	
	All sample				Rationed firms (CR = 1)				Non-rationed firms (CR = 0)				*t* test	
Variable	Mean	c.v.	Min	Max	Mean	c.v.	Min	Max	Mean	c.v.	Min	Max		
Dummy export	0.333	1.417	0	1	0.217	1.899	0	1	0.368	1.310	0	1	20.64	***
Export share	0.130	2.072	0	1	0.087	2.624	0	1	0.144	1.950	0	1	13.88	***
Credit rationing	0.236	1.799	0	1	1	0	1	1	0	0	0	0		
Number of employees	113	4	0	26,000	53	3	0	3000	132	4	0	26,000	17.39	***
Labor productivity	36.462	1.390	0	337	24.963	1.631	0	331	39.928	1.324	0	337	− 2.22	**
Age	22	0.799	1	210	20	0.789	1	146	23	0.794	1	210	13.79	***
Share of temporary workers	0.115	1.877	0	1	0.127	1.860	0	1	0.112	1.879	0	1	− 3.99	***
Share of skilled workers	0.487	0.566	0	1	0.524	0.531	0	1	0.475	0.576	0	1	− 10.39	***
Competition in national market	0.430	1.151	0	1	0.385	1.263	0	1	0.444	1.119	0	1	7.10	***
Capacity utilization	0.728	0.295	0	1.05	0.706	0.313	0	1	0.736	0.289	0	1.05	7.95	***
Balance-sheet certification	0.508	0.984	0	1	0.402	1.219	0	1	0.541	0.921	0	1	16.60	***
Payment after delivery (second tercile)	0.303	1.517	0	1	0.303	1.517	0	1	0.303	1.517	0	1	0.03	
Payment after delivery (third tercile)	0.328	1.431	0	1	0.219	1.891	0	1	0.362	1.328	0	1	19.59	***
Political instability	1.909	0.765	0	4	1.990	0.753	0	4	1.883	0.768	0	4	− 2.56	***
Assets/GDP	38.756	0.482	3.162	121.8	32.980	0.580	3.162	121.8	40.546	0.448	3.162	121.8	23.69	***
Economic freedom	59.645	0.130	38.118	77.717	57.666	0.129	38.118	77.717	60.253	0.128	38.118	77.717	20.01	***
Trade freedom	71.923	0.122	51.067	87.250	69.612	0.122	51.067	87.250	72.634	0.120	51.067	87.250	20.65	***
Rule of law	− 0.440	− 1.458	− 1.729	1.332	− 0.575	− 0.999	− 1.729	1.332	− 0.398	− 1.646	− 1.729	1.332	17.46	***
Regulatory quality	− 0.126	− 5.319	− 1.543	1.467	− 0.324	− 1.912	− 1.543	1.467	− 0.064	− 10.420	− 1.543	1.467	24.08	***
Control of corruption	− 0.393	− 1.731	− 1.480	1.450	− 0.550	− 1.080	− 1.480	1.450	− 0.344	− 2.026	− 1.480	1.450	19.47	***

Note: column (1) reports the descriptive statistics calculated on the whole sample; columns (2) and (3) report the descriptive statistics calculated on the sub-samples of credit rationed firms and not constrained firms, respectively. Column (4) reports the value of the mean-difference test. The approximate degrees of freedom for the *t* test are obtained from the formula of Welch (1947). Labor productivity is in thousands of US dollars. ** indicates significance at the 5% level, *** at the 1% level

A key feature of our data is that they allow us to consider discouraged borrowers. Indeed, firms discouraged from applying for a bank loan have found to be a sizeable share of those that can be considered as financially constrained. Levenson and Willard (2000), for example, show that the share of SMEs that were discouraged from applying for a loan is as large as the sum of the share of those that were denied and those that had to move to a different bank after their first application was rejected. Interestingly, Mol-Gómez-Vázquez et al. (2018) show that in countries where banks have a stronger market power the share of discouraged borrowers is larger, and Rostamkalei et al. (Rostamkalaei et al. 2018) show that it is those SMEs that have a satisfactory relationship with their banks that are more likely to self-restrain from loan applications, suggesting that their choice is not based on irrational fears but is due to correct expectations. In light of this evidence, failing to consider self-assessed credit rationed SMEs would introduce a severe bias in our results.

As argued in the introduction, a major issue in studying the relationship between credit constraints and exports is the potential endogeneity of a firm's financial conditions with respect to its degree of internationalization. Following the previous literature, we tackle this problem adopting an instrumental variable approach, hinging on two firm-level characteristics. The first is a measure of the amount of hard information available on the firm. One of the questions in the WEBS survey asks: "In fiscal year [insert last complete fiscal year], did this establishment have its annual financial statements checked and certified by an external auditor?". We therefore define "balance sheet certification" as a dummy variable that takes the value of one if the firm's financial statement is checked and certified by an external auditor, and zero otherwise. The second instrument is a measure of shocks to the cash flow and the availability of a level of internal sources of funds of a firm, capable of affecting the probability that it is financially constrained. Firms in the WBES survey are asked: "What percentage, as a proportion of the value of total annual purchases of material inputs or services were paid for after delivery?". The answer is a continuous variable ranging from 0 to 100. Since this variable has a very skewed distribution, we choose to create three dummies for each tercile of the distribution of the share, and we use the two dummies for firms in the second and third tercile as instruments for our measures of credit rationing. We argue that firms that are allowed to delay their payments are less likely to be credit constrained. In our sample, about 51% of firms have a financial statement that is certified and checked by an external auditor, and about 47% of firms obtain payment after delivery on purchases (Table 1). We believe that these instruments are reliable and exogenous measures of financial constraints.

In addition to instrumenting our measures of financial constraints, we control for a number of firm characteristics that are likely to impact on their export performance, following the recent literature (see, e.g., Gashi et al. 2014).

First, consistent with the ample evidence showing that large companies are more internationalized, we control for firm size, measured by the number of permanent full-time employees and managers. Second, following the literature initiated by the seminal paper by Melitz (2003), arguing that only the most productive firms are able to surmount the fixed costs of accessing foreign markets, we control for labor productivity, measured by the ratio of the dollar value of total annual sales on the number of employees. Table 1 shows that this ratio has a large variability, with a coefficient of variation of about 1.4. As an additional measure of productivity, we also control for the share of skilled workers on permanent full-time employees, measuring the impact of human capital, that has an average value of 49% and a coefficient of variation of 0.57.

Next, we control for the age of the firm, measured by the number of years since the foundation of the firm. In this way, we account for the fact that it is more likely that older firms had found it profitable sometime in the past to pay the sunk costs of entering foreign markets and therefore they still export, even if the actual conditions would have made unprofitable to enter at the moment of our data collection. Also in the case of age, our data show a significant degree of heterogeneity, ranging from 1 to 210, with an average of 22 and a coefficient of variation of 0.8.

Since firms close to full capacity utilization might be unable to increase production so as to service also foreign markets, we also control for potential slackness, measured by the share of temporary employees on total employees and by a self-reported measure of output capacity, given by the ratio of actual production over maximum output possible if using all facilities available. The average values are 11% for the share of temporary employees and 73% for capacity utilization, with coefficients of variation of 2 and 0.29, respectively.

Finally, we control for a self-assessed measure of orientation towards the internal market, that is a dummy variable taking the value of one if the main market in which the firm sells its leading product is national, and zero if it is international. In our sample, for 43% of firms this dummy takes the value of one.

An additional variable adopted in our Heckman specification (see Section 4) is the firm's perception about political stability of the local context in which it operates. This variable reports the answer to the following question: "As I list some factors that can affect the current operations of a business, please look at this card and tell me if you think that each factor is No Obstacle, a Minor Obstacle, a Moderate Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment." This indicator ranges between 0 (no obstacle) and 4 (very severe obstacle) and shows an average over the whole sample of about 2, with a coefficient of variation of 0.76.

In addition to firm specific characteristics, we also collected information on the features of the countries where they are incorporated. Following Shinkle and Kriauciunas (2010), LiPuma et al. (2013) and Krasniqi and Desai (2017), our hypothesis is that credit rationing might affect proportionally more the exporting activities of those firms that operate in countries with lower financial development, lower economic freedom, and less efficient institutions. Specifically, we measure financial development as the ratio of the total assets of deposit money banks to GDP (Beck et al. 2000),[4] that in our sample has an average of 39%, with values ranging from 3% in the Democratic Republic of Congo to 122% in China. While this is a rather crude index, it has been shown to be a good proxy of the overall degree of financial development, especially among developing and emerging countries, and it is available for a larger sample than other more refined indices. We also adopt the indicator of economic freedom produced by the Heritage Foundation as an equally weighted and averaged score on 12 components of economic freedom that can be grouped into four broad categories: rule of law (property rights, government integrity, judicial effectiveness), government size (government spending, tax burden, fiscal health), regulatory efficiency (business freedom, labor freedom, monetary freedom), open markets (trade freedom, investment freedom, financial freedom).[5] Our exercise is motivated by the fact that countries with a higher level of economic freedom provide alternative ways of addressing the negative impact that credit constraints can exert on export activities. Table 1 shows that in our sample the Heritage index of economic freedom has an average value of 60, on a 1–100 scale, with values ranging from 38.1 in Venezuela to 77.7 in Chile. In addition to the aggregate index of economic freedom, we also study the potential impact of two more specific sets of institutional characteristics. First, trade freedom, that we measure using an index also produced by the Heritage foundation, based on trade and non-trade barriers, and ranging between 51.1 in Bangladesh to 87.3 in Slovakia. Second, governance quality, that we measure using the world governance indicators of Kaufmann et al. (2007), that are standardized so as to range from −2.5 to +2.5 and focus specifically on rule of law, regulatory quality, and corruption.[6] The first indicator captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Clearly, this has a crucial impact on the ability of a firm to postpone the payment of the costs that are required to access foreign markets. Regulatory quality captures the ability of the government to formulate and implement sound policies and regulations, that permit and promote private sector development, allowing swifter contracting and better enforcement. Control of corruption refers to the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests. Again, high levels of corruption are likely to make it more difficult to enforce contracts, and therefore to find agreements that might help to overcome the impact of credit rationing. The minimum values for both rule of law and control of corruption are for Afghanistan (−1.7 and −1.5, respectively), whereas the lowest regulatory quality is in Uzbekistan (−1.5). The maximum values for all governance indicators are for Chile

[4] Data are accessible at: https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database.

[5] Data are accessible at: https://www.heritage.org/index/explore.

[6] Data are accessible at: http://info.worldbank.org/governance/wgi/#home.

(1.3, 1.5, and 1.5, respectively). While all these characteristics are very likely to have also a direct impact on the probability that a firm is credit-constrained and have an effect on their export activities, this is controlled for by the country dummies. Our focus is therefore on how they can moderate the impact of credit rationing on exports.

Panels 2 and 3 of Table 1 show that firms that self-assess themselves as credit constrained are significantly different from those that are not constrained along many dimensions. First, consistent with our research hypothesis, only 22% of credit constrained firms are exporters, as opposed to 37% of those that are not constrained. Moreover, among those that export, credit constrained firms export on average 9% of their total sales, while unconstrained firms export 14%. In both cases, the difference is statistically significant at the 99% level. These differences in the export performance are nonetheless likely to be explained, at least in part, by other differences in firm-level characteristics. In fact, credit constrained firms also have a smaller number of employees (53 vs. 132) and are younger (20 vs. 23 years old), two characteristics that are typically related with a lower degree of internationalization. However, although constrained firms are smaller and younger, there is also evidence that they are in general less efficient. Moreover, they are less likely to be focused mainly on national markets (38% vs. 44%) and they have a lower capacity utilization (71% vs. 74%). They also have a lower probability that their financial statement is certified by an external auditor (40% vs. 54%), and they are less likely to pay large share of input purchases after delivery, as it is shown by the fact that the dummy for firms in the third tercile of the distribution is 22%, as opposed to 36% for unconstrained firms. In addition, credit constrained firms are more likely to be located in low financially developed countries, in countries with low economic and trade freedom and in countries with poor governance.

Table 2 presents the bilateral correlations. As expected, the coefficient of correlation between the two measures of export performance, the extensive and intensive margins, is positive, high (0.68) and statistically significant at the 5% level. The dummy variable for firms that are credit constrained shows a negative and statistically significant correlation with the extensive and intensive margins of exports, respectively −0.14 and −0.09, confirming our expectations that financially constrained firms export less.

Both export margins are also positively and significantly correlated with firm size (0.20 and 0.17, respectively) and age (0.16 and 0.03, respectively). Labor productivity has a low (0.004 and −0.001) and statistically insignificant correlation with export performance. Concerning the instrumental variables, our measure of credit rationing is negatively and significantly correlated with the dummy indicating that the firm has a financial statement certified by an external auditor (−0.12) and with the dummy for firms that have a share of input purchases paid for after delivery in the largest tercile (−0.13).

As it was already clear from Table 1, credit rationing is also negatively correlated with firm size and age. But since these characteristics have also been shown to have a direct impact on export performance, it is of paramount importance that we extend our analysis to a partial correlation framework, using appropriate econometric models. We will turn to this analysis in the coming sections.

5 The empirical methodology

The empirical methodology adopted in this paper follows Berman and Héricourt (2010) and 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_{ikct} is a normally distributed random error with zero mean and unit variance, the probability that firm i of sector k, in country c, exports its products at time t, can be written as:

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

In this specification, analyzing the extensive margin of exports, the dependent variable $Export_{ikct}$ equals one if the firm exports at time t, and zero otherwise. As argued above, our key explanatory variable, CR_{ikct}, is a binary variable that equals one if firm i is credit rationed and zero otherwise. We also control for a set of firm characteristics that may affect exports. The vector Z_{ikct} includes size, productivity, age, share of temporary and skilled workers, competition in national market and productive capacity. We also include three sets of fixed effects, to limit the problem of possible omitted variables: (1) ν_k, that captures time-invariant sector specific characteristics, such as differences in demand or supply elasticities related to product-specific characteristics; (2)

Table 2 Correlation matrix

	Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	Dummy export	1									
(2)	Export share	0.684*	1								
(3)	Credit rationing	−0.136*	−0.089*	1							
(3)	Number of employees	0.198*	0.171*	−0.080*	1						
(4)	Labor productivity	0.004	−0.001	0.020*	0.002	1					
(5)	Age	0.165*	0.028*	−0.091*	0.184*	0.009	1				
(6)	Share of temporary workers	−0.003	−0.009	0.030*	−0.039*	−0.012	−0.023*	1			
(7)	Share of skilled workers	−0.040*	0.058*	0.0745*	0.008	0.023*	−0.085*	−0.063*	1		
(8)	Competition in national market	0.037*	−0.1804*	−0.051*	0.046*	−0.006	0.087*	−0.028*	−0.028*	1	
(9)	Capacity utilization	0.056*	0.056*	−0.059*	0.072*	0.004	−0.021*	−0.053*	0.075*	0.048*	1
(11)	Balance-sheet certification	0.210*	0.133*	−0.118*	0.158*	0.006	0.157*	0.005	−0.093*	0.117*	0.052*
(12)	Payment after delivery (second tercile)	0.015*	0.003	0.000	0.000	−0.006	−0.012	0.009	0.004	0.050*	0.067
(13)	Payment after delivery (third tercile)	0.133*	0.032*	−0.130*	0.046*	−0.004	0.146*	−0.016*	−0.142*	0.029*	−0.005
(14)	Political instability	0.016*	0.031*	0.031*	0.008	−0.059*	0.022*	−0.013	−0.008	0.041*	−0.022*
(15)	Assets/GDP	0.042*	0.043*	−0.172*	0.053*	−0.052*	0.064*	−0.103*	0.047*	0.062*	0.066*
(16)	Economic freedom	0.054*	−0.006	−0.142*	−0.023*	−0.070*	0.104*	0.013	−0.123*	−0.010	−0.047*
(17)	Trade freedom	0.064*	−0.009	−0.147*	−0.049*	−0.031*	0.064*	0.019*	−0.081*	−0.021*	−0.075*
(18)	Rule of law	0.069*	0.018*	−0.117*	−0.010	−0.017*	0.127*	−0.063*	−0.038*	0.034*	0.002
(19)	Regulatory quality	0.078*	0.008	−0.165*	−0.013	−0.060*	0.089*	−0.026*	−0.069*	0.007	−0.021*
(20)	Control of corruption	0.094*	0.005	−0.129*	−0.016*	−0.001	0.168*	−0.043*	−0.105*	0.015*	−0.023*

	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1)										
(2)										
(3)										
(3)										
(4)										
(5)										
(6)										
(7)										
(8)										
(9)										
(11)	1									
(12)	0.024*	1								
(13)	0.099*	−0.461*	1							
(14)	0.044*	0.043*	−0.041*	1						
(15)	0.101*	0.015*	0.111*	−0.022*	1					
(16)	0.013	−0.046*	0.257*	−0.211*	0.338*	1				
(17)	−0.045*	−0.031*	0.179*	−0.177*	0.150*	0.672*	1			
(18)	0.036*	−0.027*	0.204*	−0.241*	0.584*	0.767*	0.449*	1		
(19)	−0.005	−0.033*	0.267*	−0.254*	0.499*	0.929*	0.656*	0.8517*	1	
(20)	0.025*	−0.038*	0.288*	−0.231*	0.452*	0.803*	0.538*	0.937*	0.854*	1

Note: * denotes significance at 5% level

λ_c, that captures time-invariant country-level characteristics that may impact on exports, such as regulations or other institutional features, or geographic and cultural characteristics; (3) η_t, that captures any time-specific shock affecting simultaneously all countries. As predicted by the literature discussed above, we expect $\beta_1 < 0$.

We estimate Eq. (1) using three different econometric techniques. First, similar to Berman et al. (2012), we use a standard linear probability model (LPM), even if the dependent variable is binary. This methodology is attractive because it consistently estimates the parameters in the linear projection of the dependent variable on the explanatory variables (Wooldridge 2010, p. 563). In a LPM, the probability of observing a zero or a one is treated as depending on one or more independent variables, whose coefficients are estimated using least squares. A drawback of this model is that the estimated coefficients can imply probabilities that lie outside the [0,1] interval. For this reason, in our second specification, we use a probit model.

In our third specification, we instrument the measure of credit rationing with the dummy for firms that have a certified balance sheet and the two dummies for firms that have a larger share of late input payments. However, since in this case, the problems with the LPM would occur twice because the estimated coefficients of both regressions for the probability of exporting and of being credit rationed might imply predictions that lie outside the [0,1] interval, we follow the methodology of Minetti and Zhu (2011). Assuming that μ_{ikct} is a normally distributed random error with zero mean and unit variance, the probability that a firm is credit rationed can be estimated using the following binary choice model:

$$\begin{aligned}\Pr(CR_{ikct}=1) &= \Pr(\delta I_{ikct} + \lambda Z_{ikct} + \psi_k + \tau_c + \varsigma_t + \mu_{ikct} > 0) \\ &= \Phi(\delta I_{ikct} + \lambda Z_{ikct} + \psi_k + \tau_c + \varsigma_t)\end{aligned} \quad (2)$$

where I_{ikct} is a set of instrumental variables that capture exogenous restrictions on the availability of credit to firm i of sector k, in country c, at time t, and Z_{ikct} is the same vector of exogenous variables of Eq. (1). Following Minetti and Zhu (2011) and Minetti et al. (2017), Eqs. (1) and (2) can then be estimated using a recursive bivariate probit model, in which the potential endogeneity of credit rationing with respect to the export status is controlled for allowing for the error terms, ε_{ikct} and μ_{ikct}, to be correlated. The recursive structure of the model is guaranteed by the fact that the set of instruments I_{ikct} are excluded from Eq. (1).

The impact of credit rationing on the intensive margin of exports is estimated using a companion specification, in which the dependent variable y_{ikct} is the share of direct and indirect exports over total sales:

$$y_{ikct} = \alpha_1 + \beta_1 CR_{ikct} + \gamma_1 Z_{ikct} + \nu_k + \lambda_c + \eta_t + \varepsilon_{ikct} \quad (3)$$

All other variables are defined as above. Equation (3) is estimated using four econometric techniques. First, a standard linear model. Second, a tobit model, that accounts for the fact that the dependent variable is a doubly censored random variable, with values limited between zero and one. Third, an instrumental variables approach, to tackle the problem that credit rationing is potentially endogenous with respect to the share of exports over total sales. Since our dependent variable is, in this case, continuous, we estimate a standard linear two-stages least-squares (2SLS) model, in which the probability that a firm is credit rationed is instrumented with the predicted probabilities obtained from the first stage estimates of Eq. (2).

Last, in a fourth specification, we estimate a Heckman correction model to separately account for the cases in which a firm does not export at all. In this way, we transform the selection bias problem into an omitted variable problem, which can be solved by including an additional variable: the inverse Mills ratio obtained from the probit estimates of the probability of being an exporter. In the Heckman model, the extensive margin measures the probability of exporting. Accordingly, we estimate the impact of the independent variables included in Eq. (1) and of the instruments for credit rationing on a binary variable that is equal to 1 if a firm exports in a given year and 0 otherwise. In the second step (intensive margin), we estimate Eq. (3) on a reduced sample of observations, excluding all cases in which a firm does not export and including among the independent variables the inverse Mills ratio from the first stage. In the Heckman model, identification of the first stage is obtained by the exclusion of the measure of political stability in the country from the second-stage specification.

6 Baseline results

6.1 The extensive margin of exports

Results of the baseline specification for the extensive margin of exports, obtained estimating Eq. (1), are presented in Table 3. The sample includes 19,394 firm-year observations.

The results obtained estimating an LPM, reported in Column 1, confirm the hypothesis that financial conditions impact on firms' export behavior: our main variable of interest, the dummy that equals one for firms that

Table 3 Extensive margin of exports and credit rationing

Model	(1) LPM	(2) Probit	(3) Biprobit
Credit rationing	− 0.025***	− 0.026***	− 0.025***
	(0.01)	(0.01)	(0.01)
Number of employees	0.139***	0.125***	0.016***
	(0.01)	(0.00)	(0.00)
Labor productivity	0.028***	0.028***	0.002**
	(0.00)	(0.00)	(0.00)
Age	− 0.002	− 0.002	− 0.005**
	(0.01)	(0.01)	(0.00)
Share of temporary workers	0.097**	0.104***	0.025**
	(0.04)	(0.04)	(0.01)
Share of skilled workers	− 0.012	− 0.018	0.014***
	(0.01)	(0.01)	(0.00)
Competition in national market	− 0.045**	− 0.032*	− 0.006
	(0.02)	(0.02)	(0.00)
Capacity utilization	0.009	0.005	− 0.029***
	(0.02)	(0.02)	(0.00)
Instruments			
Balance-sheet certification			− 0.015***
			(0.00)
Payment after delivery (second tercile)			0.000
			(0.00)
Payment after delivery (third tercile)			−0.011***
			(0.00)
corr[ε_{ikct}, μ_{ikct}]			0.180**
			(0.070)
R^2	0.28	0.25	
Kleibergen-Paap first stage F-statistic (p value)			36.41 (0.00)
Overidentifying restrictions statistic (p value)			3.20 (0.20)
Observations	19,394	19,394	19,394

Note: The table reports the marginal effects obtained estimating Eq. (1). In Column 3 the measure of credit rationing is instrumented using a dummy variable indicating whether the balance sheet is certified by an external auditor and two dummies for the second and third tercile of the distribution of the share of delayed payments. Unreported fixed effects for sector, country and year are included in all regressions. Robust standard errors are clustered by sectors and reported in parentheses. corr[ε_{ikct}, μ_{ikct}] is the correlation coefficient (*rho*) between the unobserved determinants of the export participation decision (ε_{ikct}) and those of rationing (μ_{ikct}). Kleibergen-Paap first stage F-statistic (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 in the companion LPM specification. Overidentifying restrictions statistic (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 in the companion LPM specification. ***, **, * denote significance at 0.01, 0.05, and 0.10 levels

are credit constrained, has a negative coefficient of − 0.025, that is statistically significant at the 1% level. Since the coefficient of a linear model provides a direct measure of the impact of the dependent variable on the probability that the firm is an exporter, a credit constrained firm is 2.5% less likely to be an exporter than a non-credit-constrained firm. Compared with the unconditional probability that a firm in our sample is an exporter, that is 33.2%, credit constraints have therefore an impact of about 7.5%. This is a sizeable economic impact, considering that it is conditional on all other firm characteristics included as controls in our specification.

The results reported in Column 1 also confirm the main findings of the literature on the determinants of firm exports: firms that export are larger, as shown by the coefficient of + 0.139 of the number of full-time employees, which is statistically significant at the 1% level, and they have a higher labor productivity, as shown by the coefficient of + 0.028, also significant at the 1% level.

We also find evidence that exporters have a larger share of temporary workers (0.097, statistically significant at the 5% level), suggesting that for the firms operating in emerging and developing countries included in our sample, lower labor costs are a crucial component of competitiveness. They are also less oriented to the domestic market, as shown by the coefficient of − 0.045, statistically significant at the 5% level, of the dummy for firms that declare that the main market in which the firm sells its most important product is national. The effect of the age of the firm, of its capacity utilization, and of the share of skilled workers in its labor force is instead statistically insignificant.

Column 2 reports the results obtained estimating Eq. (1) with a probit model. Since in this case the estimated coefficients do not provide a direct measure of the impact of the dependent variable on the probability that the firm is an exporter, we report the marginal effects of each explanatory variable. Probit models are more efficient than LPM models, since they account for the fact that predicted probabilities cannot be outside the [0,1] interval, but they are also less robust to misspecification. Reassuringly, the results of Column 2 are broadly identical to those of Column 1. In particular, the marginal effect of the dummy for credit-constrained firms is − 0.026, almost the same value obtained with the LPM model, and it is statistically significant at the 1% level. In addition, all other marginal effects are extremely similar to the coefficients estimated with the LPM and have comparable statistical significance.[7]

Next, we have estimated a bivariate probit model, that accounts for the potential reverse causation of credit constraints with respect to the export status and also for the fact that both the export decision and credit rationing are binary variables. We have assumed that the probability that a firm is credit rationed is a function of all the explanatory variables included in Eq. (1), and of three additional variables that impact on credit rationing but not on the probability of exporting: a dummy for firms that have their balance-sheet certified by an external auditor and two dummies for the firms that are in the second and third tercile of the distribution of the share of delayed payments.

The upper part of Column 3 reports the marginal effects of the estimation of Eq. (1), where the dependent variable is export decision. The dummy that equals one for firms that are credit constrained has a negative marginal effect of − 0.025 on the probability that a firm is an exporter, statistically significant at the 1% level. The estimates based on the bivariate probit specification, therefore, confirm that credit rationing reduces the probability that a firm is an exporter.

The bottom part of Column 3 reports the marginal effects of the instruments used in Eq. (2) on the probability that a firm is credit constrained, that can be interpreted as a first stage regression within the two stages approach necessary to control for potential endogeneity of credit constraints with respect to the export status. A crucial aspect of our specification is the statistical significance of the three variables that are excluded from Eq. (1) and therefore allow for the identification of Eq. (2). The marginal effect of the dummy for firms that have their balance-sheet certified by an external auditor is − 0.015, and it is statistically significant at the 1% level. Similarly, the marginal effect of the dummy for the firms that are in the third tercile of the distribution of the share of delayed payments is − 0.011, and it is statistically significant at the 1% level. On the contrary, the marginal effect of the dummy for the firms in the second tercile of the distribution of the share of delayed payments is very small and statistically

[7] The R^2 is 0.28 for the LPM and 0.25 for the probit, very similar in the two specifications. They are also relatively high values for a cross-section specification, even if we consider that we include sector, country and year fixed effects.

insignificant.[8] Reassuringly, the Kleibergen-Paap *F*-statistic for the hypothesis that instruments have jointly zero coefficients in the first stage regression in the companion LPM specification of the first stage regression is 36.41, with a *p* value of 0.00. Moreover, in the companion LPM specification, the Hansen test of overidentifying restrictions is 3.20, with a p value of 0.20, revealing that we cannot reject the joint null hypothesis that the instruments are uncorrelated with the error term. Finally, the correlation coefficient, corr(ε_{ikct}, μ_{ikct}), is 0.180 with a standard error of 0.070 ($p = 0.011$), implying that the unobserved determinants of the export participation decision (ε_i) and those of rationing (μ_i) are significantly and positively correlated, and therefore we can reject the null hypothesis that credit rationing is exogenous.

In synthesis, the results of the estimates of the effect of credit constraints on the extensive margin of exports provide robust and convincing evidence that it is statistically and economically significant. We now turn to the impact on the intensive margin of exports.

6.2 The intensive margin of exports and credit rationing

The results of the baseline specification for the intensive margin of exports obtained estimating Eq. (3), are presented in Table 4.

Column 1 reports the results obtained estimating a standard OLS. Also, in this case, the hypothesis that financial conditions impact on firms' export quantity is confirmed: our main variable of interest, the dummy that equals one for firms that are credit constrained, has a negative coefficient of − 0.009, that is statistically significant at the 10% level. A credit constrained firm, therefore, exports 1% less than a non-credit-constrained firm. Compared with the unconditional mean of the export share, that is 13%, credit constraints have therefore an impact of about 8%, that also, in this case, is not negligible.

The results reported in Column 1 broadly confirm also the findings on the impact of the other determinants on the intensive margin of exports: firms that export more are larger, as shown by the coefficient of + 0.071 of the number of full-time employees, which is statistically significant at the 1% level, have a higher labor productivity, as shown by the coefficient of + 0.010, also significant at the 1% level, have a larger share of temporary workers (+ 0.046, statistically significant at the 10% level), and that they are less oriented to domestic market, as shown by the coefficient of − 0.130, statistically significant at the 1% level, of the dummy for firms that declare that the main market in which the firm sells its most important product is national. In addition, we find a statistically significant effect also of the share of skilled workers (+ 0.024), and of the age of the firm, as shown by the coefficient of − 0.028, which is statistically significant at the 1% level. This last result suggests that controlling for age, younger firms tend to be more international than older firms, possibly because the latter have a more consolidated position in the national market.

Column 2 reports the results obtained estimating Eq. (3) with a tobit model, that accounts for the fact that our dependent variable, the share of exports over total sales, is bounded by construction within the [0,1] interval. Since also, in this case, the estimated coefficients do not provide a direct measure of the impact of the dependent variable on the probability that the firm is an exporter, Column 2 reports the marginal effects of each explanatory variable. As in the case of probit models as opposed to LPM, tobit models are more efficient than OLS, but they are also less robust to misspecification. Reassuringly, as in the case of the extensive margin, results of Column 2 are broadly identical to those of Column 1. In particular, the marginal effect of the dummy for credit-constrained firms is − 0.013, slightly larger than what obtained with the OLS, and it is statistically significant at the 5% level. The impact of the age of the firm and of the dummy for firms that focus mostly on the national market estimated using the tobit specification is about half that obtained with OLS, and that of the share of skilled workers vanishes, both statistically and economically.[9]

Columns 3 and 4 present the results of the estimation of an IV-linear model in which the dummy for firms that are credit-rationed is instrumented using the same variables as for the extensive margin. The reason why we estimate an IV-linear model instead of an IV-tobit model is that our instrumented variable is discrete, and therefore the IV-tobit specification cannot be applied. Following the standard procedure suggested by Angrist and Pischke (2009) and Wooldridge (2010), we have used the predicted values of the estimates of Eq. (2),

[8] The (unreported) F-test for joint significance of the three variables excluded from equation (1) is 106.98, implying that they are jointly statistically significant at the 1% level.

[9] The R^2 is 0.28 for the OLS and 0.23 for the tobit, very similar in the two specifications.

Table 4 Intensive margin of exports and credit rationing

Model	(1) OLS	(2) Tobit	(3) 2SLS	(4)	(5) Heckman
			First stage	Second stage	Second stage
Credit rationing	− 0.009*	− 0.013**		− 0.165***	− 0.167*
	(0.01)	(0.01)		(0.06)	(0.09)
Number of employees	0.071***	0.059***	− 0.037***	0.065***	0.057***
	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
Labor productivity	0.010***	0.012***	− 0.013***	0.007***	0.009**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Firm age	− 0.028***	− 0.014***	− 0.012***	− 0.029***	− 0.053***
	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
Share of temporary workers	0.046*	0.049**	0.004	0.046*	0.065***
	(0.03)	(0.02)	(0.01)	(0.03)	(0.02)
Share of skilled workers	0.024**	0.000	0.054***	0.034***	0.086***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Competition in national market	− 0.130***	− 0.063***	0.004	− 0.130***	− 0.281***
	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
Capacity utilization	0.001	− 0.002	− 0.092***	− 0.014*	− 0.030
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Instruments					
Balance-sheet certification			− 0.046***		
			(0.00)		
Payment after delivery (second tercile)			0.003		
			(0.01)		
Payment after delivery (third tercile)			− 0.033***		
			(0.01)		
Mills ratio					0.141***
					(0.04)
R^2	0.283	0.231	0.151		
Kleibergen-Paap first stage *F*-statistic (*p* value)				36.41 (0.00)	
Overidentifying restrictions statistic (*p* value)				2.54 (0.28)	
Observations	19,394	19,394	19,394		6316

Note: The table reports the estimates of Eq. (3). Column 1 reports the coefficients obtained using the OLS model. Column 2 reports the marginal effects obtained using the tobit model. Column 3 reports the marginal effects of the probit model estimated on the dummy for credit rationing and column 4 reports the coefficients obtained estimating a linear two-stages least-squares model on the share of exports, where credit rationing is instrumented using the predicted probability from the first stage. Column 5 reports two-stage least-squares estimates on the subsample of exporting firms, where credit rationing is instrumented using the predicted probability from the first stage reported in column 3, and includes the inverse Mills ratio. Unreported fixed effects for sector, country and year are included in all regressions. Kleibergen-Paap first stage *F*-statistic (*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 in the companion LPM specification. Overidentifying restrictions statistic (*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 in the companion LPM specification. Robust standard errors are clustered by sectors and reported in parentheses. ***, **, * denote significance at 0.01, 0.05, and 0.10 levels

presented in Column 3, as an instrument for the dummy for credit-constrained firms in Eq. (3).

Column 3 reports the marginal effects of the estimation of Eq. (2), on the probability that a firm is credit

constrained, that we have then used to construct the predicted values, used in turn as the instrument for the two-stage estimation of Eq. (3). Reassuringly, the coefficient of the predicted values obtained from the probit model in the first stage estimation of Eq. (2) is statistically significant at the 1% level.

Not surprisingly, in the case of the intensive margin of exports, the impact of credit rationing estimated using an instrumental variable framework is much larger than that obtained without accounting for the role of endogeneity due to possible reverse causation. As reported in Column 4, the coefficient of the dummy for credit-rationed firms is − 0.165, about one order of magnitude larger than that estimated with OLS and tobit, and it is statistically significant at the 1% level. Firms that are not credit-rationed export, therefore, twice the amount of their total sales than firms that are rationed. Interestingly, the coefficients of all other explanatory variables are broadly in line with those obtained with the OLS model. Also in the case of the intensive margin the specification passes the usual tests conducted on the companion LPM specification: the Kleibergen-Paap *F*-statistic for the hypothesis that the instruments have jointly zero coefficients in the first stage regression is 36.41, with a *p* value of 0.00, and the Hansen test of overidentifying restrictions is 2.54, with a p value of 0.28, revealing that we cannot reject the joint null hypothesis that the instruments are uncorrelated with the error term.

Finally, Column 5 presents the results of a Heckman two-step estimation of Eq. (3) on the subsample of actual exporters, instrumenting the dummy for credit-constrained firms as in the case of the specification presented in Column 4, and controlling for the potential effect of the sample selection bias induced by excluding non-exporters. Following Minetti and Zhu (2011), to improve on the identification of the equations for the two stages, that otherwise would hinge only on the non-linearity of the first-stage probit estimates with respect to the linear second stage, we include in the first stage estimates a measure of the degree of political instability of the exporting country. Column 5 shows that the estimated impact of credit rationing is in this case very close to that obtained with the IV-linear model, with a coefficient of the dummy for a credit-rationed firm of − 0.167, statistically significant at the 10% level. Since the average share of exported sales for exporting firms is about 40%, the effect of removing the credit constraints for these firms would be to increase their export share of nearly 42%, again an economically significant impact.

The results in Column 5 also confirm by and large the findings on the impact of the other determinants on the intensive margin exports: firms that export more are larger, have a higher labor productivity, and have a higher incidence of temporary workers. The estimated coefficients of the other control variables — the age of the firm, the dummy for firms that declare that the main market in which the firm sells its most important product is national, and the share of skilled workers — have the same sign as in the previous specifications, but their absolute value is about twice as large. The inverse Mills ratio is 0.141 and it is statistically significant at the 1% level, suggesting that controlling for the effect of the sample selection bias was crucial to obtain unbiased estimates. However, the comparison of the coefficients with those obtained from the full sample estimates shows that the distortion caused by not accounting for sample selection is quantitatively negligible.

Overall, also the results of the estimates of the effect of credit constraints on the intensive margin of exports provide robust and convincing evidence that it is statistically and economically significant. In the following, we will present the results of a number of additional robustness checks.

7 Additional results: subsamples on firm and country characteristics

Our baseline results provide strong evidence that credit constraints hinder the ability of firms to export. However, the average estimated effects might differ depending on other characteristics of the firms or of the countries where they are based. To this end, we have run two additional set of regressions on subsamples of firms and countries.[10] First, we have split the sample by size and age of the firm. As argued above, small and young firms are likely to experience stronger difficulties in anticipating the costs of accessing foreign markets than larger and more experienced firms (Beck and Demirguc-Kunt 2006; Shinkle and Kriauciunas 2010; LiPuma et al. 2013). As a result, the impact of credit-constraints on the exporting activities of these firms might be stronger than that on those

[10] While we have estimated all the specifications presented above for each subsample, to economize on space in the following we will present and comment only the results obtained with our preferred specification, that is the bivariate probit model for the extensive margin and the IV-linear model for the intensive margin.

that are larger and more experienced. In both cases, we have used as a benchmark the median value of the variable of interest calculated at the sector-country level where they operate. We have measured size with the number of full-time workers and experience with the number of years since foundation.

Results are reported in Table 5 for both margins of exports. Columns 1 and 2 of Table 5 present the results of the estimates of Eq. (1) with the bivariate probit model on two samples of smaller and larger firms. The marginal effect of − 0.076 for smaller firms (Column 1), statistically significant at the 1% level, compares with the smaller and statistically insignificant marginal effect of − 0.011 for medium-sized firms (Column 2), confirming that credit constraints have a strong negative effect only on the probability that small firms export.[11] Similarly, Columns 3 and 4 report the IV-linear estimates of Eq. (3) for the intensive margin on the two subsamples. Also, in this case, credit constraints hinder only the international activities of smaller firms, with a marginal effect of − 0.237, statistically significant at the 1% level.[12] Columns 5–8 present the results of the second sample split, that by firm age, showing that credit constrains negatively affect only the decision to export of younger firms. The coefficient (− 0.048) is statistically significant at the 1% level. The impact on the intensive margin is instead statistically insignificant in both subsamples, due to the lower precision of the estimates. Overall, these results provide evidence that financing obstacles have a stronger impact on the exporting activities of firms that are already more likely to face them, i.e., small and young firms.

In our second set of additional regressions, we have focused on how different country characteristics might moderate the size of the impact of credit constraints on exporting activities.[13]

As argued by several studies in the literature, the quality of country institutions reflects the environment in which a firm operates and can affect exporting through different channels, by raising or lowering export-related costs (see LiPuma et al. 2013; Krasniqi and Desai 2017). Our focus is on how institutional quality, that is typically lower in emerging countries than in developed countries (LiPuma et al. 2013), can affect the impact of credit rationing on a firm's export performance. In addition to the level of financial development, measured by the ratio of total assets of deposit money banks to GDP, we consider five different dimensions of institutional quality: overall economic freedom, trade freedom, rule of law, regulatory quality, corruption. For all these indices, we refer to the description in Section 4. In all cases, we have split the sample using as a benchmark the median value of the variable of interest.

While it is likely that firms operating in countries with more developed financial markets are better able to contrast the negative impact of credit constraints on exporting activities, the effect of the institutional environment is less obvious. Ample evidence shows that better institutions have a positive effect on both exporting activities and credit availability, but it is possible to provide reasons why the compound effect could be either positive or negative. For example, one may argue that in countries with a high level of corruption, the ability of a firm to export depends on its connections and eventually on its ability to bribe. In this case, although firms are more likely to be credit rationed, the impact on exports could be less relevant, because exporting activities are driven for the most part by other factors. However, one may also argue that in an institutional environment more supportive of market transactions the problems caused by credit constraints on exporting activities are lower because firms face fewer impediments to access foreign markets, and therefore lower expenses. What effect prevails is, therefore, an empirical issue, that provides the rationale of our analysis.

Table 6 reports the coefficients of the dummy for credit rationed firms estimated in the two subsamples of countries with a level above and below the median of the country-specific characteristic.[14] Columns 1 and 2 present the results splitting the sample according to the level of financial development. For the 15,157 firms located in countries where the ratio of bank assets to GDP is below the median, the marginal effect of being credit-rationed on the probability of being an exporter (i.e., the extensive margin) is − 0.045, and it is statistically significant at the 1% level (Column 1). For the 4121 firms located in countries with more developed financial markets, the marginal effect is instead lower, at − 0.026, and statistically significant at the 5% level (Column 2). Similar differences are found also

[11] Also the other determinants of the probability that a firm is an exporter have different marginal effects for small firms and for medium firms.

[12] Nearly all other determinants of the share of exported sales have different marginal effects for medium-small firms and for large firms.

[13] We thank an anonymous Reviewer for suggesting to expand this part of the analysis.

[14] Also in this case, results of the full regressions are not reported to make the table more intelligible and to economize on space, but are available upon request.

Table 5 Sample split by firm characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Size				Age			
	Extensive margin		Intensive margin		Extensive margin		Intensive margin	
Sample	Small	Medium	Small	Medium	Young	Old	Young	Old
Credit rationing	− 0.076***	− 0.011	− 0.237***	− 0.167	− 0.048***	− 0.002	− 0.085	− 0.065
	(0.02)	(0.01)	(0.07)	(0.11)	(0.01)	(0.01)	(0.09)	(0.05)
Number of employees	0.028***	0.007***	0.054***	0.067***	0.018***	0.013***	0.076***	0.062***
	(0.00)	(0.00)	(0.02)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
Labor productivity	0.002	0.002	0.004	0.010	0.002	0.002	0.009	0.010
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age	− 0.007**	− 0.005**	− 0.016**	− 0.038***	− 0.008***	0.004	− 0.029***	− 0.023***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
Share of temporary workers	0.032***	0.013	0.046**	0.043	0.020	0.026***	0.048*	0.041
	(0.01)	(0.01)	(0.02)	(0.04)	(0.01)	(0.01)	(0.03)	(0.03)
Share of skilled workers	0.013	0.021**	0.019	0.050***	0.013	0.012**	0.025	0.032***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
Competition in national market	− 0.004	− 0.006	− 0.070***	− 0.184***	− 0.007	− 0.006***	− 0.129***	− 0.130***
	(0.01)	(0.00)	(0.02)	(0.02)	(0.01)	(0.00)	(0.02)	(0.02)
Capacity utilization	− 0.017**	− 0.054***	− 0.007	− 0.031	− 0.025***	− 0.032***	− 0.010	0.006
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Instruments								
Balance-sheet certification	− 0.013***	− 0.020***	− 0.045***	− 0.044***	− 0.017	− 0.013	− 0.047***	− 0.046***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
Payment after delivery (second tercile)	− 0.001	0.001	0.000	0.004	0.002	− 0.003	0.014	− 0.011
	(0.00) ***	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
Payment after delivery (third tercile)	− 0.011	− 0.012*	− 0.040***	− 0.025**	− 0.010***	− 0.012***	− 0.025**	− 0.041***
	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
corr[ε_{ikct},μ_{ikct}]	0.488***	0.063			0.364***	0.059		
	(0.10)	(0.10)			(0.096)	(0.10)		
Kleibergen-Paap first stage *F*-statistic (*p* value)	17.00 (0.00)	18.21 (0.00)	17.05 (0.00)	18.10 (0.00)	19.96 (0.00)	16.15 (0.00)	16.53 (0.00)	16.21 (0.00)
Overidentifying restrictions statistic (*p* value)	2.31 (0.31)	2.70 (0.26)	3.92 (0.14)	0.71 (0.70)	5.75 (0.06)	0.04 (0.98)	2.62 (0.27)	2.99 (0.22)
Observations	10,195	9199	10,195	9199	10,343	9051	10,343	9051

Note: The table reports the estimates of Eqs. (1) and (3) on sub-samples of firms by size and age. Column 1–2 and 5–6 report the marginal effects obtained using the bivariate probit model on the dummy for exports. Column 3–4 and 7–8 report the coefficients obtained using the linear two-stages least-squares model on the share of exports, where credit rationing is instrumented using the predicted probability from the first stage regression, and the marginal effect of instruments on credit rationing. Small firms and young firms are those below the median level of the sector-country distribution, medium firms and old firms are all the others. corr[ε_{ikct}, μ_{ikct}] is the correlation coefficient (*rho*) between the unobserved determinants of the export participation decision (ε_{ikct}) and those of rationing (μ_{ikct}). Kleibergen-Paap first stage *F*-statistic (*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 in the companion LPM specification. Overidentifying restrictions statistic (*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 in the companion LPM specification. Unreported fixed effects for sector, country and year are included in all regressions. Robust standard errors are clustered by sectors and reported in parentheses. ***, **, * denote significance at 0.01, 0.05, and 0.10 level

Table 6 Sample split by country characteristics

	(1) Financial development	(2)	(3) Economic freedom	(4)	(5) Trade freedom	(6)	(7) Rule of law	(8)	(9) Regulatory quality	(10)	(11) Corruption	(12)
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Extensive margin												
Credit rationing	−0.045***	−0.026**	−0.053***	−0.018	−0.045**	−0.009	−0.039***	−0.010	−0.046***	−0.026**	−0.034**	−0.016*
	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
Intensive margin												
Credit rationing	−0.278***	0.075	−0.319***	−0.087	−0.243***	−0.093	−0.366***	−0.004	−0.299***	−0.105**	−0.264***	−0.080*
	(0.07)	(0.08)	(0.07)	(0.05)	(0.06)	(0.16)	(0.10)	(0.04)	(0.07)	(0.05)	(0.08)	(0.05)
Observations	15,157	4121	8657	10,573	10,500	8730	9716	9678	9247	10,147	8702	10,692

Note: The table reports the marginal effects of the dummy for credit rationed firms obtained from the estimation of Eqs. (1) and (3) on sub-samples of countries based on whether the value of the characteristic reported is above or below the median. Unreported fixed effects for sector, country and year are included in all regressions. Robust standard errors are clustered by sectors and reported in parentheses. ***, **, * denote significance at 0.01, 0.05, and 0.10 levels

for the impact of credit-rationing on the intensive margin of exports, with a coefficient of − 0.278, statistically significant at the 1% level, for less developed countries, and of + 0.075 and statistically insignificant for more developed countries. Columns 3 and 4 show that also higher economic freedom has a moderating effect on the impact of credit constraints: the coefficient of the equation for the extensive and the intensive margins are respectively − 0.053 and − 0.319 and they are both statistically significant at the 1% level in countries with low levels of economic freedom; on the contrary, in the case of countries with higher economic freedom both coefficients are smaller in size and statistically insignificant. Interestingly, also countries with a lower level of trade freedom, a measure of the impact of tariff and non-tariff barriers to international trade, show a stronger impact of credit constraints on exports (columns 5 and 6). Focusing on specific aspects of the index of economic freedom, Columns 7–12 show that rule of law, regulatory quality and corruption have a significant moderating effect on the impact of credit-rationing on exports. Indeed, a lower development across all these dimensions — i.e., less respect of the rule of law, lower regulatory quality and higher levels of corruption — has a magnifying effect on the impact of credit constraints on exports, as it is confirmed by the higher value of the coefficients estimated in the subsample of countries whose institutional development is below the sample median.

Overall, these results provide a very neat picture on how institutional characteristics affect the size of the impact of credit constraints on exporting activities: firms operating in countries where market-oriented activities find a more friendly environment are better able to tackle the negative impact of credit constraints. This may happen because the explicit and implicit costs of accessing foreign markets are lower and because it is easier to find arrangements that are alternative to credit to cover them. Importantly, this provides additional support to the view that it is precisely in those countries that already face other types of impediments to exporting activities that improving access to credit is most beneficial.

8 Conclusions

Researchers in business and economics have examined thoroughly the role of financial constraints on export behavior (see, e.g., Berman and Héricourt 2010; Minetti and Zhu 2011; Bartoli et al. 2014; Gashi et al. 2014; Fauceglia 2015; Krasniqi and Desai 2016), but many

questions are still unanswered. We contributed to the understanding of some additional features of this relationship studying a large sample of over 19,000 SMEs operating in 65 emerging and developing countries.

Our results provide additional robust and convincing evidence that credit constraints have a negative effect 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). But we also add four original contributions to the previous literature. First, we confirm the results of the previous analyses using a measure of credit constraints provided by each firm's self-assessment of its conditions. We believe that this is a relevant result, given both the ample debate on how to define measures of credit constraints and the importance of borrowers' discouragement, especially in the case of SMEs, as shown for example by Levenson and Willard (2000) and Mol-Gómez-Vázquez et al. (2018). Second, we use a larger and more heterogeneous sample than previous studies, in terms of both the number of firms and the number of countries, providing additional robustness to the previous findings. Third, we address thoroughly the potential endogeneity problems of the relationship between credit constraints and exports, controlling for a number of individual attributes that may affect exports and in particular, adopting an instrumental variable approach that exploits firm-level instruments. Fourth, and most relevant, taking advantage of the size and features of our sample, we study in detail how characteristics that are specific of some firms and countries can affect the strength of the relationship between credit availability and exports. In particular, we show that credit constraints have a stronger negative effect on exports for smaller and younger SMEs, and for those operating countries with a less developed financial system and a worse institutional environment. Interestingly, a crucial characteristic is shown to be how favorable are institutions and regulations to market transactions.

We believe that these findings have relevant policy implications because they uncover one additional reason of vulnerability of SMEs to overall market conditions and institutional arrangements (Buckley 1989; Hessels and Parker 2013). Policy-makers seeking to support entrepreneurial efforts to access international markets should, therefore, remove bank-generated and self-perceived obstacles that discourage firms to apply for credit. And this would benefit relatively more small SMEs operating in countries that already face significant constraints to internationalization, due to poorer institutions. In turn, these results suggest that creating a more market-friendly environment helps to reduce the negative impact of credit constraints on exporting activities.

Our analysis still suffers from some limitations, partly due to the nature of our data. Further research, possibly based on a large panel including information on many firms and countries, might, for example, allow to study more in detail the dynamic impact of the removal of credit constraints and of the improvement of institutional characteristics. Nonetheless, we believe that our analysis contributes to better understanding how emerging and developing countries could sustain SMEs' export growth.

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References

Aidis, R., Estrin, S., & Mickiewicz, T. M. (2012). Size matters: entrepreneurial entry and government. *Small Business Economics, 39*(1), 119–139. https://doi.org/10.1007/s11187-010-9299-y.

Anderson, J., & Marcouiller, D. (2002). Insecurity and the pattern of trade: an empirical investigation. *Review of Economics and Statistics, 84*(2), 342–352. https://doi.org/10.1162/003465302317411587.

Angrist, J., & Pischke, J. S. (2009). *Mostly harmless econometrics: an empiricist's companion*. Princeton, N.J: Princeton University Press.

Bartoli, F., Ferri, G., Murro, P., & Rotondi, Z. (2014). Bank support and export: evidence from small Italian firms. *Small Business Economics, 42*(2), 245–264. https://doi.org/10.1007/s11187-013-9486-8.

Becchetti, L., & Trovato, G. (2002). The determinants of growth for small and medium sized firms. The role of the availability of external finance. *Small Business Economics, 19*(4), 291–306. https://doi.org/10.1023/A:1019678429111.

Beck, T. (2002). Financial development and international trade: is there a link? *Journal of International Economics, 57*(1), 107–131. https://doi.org/10.1016/S0022-1996(01)00131-3.

Beck, T., & Demirguc-Kunt, A. (2006). Small and medium-size enterprises: access to finance as a growth constraint. *Journal of Banking & Finance, 30*(11), 2931–2943. https://doi.org/10.1016/j.jbankfin.2006.05.009.

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2000). A new database on the structure and development of the financial sector. *The World Bank Economic Review, 14*(3), 597–605. https://doi.org/10.1093/wber/14.3.597.

Becker, B., Chen, J., & Greenberg, D. (2012). Financial development, fixed costs, and international trade. *The Review of Corporate Finance Studies, 2*(1), 1–28. https://doi.org/10.1093/rcfs/cfs005.

Bellone, F., Musso, P., Nesta, L., & Schiavo, S. (2010). Financial constraints and firm export behaviour. *The World Economy, 33*(3), 347–373. https://doi.org/10.1111/j.1467-9701.2010.01259.x.

Berger, A. N., & Udell, G. F. (2006). A more complete conceptual framework for SME finance. *Journal of Banking & Finance, 30*(11), 2945–2966. https://doi.org/10.1016/j.jbankfin.2006.05.008.

Berman, N., & Héricourt, J. (2010). Financial factors and the margins of trade: evidence from cross-country firm-level data. *Journal of Development Economics, 93*(2), 206–217. https://doi.org/10.1016/j.jdeveco.2009.11.006.

Berman, N., Martin, P., & Mayer, T. (2012). How do different exporters react to exchange rate changes? *The Quarterly Journal of Economics, 127*(1), 437–492. https://doi.org/10.1093/qje/qjr057.

Bowen, H. P., & De Clercq, D. (2008). Institutional context and the allocation of entrepreneurial effort. *Journal of International Business Studies, 39*(4), 747–767. https://doi.org/10.1057/palgnave.jibs.8400343.

Buch, C.M., Kesternich, I., Lipponer, A., & Schnitzer, M. (2010). Exports versus FDI revisited: does finance matter? Bundesbank Series 1 Discussion Paper No. 2010,03. Available at SSRN: https://ssrn.com/abstract=2785367.

Buckley, P. J. (1989). Foreign direct investment by small-and medium-sized enterprises: The theoretical background. In *The multinational enterprise* (pp. 24–45). London: Palgrave Macmillan.

Chaney, T. (2016). Liquidity constrained exporters. *Journal of Economic Dynamics and Control, 72*, 141–154. https://doi.org/10.1016/j.jedc.2016.03.010.

Dimitratos, P., Lioukas, S., & Carter, S. (2004). The relationship between entrepreneurship and international performance: the importance of domestic environment. *International Business Review, 13*(1), 19–41. https://doi.org/10.1016/j.ibusrev.2003.08.001.

Egger, P. H., & Kesina, M. (2014). Financial constraints and the extensive and intensive margin of firm exports: panel data evidence from China. *Review of Development Economics, 18*(4), 625–639. https://doi.org/10.1111/rode.12107.

Fauceglia, D. (2015). Credit constraints, firm exports and financial development: evidence from developing countries. *The Quarterly Review of Economics and Finance, 55*, 53–66. https://doi.org/10.1016/j.qref.2014.08.003.

Fazzari, S. M., Hubbard, R. G., & Petersen, B. C. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity, 1988*(1), 141–206 https://www.jstor.org/stable/2534655.

Feenstra, R. C., Li, Z., & Yu, M. (2014). Exports and credit constraints under incomplete information: theory and evidence from China. *Review of Economics and Statistics, 96*(4), 729–744. https://doi.org/10.1162/REST_a_00405.

Gashi, P., Hashi, I., & Pugh, G. (2014). Export behaviour of SMEs in transition countries. *Small Business Economics, 42*(2), 407–435. https://doi.org/10.1162/REST_a_00405.

Gorodnichenko, Y., & Schnitzer, M. (2013). Financial constraints and innovation: why poor countries don't catch up. *Journal of the European Economic Association, 11*(5), 1115–1152. https://doi.org/10.1111/jeea.12033.

Greenaway, D., Guariglia, A., & Kneller, R. (2007). Financial factors and exporting decisions. *Journal of International Economics, 73*(2), 377–395. https://doi.org/10.1016/j.jinteco.2007.04.002.

Guiso, L., Sapienza, P., & Zingales, L. (2004). Does local financial development matter? *Quarterly Journal of Economics, 119*, 929–969. https://doi.org/10.1162/0033553041502162.

Hashi, I., & Krasniqi, B. A. (2011). Entrepreneurship and SME growth: evidence from advanced and laggard transition economies. *International Journal of Entrepreneurial Behavior & Research, 17*(5), 456–487. https://doi.org/10.1108/13552551111158817.

Hessels, J., & Parker, S. C. (2013). Constraints, internationalization and growth: a cross-country analysis of European SMEs. *Journal of World Business, 48*(1), 137–148. https://doi.org/10.1016/j.jwb.2012.06.014.

Jappelli, T. (1990). Who is credit constrained in the US economy? *Quarterly Journal of Economics, 105*, 219–234 https://www.jstor.org/stable/2937826.

Jinjarak, Y., & Wignaraja, G. (2016). An empirical assessment of the export-financial constraint relationship: how different are small and medium enterprises? *World Development, 79*, 152–163. https://doi.org/10.1016/j.worlddev.2015.11.012.

Kaplan, S. N., & Zingales, L. (1997). Do investment-cash flow sensitivities provide useful measures of financing constraints? *The Quarterly Journal of Economics, 112*(1), 169–215. https://doi.org/10.1162/003355397555163.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2007). The worldwide governance indicators project: answering the critics. Policy Research working paper no. WPS 4149. Washington, DC: World Bank. Available at: http://documents.worldbank.org/curated/en/979231468178138073/The-worldwide-governance-indicators-project-answering-the-critics.

Kersten, R., Harms, J., Liket, K., & Maas, K. (2017). Small firms, large impact? A systematic review of the SME finance literature. *World Development, 97*, 330–348. https://doi.org/10.1016/j.worlddev.2017.04.012.

Kletzer, K., & Bardhan, P. (1987). Credit markets and patterns of international trade. *Journal of Development Economics, 27*(1–2), 57–70. https://doi.org/10.1016/0304-3878(87)90006-X.

Krasniqi, B. A., & Desai, S. (2016). Institutional drivers of high-growth firms: country-level evidence from 26 transition economies. *Small Business Economics, 47*(4), 1075–1094. https://doi.org/10.1007/s11187-016-9736-7.

Krasniqi, B. A., & Desai, S. (2017). Institutions and export performance in 26 transition economies. In *Entrepreneurship in transition economies* (pp. 57–73). Cham: Springer.

Krasniqi, B. A., & Mustafa, M. (2016). Small firm growth in a post-conflict environment: the role of human capital, institutional quality, and managerial capacities. *International Entrepreneurship and Management Journal, 12*(4), 1165–1207. https://doi.org/10.1007/s11365-016-0384-9.

Levenson, A. R., & Willard, K. L. (2000). Do firms get the financing they want? Measuring credit rationing experienced by small businesses in the US. *Small Business Economics, 14*(2), 83–94. https://doi.org/10.1023/A:1008196002780.

LiPuma, J. A., Newbert, S. L., & Doh, J. P. (2013). The effect of institutional quality on firm export performance in emerging

economies: a contingency model of firm age and size. *Small Business Economics, 40*(4), 817–841. https://doi.org/10.1007/s11187-011-9395-7.

Manova, K. (2008). Credit constraints, equity market liberalizations and international trade. *Journal of International Economics, 76*(1), 33–47. https://doi.org/10.1016/j.jinteco.2008.03.008.

Manova, K. (2012). Credit constraints, heterogeneous firms, and international trade. *Review of Economic Studies, 80*(2), 711–744. https://doi.org/10.1093/restud/rds036.

Manova, K., Wei, S. J., & Zhang, Z. (2015). Firm exports and multinational activity under credit constraints. *Review of Economics and Statistics, 97*(3), 574–588 https://doi.org/10.1162/REST_a_00480.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica, 71*(6), 1695–1725.

Minetti, R., & Zhu, S. C. (2011). Credit constraints and firm export: microeconomic evidence from Italy. *Journal of International Economics, 83*(2), 109–125. https://doi.org/10.1016/j.jinteco.2010.12.004.

Minetti, R., Murro, P., Rotondi, Z., & Zhu, S. C. (2017). Financial constraints, firms' supply chains, and internationalization. *Journal of the European Economic Association*. https://doi.org/10.1093/jeea/jvx056.

Mol-Gómez-Vázquez, A., Hernández-Cánovas, G., & Koëter-Kant, J. (2018). Bank market power and the intensity of borrower discouragement: analysis of SMEs across developed and developing European countries. *Small Business Economics*, 1–15. https://doi.org/10.1007/s11187-018-0056-y.

Motta, V. (2018). Lack of access to external finance and SME labor productivity: does project quality matter? *Small Business Economics*, 1–16. https://doi.org/10.1007/s11187-018-0082-9.

Musso, P., & Schiavo, S. (2008). The impact of financial constraints on firm survival and growth. *Journal of Evolutionary Economics, 18*(2), 135–149. https://doi.org/10.1007/s00191-007-0087-z.

Rajan, R. G., & Zingales, L. (1998). Power in a theory of the firm. *The Quarterly Journal of Economics, 113*(2), 387–432. https://doi.org/10.1162/003355398555630.

Rostamkalaei, A., Nitani, M., & Riding, A. (2018). Borrower discouragement: the role of informal turndowns. *Small Business Economics*, 1–16. https://doi.org/10.1007/s11187-018-0086-5.

Secchi, A., Tamagni, F., & Tomasi, C. (2016). Financial constraints and firm exports: accounting for heterogeneity, self-selection, and endogeneity. *Industrial and Corporate Change, 25*(5), 813–827. https://doi.org/10.1093/icc/dtw033.

Shinkle, G. A., & Kriauciunas, A. P. (2010). Institutions, size and age in transition economies: implications for export growth. *Journal of International Business Studies, 41*(2), 267–286. https://doi.org/10.1057/jibs.2009.9.

Silva, A. (2011). Financial constraints and exports: evidence from Portuguese manufacturing firms. *International Journal of Economic Sciences & Applied Research, 4*(3).

Stiebale, J. (2011). Do financial constraints matter for foreign market entry? A firm-level examination. *The World Economy, 34*(1), 123–153. https://doi.org/10.1111/j.1467-9701.2010.01306.x.

Wagner, J. (2014). Credit constraints and exports: evidence for German manufacturing enterprises. *Applied Economics, 46*(3), 294–302. https://doi.org/10.1080/00036846.2013.839866.

Wang, X. (2016). Financial constraints and exports (January 27, 2016). Available at SSRN: https://ssrn.com/abstract=2698358.

Welch, B. L. (1947). The generalization of 'student's' problem when several different population variances are involved. *Biometrika, 34*(1–2), 28–35 https://www.jstor.org/stable/2332510.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.