# Imports and Credit Rationing: A Firm-Level Investigation

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**Abstract**

Firm performance is known to benefit from participation in import markets. For this reason, understanding whether credit constraints hamper firms' ability to purchase foreign inputs is a relevant issue. In this paper, we investigate the relationship between financial constraints and imports of intermediate inputs using a large sample of small- and medium-sized enterprises from 66 developing countries. To measure credit constraints we use information from a firm's in-depth self-assessment of its difficulties in having access to external finance. Furthermore, to tackle the endogeneity problems in the estimation, we rely on an instrumental variable approach that allows us to establish more directly the impact of financial constraints on importing activities. We provide robust evidence of a statistically and economically significant restraining effect of credit constraints on both the probability of importing intermediates (the extensive margin) and the incidence of imported intermediates in total input expenditure (the intensive margin). Moreover, we show that the impact on these margins of import is stronger for firms operating in countries where the financial system is less developed, the quality of institutions poorer and the overall level of economic freedom lower.

JEL classification: D22, F10, F14, F23, M21
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## 1. Introduction

The international trade literature has established that firm's importing activities positively affect its performance along several dimensions. An important area of research deals with the productivity gains arising from import market participation. For example, using microeconomic data Amiti and Konings (2007), Kugler and Verhoogen (2009) and Halpern et al. (2015) show that imports of intermediate inputs are conducive to higher productivity. Along similar lines, Goldberg et al. (2010) estimate substantial dynamic gains from trade associated to the use of imported inputs, as they enable firms to increase their domestic product scope through the introduction of new product varieties.

Given the beneficial role of import market participation, analyzing firm-specific factors that deter it is a relevant topic. As the presence of financial constraints is a good candidate, our paper seeks to investigate whether and how the ability to have access to finance provides a degree of specificity across firms that characterizes their presence in import markets.

In general, credit constraints contribute to shape the firm's degree of external orientation. The rationale of this lies in the characteristics of the fixed and variable-type incremental costs that a firm faces when it engages in international activities. These costs, in general, must be paid upfront, with the implication that firms conducting trade tend to demand external funds to a greater extent than firms not involved in international activities.

A variety of theoretical and empirical papers have analyzed the relationship between credit constraints and exports, establishing that financial constraints negatively affect export market participation on both the extensive and intensive margin (see e.g., Greenaway et al., 2007; Manova, 2013; Minetti and Zhu, 2011 and Chaney, 2016). Other papers have shown that credit constraints hinder the pattern of foreign direct investment (FDI) and multinational activity (e.g. Manova et al., 2015 and Antràs et al., 2009). By contrast, there is scarce literature on the relationship between credit constraints and participation in import markets. This is surprising because, not only importing and exporting firms are shown to exhibit similar characteristics, but the literature has also established a causal effect of increased imported intermediate inputs on firm export outcomes. In particular, Feng et al. (2016) convincingly show that the product upgrading facilitated by technology or quality embedded in imported inputs induces firms to expand the scale and breadth of their participation in export markets. Similar conclusions are also drawn by Bas (2012) and Bas and Strauss-Kahn (2014).

To our knowledge, only five contributions address the question that we analyze in this paper. Muûls (2015) uses microeconomic data for Belgian manufacturing and shows that financially-constrained firms have a lower probability of being importers and, among the importers, they tend to import less. On the other hand, while the extensive margin of imports in terms of number of products is responsive

to financial constraints, the one in terms of number of countries of origin is not. Wagner (2015) employs enterprise-level information for German manufacturing and provides empirical evidence that firms with a better credit rating score have a higher probability to import, and that the number of products and the countries from which they import tends to be higher. On the contrary, he documents that credit constraints do not influence the incidence of firms' imports in total sales (the intensive margin of imports). Fauceglia (2015) relies on firm-level panel data across several developing countries and finds that credit constraints exert a negative and statistically significant impact on the probability that a firm imports capital goods in the form of machinery or equipment. On the other hand, however, the volume of imported capital goods is unresponsive to credit constraints, and so is the firm's decision to import intermediate inputs. By using data for a sample of European manufacturing firms drawn from the EFIGE survey, Aristei and Franco (2014) employ direct indicators of credit rationing, based on survey responses, and find that the presence of credit constraints reduces both the probability of importing intermediate goods and the volume of imported inputs. Finally, Bas and Berthou (2012) rely on data for Indian manufacturing and show that firms with lower leverage and higher liquidity are more likely to be importers of capital goods. By contrast, however, only the liquidity ratio has a significant effect on the firms' decision to import intermediate products. Based on their findings, Bas and Berthou (2012) conclude that credit constraints are binding for imports of capital goods, but have only a limited impact on the use of foreign intermediates.

The existing empirical evidence on the relationship between credit constraints and imports is thus blurred, and it does not point to univocal conclusions. This calls for an investigation that sheds further light on the matter. Against this backdrop, we use a large sample of establishment-level data for 66 countries drawn from the World Bank Enterprise Surveys (hereby WBES) and analyze whether and how the presence of credit constraints impinges on the probability of importing (the extensive margin), and on the incidence of expenditure for imported intermediates in total input expenditure (the intensive margin).

A critical issue in our analysis is that of approximating an unobservable variable such as the presence of financial constraints at the firm level. A number of approaches have been proposed in the literature to measure credit constraints, many of which rely on information drawn from firms' balance sheet and cash flow statement. Whilst widely used, the ability of these approaches to gauge firms' difficulties in having access to finance is often put into question. Fortunately, in our analysis we can rely on firms' responses to a number of questions in the WBES Survey that provide a comprehensive self-assessment of whether they are financially constrained.

Each firm in the Survey is asked, first, whether it has been turned down for a loan. Subsequently, every firm that needs external finance but that, in spite of this, has not applied for a loan is asked to

indicate the main reasons that discouraged it from applying, choosing among a set of alternatives proposed in the Survey.

Using this information, we classify a firm as financially constrained if it either had a loan application denied from the bank, or it was discouraged from applying despite its actual financial needs.[1] We believe that our measuring procedure, that combines an objective feature, such as the bank loan rejection, with a firm's subjective appraisal, is less exposed to the concerns often raised about constructing indicators based only on balance-sheet information.

Moreover, our estimation methodology on firm-level data relies on an instrumental variables approach to tackle the endogeneity problems that may otherwise affect our empirical findings.[2] This enables us to better identify causal effects and establish more directly the impact of financial constraints on importing activities.

We provide robust evidence of a statistically and economically significant restraining effect of credit constraints on both the probability of importing intermediate inputs (the extensive margin) and the incidence of imported intermediates in total input expenditure (the intensive margin).

Moreover, our empirical investigation exploits heterogeneity not only across firms, but also across countries. In particular, our dataset allows us to augment our estimation framework with a variety of country-specific information, which include the degree of financial development, the quality of regulatory institutions, the degree of economic freedom and that of trade liberalization. We show that a country's weakness along each of these dimensions amplifies the negative effects of financial constraints on import participation of firms operating in that country.

The remaining of the paper is organized as follows. Section 2 illustrates the relevant issues and surveys the related literature. Section 3 focuses on the data and descriptive statistics. Section 4 illustrates the econometric methodology. Section 5 presents the baseline empirical findings, while Section 6 provides additional results by focusing on extensions and robustness checks. Section 7 draws some concluding remarks.

[1] We therefore interpret the status of discouraged borrower as a firm's self-assessment of being credit constrained. The same approach has been followed for example by Pietrovito and Pozzolo (2019), Aristei and Franco (2014) and Minetti and Zhu (2011).

[2] Specifically, idiosyncratic and unobservable firms' features may impinge on both their ability to access external finance and their imports of intermediates, and reverse causation may be at work in the relationship between credit constraints and imports as, for example, participation in import markets may signal healthy financial conditions and thereby loosen credit constraints.

## 2. Background and Related Literature

A burgeoning literature has emphasized the gains from trade associated with firm's access to intermediate inputs produced abroad. Indeed, through adoption of technological knowledge embodied in imported intermediates, firms can improve the efficiency of production and boost their productivity, as it is predicted, for example, by the endogenous growth model of Grossman and Helpman (1991). Indeed, using Indonesian manufacturing census data with plant-level information on imported inputs, Amiti and Konings (2007) show that larger imports of intermediates arising from tariffs reduction lead to increases in firm productivity, thanks to the foreign technology embodied in the imported intermediate inputs. Using Colombian plant-level data, Fernandes (2007) not only documents that trade liberalization induces productivity gains, but also that this effect is linked to within-plant increases in imported intermediates. Kasahara and Rodrigue (2008), relying on detailed panel information on Chilean manufacturing plants, also provide evidence that imported intermediates improve a plant's productivity. Using data from a panel of Hungarian firms, Halpern et al. (2015) estimate a structural model of imports, showing that improved access to imported intermediates induces a sizeable effect on firm productivity: according to their findings, one-quarter of the productivity expansion in Hungary during the 1993–2002 period was due to imported inputs. Based on firm-level information on Indian manufacturing, Topalova and Khandelwal (2011) show that reductions in trade protection boosted firm-level productivity, and that the primary force driving this result is the access to better inputs through the increase in the number and volume of imported inputs.

In spite of its positive impact on firm performance, participation in import markets is expensive, and not all firms may be able to afford the associated costs. Let us therefore elucidate the reasons as to why a lack of financial strength may prevent a firm from reaping the benefits of importing activities. Firms engaged in foreign activities typically face incremental fixed and variable expenses (see e.g. Manova, 2013). In the case of import market participation, a shift in the firm's sourcing of part of its intermediate inputs from domestic to foreign suppliers would imply extra costs, which range from those of gathering information on foreign suppliers in different countries and selecting the most suitable ones and verifying the technological features of the imported inputs, to those related to custom and regulatory compliance.[3] Importing activities may also bring about variable-type costs for transportation, distribution and insurance and for cross-countries payment services. More in general,

[3] As discussed in Fauceglia (2015), firms that become importers of intermediate inputs for the first time must face higher fixed expenses with respect to incumbent input importers. In addition to finding suitable foreign suppliers and negotiating the trade contracts, the newly importers must adapt or upgrade their production process to the technology embedded in the imported inputs and train the workforce accordingly.

importing firms typically encounter additional expenses associated to maintaining an international sourcing network (see Fauceglia, 2015). Furthermore, as discussed in Wagner (2015), firms relying on imported intermediate inputs are often asked to pay in advance of delivery, with a longer time span between the payment for imported inputs and the revenues from selling their own products.

Other things being equal, all these incremental expenses contribute to make importing firms more dependent on external finance compared to firms solely relying on domestically produced inputs. Thus, participation in import markets may be seriously prevented for financially constrained firms.

Moreover, a condition of credit restraints is likely to mirror or to be perceived as a critical situation of the firm. As argued convincingly by Muûls (2015), this may induce foreign suppliers to be reluctant towards undertaking trading activities. Indeed, foreign suppliers are not willing to take a default risk if the financial status of the potential importer is that of a credit-constrained firm. Likewise, international trade is often perceived as a riskier activity than that between two firms operating in the same country. As emphasized by Wagner (2015), for example, the difficulties in enforcing cross-border contracts imply that foreign suppliers require higher liquidity and financial strength on the part of the firm. These additional features strengthen the negative impact of credit constraints on import market participation, amplifying the standard effect induced by the inability of financially constrained firms to afford the fixed and variable upfront costs associated to importing.

Of course, this discussion on the extra costs sustained by importing firms with respect to those relying only on domestically produced inputs can be extended to all firms operating in foreign markets and, in particular, those involved in exporting activities.[4] Thus, as convincingly established by a large body of literature, also the decision to participate in export markets is affected by whether a firm is financially constrained or not. Theoretical contributions include those by Manova (2013), Feenstra et al. (2014) and Chaney (2016), who augment the Melitz's (2003) trade model for heterogeneous firms and show that financial frictions restrict exporting activities as credit-constrained firms need to attain a higher level of productivity than unconstrained firms to be able to export. As for the empirical studies, a growing number of papers have documented a restraining effect of financial constraints on exports. For example, using the measurement approach for credit constraints first proposed by Rajan and Zingales (1998), Manova (2013) shows that firms in industries that are more dependent on external finance are more likely to export if they operate in countries with a higher level of financial

[4] In order to participate in export activities, firms need to gather information on destination markets and foreign customers, adapt their products to the local regulatory framework and establish and maintain an international distribution network. Moreover, the volume of foreign sales can be harder to predict than in the case of domestic sales and the enforcement of cross-border contracts can be more challenging. In general, completing an export order and collecting payment after shipping is expected to take more time compared to a domestic order, and this implies higher working capital requirement for the exporters (see Wagner, 2014, and Aristei and Franco, 2014).

development. A number of contributions reach similar conclusions by using instead firm-level data from a single country (see e.g. Greenaway et al., 2007, Minetti and Zhu, 2011, Feenstra et al., 2014 and Manova et al. 2015) or from more countries (see e.g. Berman and Héricourt, 2010 and Pietrovito and Pozzolo, 2019).

Given the motivation provided in this and the previous sections, let us now turn to our empirical analysis.

## 3. Data and Descriptive Statistics

### *3.1 Firm-level characteristics*

To appraise whether and how credit constraints affect firm's importing activities, we employ the data drawn from the World Bank Enterprise Surveys (WBES), a public and influential source of firm-level data for over 140 countries. The WBES have been used in several papers analyzing the impact of credit rationing on export behavior and trading patterns (see, for instance, Berman and Héricourt, 2010, Fauceglia, 2015 and Pietrovito and Pozzolo, 2019).[5]

To maintain the same number of observations across the different estimating equations, we include firms in the dataset only if they report information on all the individual controls. In this way, we end up with a sample of 21,079 firms from 66 emerging and developing countries, over the years 2003 and 2006-2014.[6] The total number of firm-year pairs is 21,713, which – compared to the number of firms – indicates that the database includes only a small panel component, of about 634 firms. Since it is hard to detect robust relationships with such a small panel component, our analysis is conducted on the pooled data over those years.[7]

The WBES cover a broad range of information on the firm, including those on sales, costs of production, the number of employees and the characteristics of the workforce, the value of the assets and access to finance. Information is provided also on a number of dimensions of the business environment such as, for example, those on infrastructure, competition, corruption and crime. The questions in the ES that we use in our empirical analysis are reported in Appendix A1.

[5] An Enterprise Survey (ES) is a survey conducted by the World Bank on a representative sample of firms with 5 or more employees, operating in the private sector, primarily in manufacturing and services. In the ES, firms are selected using a stratified random sampling method, based on four characteristics: size, business sector, and geographic region within a country. Through this method, the probability of selecting each unit is ex-ante identical within each stratum (see http://www.enterprisesurveys.org for details on the sampling methodology and data availability).

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

[7] See also Gorodnichenko and Schnitzer (2013) on this issue.

To construct the dependent variables of our empirical model, we extract information on the import expenditures of a firm from the 'sales and supplies' section of the WBES. This allows us to measure both the extensive and intensive margins of imports. As for the former, we employ a dummy variable equal to one if the firm does import some material inputs or supplies and to zero if it relies exclusively on domestically produced intermediate inputs. Conversely, the intensive margin is measured by the share of material inputs or supplies of foreign origin over the total value of material inputs or supplies purchased in the year.[8]

The information on importing activities is supplemented with that on other individual characteristics, which serve as control variables in the empirical specifications. As for those related to the structure of the firm, we use the number of permanent full-time employees to approximate firm size. For labor productivity we jointly use two variables: (i) the ratio of total sales to the number of employees and (ii) the share of skilled workers in the number of permanent full-time employees. Firm age is measured by the number of years since its foundation. We also control for the share of temporary employees in total employees and for a self-reported measure of capacity utilization.

Moreover, we control for other dimensions of firm's orientation towards international markets by considering two dummy variables in our empirical specification: the first reflects the firm exporting status, and takes the value of one if the firm exports its products to foreign markets and zero otherwise; the second takes the value of one if the main market in which the firm sells its leading product is national and zero otherwise. We expect that exporting firms are more likely to afford the sunk extra costs related to imported inputs because of their advantage in terms of knowledge on how to conduct international trade.

*3.2. The measure of financial constraints*

A critical issue in our empirical analysis is that of measuring the presence of financial constraints, a characteristic that is not directly observable. A large body of empirical research has been conducted approximating firms' credit constraints through information drawn from firms' balance sheet and cash flow statement items. Whilst this measurement approach is extensively used in the literature, several concerns have been raised over its ability to measure the true firm dependence on external financing (see e.g. Farre-Mensa and Ljungqvist, 2016).

Previous contributions analyzing the relationship between firm's financial conditions and imported inputs rely on widely-used indicators as proxies for financial constraints. They range from (i) credit

[8] Unfortunately, the data do not include information on the number of different products imported and the number of countries of origin. This prevents us from analysing the extensive margins in terms of products and origins, as in Muûls (2015) and Wagner (2015).

scores produced by banks and credit institutions, containing synthetic information on firm's risk (Muûls, 2015; Wagner, 2015) to (ii) leverage and liquidity ratios, extracted from balance sheets (Bas and Berthou, 2012; Fauceglia, 2015).

In constructing our indicator of credit rationing, we follow instead the approach pioneered in Jappelli (1990), emphasizing the notion of discouraged borrowers. In particular, we employ a direct measure of credit rationing that reflects an in-depth self-assessment of each firm on its ability to have access to external finance. We define a firm as credit constrained if it has no credit lines or loans from a financial institution because it either (i) applied for a loan, but did not obtain it by the financial intermediary, or (ii) did not apply for a loan because one or more of the following reasons discouraged it from doing so: a) too complex procedures, b) unfavorable interest rate, c) too high collateral requirements, d) insufficient size and contract length of the available loan or e) expectations that the loan application would be rejected.[9]

*3.2 Descriptive statistics*

Table 1 shows the main descriptive statistics for the whole sample of 21,079 firms and separately for the two sub-samples of importing and non-importing firms. In the whole sample, 64 per cent of firms import intermediate inputs. In addition, for those firms that import, the share of expenditures for material inputs and supplies of foreign origin is about 52 per cent of total input expenditures. These relatively high values reflect the fact that firms in our sample operate in developing countries and are, therefore, more dependent on foreign suppliers of intermediate inputs, possibly incorporating technologies not available in their domestic countries. As a matter of fact, Table 1 indicates that 35 per cent of firms in our sample exports to foreign markets and this share is higher for the importers (44 per cent) than for the non-importers (18 per cent).

**[Table 1]**

Considering our key explanatory variable, about 23 per cent of firms in our sample face credit restrictions from banks and other financial intermediaries. Not surprisingly, the incidence of credit-constrained firms is significantly higher among non-importers (28 per cent) than it is among importers (19 per cent).

The variables shaping the firm' structure indicate a high degree of heterogeneity within our sample. The average number of employees is 115, with a coefficient of variation of 4. Also in the case of age and labor productivity, the sample shows a large dispersion among firms. The share of skilled workers is on average 50 per cent, with a coefficient of variation of 0.55. Consistent with previous empirical

[9] Other contributions relying on direct indicators based on answers to Survey questions include Minetti and Zhou (2011), Aristei and Franco (2014) and Pietrovito and Pozzolo (2019).

evidence, importers in our sample are, in general, larger, more productive and older that non-importers.

## 4. The empirical methodology

The descriptive statistics presented in Table 1 show that, on average, importers are not only larger and more productive than non-importers, but also less credit constrained. In this section we describe the methodology adopted to analyze the impact of credit constraints on both margins of imports, controlling for a set of individual characteristics that are likely to affect the importing activities of firms.

The empirical strategy is based, first, on the estimation of an equation in which the probability of importing intermediate inputs from abroad (the extensive margin) is explained by credit constraints and other firm-level characteristics. Similar to Muûls (2015) and Fauceglia (2015), we adopt the following specification:

$$Pr(Import_{ikct} = 1) = Pr(\alpha + \beta CR_{ikct} + \gamma Z_{ikct} + \nu_k + \lambda_c + \eta_t + \varepsilon_{ikct} > 0)$$

$$= \Phi(\beta CR_{ikct} + \gamma Z_{ikct} + \nu_k + \lambda_c + \eta_t) \qquad (1)$$

where *i* indexes for firm, *k* for the sector to which the firm belongs, *c* for country, *t* for time. The dependent variable, $Import_{ikct}$, is equal to one if the firm imports intermediate inputs at time *t* and zero otherwise. $CR_{ikct}$ is a binary variable that equals one if firm *i* is credit rationed and zero otherwise. As discussed in the previous section, we control for a set of firm-level characteristics, $Z_{ikct}$, including size, productivity, age, share of temporary and skilled workers, competition in national market, export status and capacity utilization. Moreover, to control for additional factors that might affect the probability of importing, we also include three sets of fixed effects: 1) $\nu_k$, which reflect time-invariant, sector-specific characteristics; 2) $\lambda_c$, which reflect time-invariant, country-level characteristics that may impact on imports, such as regulatory aspects and geographic and cultural specificities; and 3) $\eta_t$, which reflect any time-specific shock affecting simultaneously all countries, such as oil price or world trade shocks. $\varepsilon_{ikct}$ is a normally distributed random error with zero mean and unit variance.

Equation (1) is estimated first using a linear probability model (LPM). While, on the one hand, the LPM makes it possible to estimate some parameters of interest that cannot instead be estimated in either logit or probit models (for example, the coefficient on a dummy variable for membership in a group where every member has the same value for the dependent variable), on the other hand, it may yield predicted probabilities that lay outside the 0-1 interval (Caudill, 1988). For this reason, we

estimate equation (1) also by using a probit model, that is more efficient because it accounts for the constraint that predicted probabilities always lay within the 0-1 interval.

However, both LPM and probit model do not control for the potential endogeneity of credit rationing with respect to import decisions. For this reason, we also estimate our model with an instrumental variable methodology, still consistent with the fact that our dependent variable and our main regressor are both dichotomous. We thus estimate with maximum-likelihood a two-equation probit model (a bi-probit) in which one equation is identical to equation (1), and estimates the probability of importing conditional on being credit rationed, and the other equation (equation 2) estimates the probability that a firm is credit rationed:

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

In equation (2) above, $I_{ikct}$ 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*, $Z_{ikct}$ is the same vector of exogenous variables of equation (1), and $\mu_{ikct}$ is a normally distributed random error with zero mean and unit variance. Following Minetti and Zhu (2011) and Minetti et al. (2017), equations (1) and (2) are estimated using a recursive bi-probit model, in which the potential endogeneity of credit rationing with respect to the import status is controlled for, and the error terms, $\varepsilon_{ikct}$ and $\mu_{ikct}$, are allowed to be correlated. The recursive structure of the model is ensured by the fact that the set of instruments $I_{ikct}$ are excluded from equation (1).

Our instruments for credit constraints are firm-level information on two characteristics which are likely to affect whether a firm is financially constrained. The first is 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 availability of internal sources of funds, constructed as the proportion of total annual sales of firm's products that are paid for after delivery. Since this continuous variable, ranging from zero to 100, has a very skewed distribution, we create one dummy variable equal to one for firms with a share of payment inflows after delivery higher than 90 per cent and we interact it with a firm size dummy (we consider four of them, each corresponding to one of the quartiles of the distribution of firm size).[10]

[10] Arguably, firms that allow debtors to delay their payments are less likely to be credit constrained and the magnitude of this effect might depend on firm size. However, one may also support the opposite argument that frequent delays in payments on the part of customers may signal financial vulnerability rather than strength. Thus, while we believe that this

The second set of estimating regressions concerns the intensive margin of imports. The specification adopted reads as follows:

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

where the dependent variable, $y_{ikct}$, is the share of imported materials or supplies over total input purchases in a given year, and all other variables are defined as before.

As in the extensive margin case, we adopt different econometric techniques to estimate equation (3). First, an ordinary least square (OLS) model. Second, a Tobit model that allows 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 imported intermediates over total purchases. Since our dependent variable is in this case continuous, we estimate a standard linear two-stage least squares (2SLS) model, in which the credit rationing indicator is instrumented with the predicted probabilities obtained from the first stage estimates of equation (2).

Last, in a fourth specification, we estimate a two-stage Heckman correction model to account for the cases in which a firm is an importer. 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 importer. In the Heckman model, the extensive margin measures the probability of importing. Moreover, to account also for the potential endogeneity of credit rationing relative to importing, we follow Minetti and Zhu (2011) and estimate a binary model for the import decision, in which, in the first stage, the dependent variable is equal to one if the firm is an importer in a given year and zero otherwise, and the explanatory variables are the instruments for credit rationing used in the estimation of equation (2) and the independent variables included in equation (1). In the second step (intensive margin), we estimate equation (3) on a reduced sample of observations, excluding all cases in which a firm does not import and including among the independent variables the inverse Mills ratio from the first stage. Identification of the first stage is obtained by excluding a specific variable from the second-stage specification: this variable is the firm's perception of the influence of political instability on its business operations. Moreover, in the second stage of the Heckman specification, we also instrument the variable for credit rationing using the fitted probabilities obtained from equation (2).

instrument has information content (power) for credit constraints, we are agnostic on the sign of its effect on credit constraints.

## 5. Baseline results

Table 2 presents the estimation results for equation (1), which focuses on the extensive margin of imports. The analysis is based on a sample of 21,079 firms, from 66 countries. Panel 1 documents the findings obtained by estimating a LPM (Linear Probability Model), with standard errors clustered at the industry level.[11] Consistent with our hypothesis, the coefficient of the dummy variable which takes the value of one for credit-constrained firms is negative and statistically significant (-0.022 with a standard error of 0.009). According to this specification, credit constrained firms are therefore 2.2 per cent less likely to import intermediate inputs than unconstrained firms.

**[Table 2]**

The coefficients of the control variables are in line with the previous findings in the literature. Consistent with Feng et al. (2016), exporters are 15 per cent more likely to import their intermediate inputs than non-exporters, and the effect is statistically significant. Larger and more productive firms are also more likely to be importers, as shown by the estimated coefficients of (the logarithm of) the number of workers (0.053, with a standard error of 0.006) and labor productivity (0.033, with a standard error of 0.003). Firms selling their products mainly in the domestic market are also more likely to import part of their inputs, as shown by the estimated coefficient of 0.063 (with a standard error of 0.016). Interestingly, firms that employ a higher share of skilled workers and that have a higher capacity utilization are less likely to import intermediates (the estimated effects are, respectively, -0.058, with a standard error of 0.023, and -0.093, with a standard error of 0.019).

Panel 2 presents the marginal effects obtained using a probit model where the observed characteristics are evaluated at their mean level. Reassuringly, the results are very similar to those obtained with the LPM, and the statistical significance is also comparable. This confirms that our baseline empirical model does not suffer from major mis-specification problems. The relevant issue that remains to be addressed is the potential endogeneity of the measure of credit rationing.

As already discussed in the previous section, we tackle the endogeneity problem by adopting a bi-probit specification, in which the equation for the probability that a firm is credit rationed (Eq. (2)) is jointly estimated with the equation for the probability that a firm is an importer of intermediates (Eq. (1)). Since the model has a recursive structure, its identification requires that among the determinants

[11] Unreported results, available on request, confirm that if standard errors are clustered at the country-industry our findings remain qualitatively unchanged.

of the probability of being credit constrained (Eq. (2)) we include at least one variable that is excluded from equation (1), consistently with the logic of instrumental variable regressions.[12]

The results reported in Panel 3 of Table 2 show that the correlation between the error terms of the two equations is positive and statistically significant at the 10 per cent level. This confirms that the condition of being credit rationed and that of being an importer are jointly determined, so that the estimates obtained using the LPM and the probit model are biased and the sign of the bias is negative. In fact, the positive correlation implies that an unobserved shock that increases the probability that a firm is credit rationed has also a positive and direct impact on the probability that the same firm is an importer. The coefficients estimated using the LPM and probit specifications are therefore the sum of the exogenous negative effect of credit constraints on a firm being an importer and the positive effect of the positively-correlated unobserved determinants. Reassuringly, the specification that we adopt to tackle this problem is robust: the variables that are excluded from the equation for the probability that a firm is an importer are strongly statistically significant, the Kleibergen-Paap test rejects the null hypothesis that the model is under-identified, and the Hansen test of over-identifying restrictions cannot reject the null hypothesis that the variables excluded from equation (2) are uncorrelated with the error term of equation (1).

The direct consequence of the presence of endogeneity is that the marginal effect estimated using the bi-probit specification is substantially larger in absolute value than that estimated using the LPM and probit specifications. The value of -0.125, statistically significant at the 5 per cent level, is more than five times larger than that estimated without accounting for endogeneity, and this points to a significant impact also from an economic perspective.

Reassuringly, the other estimated coefficients are broadly unchanged when we control for the endogeneity of credit rationing, suggesting that the unobserved determinants of being rationed that are correlated with the condition of being an importer are not significantly correlated with other firm characteristics.

Overall, our estimates confirm that credit rationed firms are, *ceteris paribus*, less likely to be importers. When it is estimated accounting for endogeneity, the impact is more significant in economic terms.

We now turn to the empirical results for the intensive margin of import. Table 3 presents the results of the analysis using the baseline specification, estimated on the same sample of 21,713 observations

[12] To this aim, we include the firm's characteristics discussed in the previous section: first, a dummy variable indicating whether the firm's balance sheet is certified by an external auditor; second, a dummy variable indicating whether the firm has a share of its sales paid after delivery equal or above 90 per cent. This latter dummy variable is interacted with a size dummy and there are four of them depending on the quartile to which the firm belongs in the distribution of firm by size.

that was used for the extensive margin. Panels 1 and 2 present the results obtained through the OLS and Tobit estimation procedures, not controlling for the potential endogeneity of credit rationing with respect to the share of imported intermediates. We report the coefficient for the OLS estimates and the marginal effect for the Tobit estimates. Also in this case, coefficients and marginal effects are very similar, suggesting that the estimates obtained with a linear model are a very good approximation of those obtained from a non-linear Tobit model, which accounts for the censored nature of the share of imported intermediate inputs (our dependent variable). The $R^2$ of the OLS specification is 0.24, similar to that of the extensive margin (0.23), while the pseudo $R^2$ of the Tobit specification is quite smaller (0.17).

**[Table 3]**

The coefficient and the marginal effect of credit rationing is negative and statistically significant in both cases (it is, respectively, -0.023, with a standard error of 0.005 and -0.024, with a standard error of 0.006). The reliance of imported inputs by credit-constrained firms is therefore 2 per cent lower than that of unconstrained firms.

The estimated coefficients and marginal effects of the control variables are in line with the corresponding results from the analysis on the extensive margin. Exporters import a larger share of intermediate inputs, as shown by the coefficient and the marginal effect of the dummy variable identifying exporting firms (equal, respectively, to 0.072 and 0.085, with standards errors of 0.012 and 0.013). Larger and more productive firms also import a larger share of inputs, as shown by the coefficient and marginal effect of (the logarithms of) the number of workers (0.019 and 0.027, respectively) and labor productivity (0.024 and 0.027, respectively), all statistically significant at the one per cent level. Firms selling their products mainly in the domestic market also have a higher incidence of imported inputs, as shown by the values of 0.023 and 0.035 of the coefficients and of the marginal effects, statistically significant at, respectively, the 5 and one per cent level. As in the case of the extensive margin, firms with a higher share of skilled workers import a smaller share of inputs, with a coefficient of -0.022 in the OLS regression and a marginal effect of -0.034 in the Tobit specification (with a standard error of 0.011 and 0.016, respectively). Finally, higher capacity utilization is associated with a smaller share of imported inputs, with a coefficient and a marginal effect of -0.054 and -0.064, respectively, both statistically significant at the one per cent level.

Panels 3 and 4 present the estimation results using a two-stage, instrumental variable approach to control for the potential endogeneity of credit rationing with respect to importing. As already elucidated in Section 3, we estimate a linear model using as instrument the predicted probability that a firm is rationed, obtained from the probit estimation of equation (2). To be consistent with the bi-

probit specification that we used for the extensive margin, the regressors of equation (2) which are excluded from the second stage regression are a dummy variable indicating whether or not the firm's balance sheet is certified by an external auditor and a dummy variable for firms whose share of sales paid for after delivery is equal or above 90 per cent (interacted with a size dummy variable). According to the Kleibergen-Paap test, also in this case we can reject the null hypothesis that the model is under-identified. Similarly, the Hansen test for over-identifying restrictions, conducted on a specification in which both regressions are estimated using a linear model, does not allow us to reject the null hypothesis that the variables excluded from the first stage regression are uncorrelated with the error term of the second stage regression.[13]

As for the extensive margin, the coefficient estimated controlling for the potential endogeneity of credit rationing is much larger than that obtained with a standard OLS model. Indeed, the value of -0.313 (with a standard error of 0.069) is more than ten times larger than the coefficient and the marginal effect estimated using the OLS and Tobit specifications, where endogeneity is not controlled for. Given that the unconditional average share of imported inputs in our sample is 0.33, these results show that credit constraints have a substantial impact in economic terms on the ability of firms to purchase foreign intermediates. Reassuringly, the impact of all other explanatory variable is broadly unchanged, although in general the impact is estimated to be smaller than that obtained with the previous estimation procedures (in the case of the share of skilled workers, the estimated coefficient is no longer statistically significant).

A relevant issue in our empirical framework is that the model for the intensive margin is estimated on the whole sample of firms, including importers and non-importers. Implicitly, this amounts to assuming that the effect of being credit rationed on the share of imported inputs is the same irrespective of whether the firm's share is zero or takes a positive value. Clearly, as it is forcefully argued for example in the vast literature on the treatment of zeros in the gravity equations (see Silva and Tenreyro, 2006, for a thorough discussion) this is a strong assumption, because the impact of any explanatory variable on the decision to start importing is likely to be different from that on the decision to increase the amounts imported. To control for this aspect, we have estimated equation (3) using a two-stage Heckman correction model on the 13,869 importing firms in our sample. By doing so, we control for both the potential selection bias caused by omitting non-importers and the endogeneity of credit rationing.

[13] As explained in Section 3, the probability that a firm is credit rationed is a dichotomous variable and we have thus used its predicted value as instrument in our second stage regression. However, with a single instrument the Hansen over-identification test cannot be conducted. For this reason, we have run the Hansen test on a two-stage linear regression model estimated as if all variables were continuous and using all our instruments of the second stage regression.

The results, reported in Panel 5, show that estimating the intensive margin in the whole sample causes a positive bias on the marginal effect of credit rationing. The marginal effect obtained from the two-stage Heckman correction model is more than five times larger than that obtained using the OLS and the Tobit specification, and also in this case it is statistically significant at the 1 per cent level. Moreover, the coefficient of the inverse Mill's ratio is positive and statistically significant, suggesting that not controlling for the impact of the sample selection bias would underestimate the probability that a firm is an importer.

Overall, when endogeneity is taken into account, the impact of credit rationing on the intensive margin of import is substantial in economic terms, and it is larger than that uncovered on the extensive margin. This provides indirect support to the view that the determinants of the decision to be an importer are partly different from those of the amount to import.

## 6. Some Extensions

### *6.1. The Role of Country-Specific Characteristics*

Our baseline results provide convincing evidence of a statistically and economically significant impact of credit rationing on importing activities. However, there are country-specific characteristics that may contribute to shape this relationship, providing an additional degree of specificity across firms in the effect of credit constraints on imports. Of course, the impact of country characteristics on imports is already controlled for in our specification through the inclusion of country fixed effects. To investigate whether country characteristics have an impact on the credit rationing-imports link, we split our sample using some relevant structural information on each country. These refer to six different characteristics: (1) the degree of financial development; (2) the level of economic freedom; (3) the extent of trade liberalization; (4) the degree of compliance with laws and contracts; (5) the level of regulatory quality and (6) the control of corruption.[14]

First, borrowing from the finance literature (see e.g. Beck et al., 2000), we measure a country's financial development as the ratio of bank deposit to GDP, that is on average 40 per cent, with values ranging from 3 per cent in the Democratic Republic of Congo to 122 per cent in China.[15] Second, we use a measure of the quality of institutions by adopting the composite index of economic freedom produced by the Heritage Foundation as an equally weighted and averaged score on 12 components 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

[14] See Pietrovito and Pozzolo (2019) for a similar analysis focusing, however, on firms' participation in export markets.
[15] Data are accessible at: https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database.

efficiency (business freedom, labor freedom, monetary freedom), open markets (trade freedom, investment freedom, financial freedom).[16] The economic freedom indicator has an average value of 59, on a 1-100 scale, with values ranging from 38 in Venezuela to 78 in Chile.

In addition to the aggregate index of economic freedom, we also analyze the potential impact of other features. First, trade freedom, which is measured by an index based on trade and non-trade barriers and ranges from 51 in Bangladesh to 87 in Slovakia, on a scale from 0 to 100. Second, we focus on some of the indicators of governance quality produced by Kaufmann et al. (2007), each ranging from -2.5 to +2.5. In particular, we consider the compliance with the rule of law, the level of regulatory quality and the degree of diffusion of corruption.[17] The first indicator reflects perceptions about the extent to which agents have confidence in the rules of society and, in particular, the quality of contract enforcement, property rights, the police and the courts, taking also into account the likelihood of crime and violence. 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 over corruption refers to the extent to which public power is exercised for public interest and to which State capture is not carried out by elites and private interests.

Panels 1 through 12 of Table 4 present the estimation results for the impact of credit rationing on the extensive margin of import obtained from the bi-probit model. For each of the country characteristics described earlier we split the sample using as threshold the median of the corresponding indicator. A very neat pattern emerges across all the country-specific features, showing a larger effect of credit constraints on imports in countries with a lower level of financial and institutional development and of economic and trade freedom. Indeed, the estimated effect of the variable for credit rationing is always highly statistically significant and larger in absolute value in the subsample of countries with a level of financial development, economic and trade freedom, compliance with laws, regulatory quality and control over corruption below the sample median. Interestingly, the estimated impact of credit rationing in the subsample of countries in which the values of the characteristics are above the median is negative but, in general, statistically insignificant, with the exception of the level of economic freedom.

**[Table 4]**

Table 5 presents the results for the intensive margin of imports, using the two-stage instrumental variables specification described above. The results broadly confirm the previous findings. In all cases

[16] Data are accessible at: https://www.heritage.org/index/explore.
[17] Data are accessible at: http://info.worldbank.org/governance/wgi/#home.

the coefficients estimated in the subsample of countries in which the values of the country characteristics are below the median are statistically significant at the one per cent level and are larger in absolute value than those estimated in the remaining subsample (with the exception of the degree of compliance with the rule of law).

**[Table 5]**

Overall, these results point to a compounding effect of market inefficiencies. Not only credit rationing has a negative impact on the ability of firms to undertake importing activities, but this effect is amplified for firms operating in countries with lower financial development and where institutional characteristics make it more difficult for market forces to operate in the economy. From a policy perspective, this suggests that removing the barriers to access bank credit has a larger effect in financially and institutionally less developed countries. Moreover, it also shows that fostering financial development and improving institutional quality can have positive effects by attenuating the restraining impact of credit rationing on firms' importing activities.

*6.2. Distinguishing between Direct and Indirect Imports of Intermediates*

Firms need not import directly from foreign producers. Especially in the case of smaller firms, trade intermediaries can help reducing the fixed costs associated to have access to foreign markets for sourcing intermediate inputs. Moreover, since importing through an intermediary most likely affects also the payment method, it may be the case that the impact of credit rationing on importing activities differs depending on whether a firm imports directly or indirectly (through an intermediary). Fortunately, the WBES include a specific question on this aspect and this allows us to test this additional hypothesis. Interestingly, 47 per cent of the importing firms in our sample do it through an intermediary.

Table 6 presents the results obtained by estimating the baseline specifications on two subsamples. The first includes only firms that import directly and those that do not import, while the second includes only firms that import through an intermediary and those that do not import.[18] Interestingly, credit rationing impacts only upon direct importing, with no statistically significant effect on indirect importing. The marginal effects of credit rationing on the extensive and intensive margin of direct imports reported in Panels 1 and 3 are respectively -0.319 and -0.546, and they are both statistically significant at the 1 per cent level (with standard errors of, respectively, 0.017 and 0.111). These values

[18] Admittedly, these specifications do not consider the potential sample selection bias induced by excluding from the first subsample the firms that import indirectly, and from the second subsample those that import directly. However, since our major concern is to control for the endogeneity of credit rationing and this requires estimating a bi-probit specification for the extensive margin and a two-stage instrumental variables estimator for the intensive margin, controlling also for the sample selection bias would become a challenging econometric task. We have thus chosen not to tackle this additional issue.

are broadly in line with those estimated on the whole sample. On the contrary, the marginal effects on indirect imports, reported in Panels 2 and 4, whilst negative (and equal, respectively, to -0.004 and -0.042), they are both statistically not different from zero. Indeed, there is no evidence that credit rationing has any impact on importing activities undertaken through an intermediary. This lends support to the view that not only is the method of payment of indirect importing different from that of direct importing, but the former is also less dependent on bank credit, possibly because intermediaries themselves extend trade credits to importers.

**[Table 6]**

Interestingly, these results point to an additional policy suggestion to attenuate the negative impact of credit rationing on the ability of firms to import from abroad, which is promoting the activity of trade intermediaries. On the other hand, however, while the presence of intermediaries reduces the impact of credit rationing on firms' importing activities, it is also likely to have an effect on the unit costs of the imported inputs.

*6.3. Alternative Measures of Credit Rationing*

The analysis presented in the previous Sections adopts an empirical measure of credit rationing which is based on the notion of discouraged borrower and has the advantage of being constructed through a detailed self-assessment of the status of credit rationing.

However, since all measures of financial constraints are often subject to criticisms, to verify whether our findings are robust to other approaches, we have estimated our baseline specifications using an alternative definition of credit constraints, still based on a firm's self-assessment. In particular, considering additional questions contained in the WBES, we have defined as credit rationed those firms declaring that access to finance –spanning credit availability and costs, interest rates, fees and collateral requirements – is a moderate, major or very severe obstacle to their current operations.

Table 7 shows that the negative and statistically significant impact of credit rationing on both the extensive and intensive margins of import is confirmed when this alternative indicator is employed. In particular, the estimated marginal effect of credit rationing on the probability of being importer is -0.245 (with a standard error of 0.038), while its estimated effect on the share of imported intermediates is -0.471 with a standard error of 0.182. Reassuringly, the estimated marginal effects are broadly in line with those documented in the previous Sections, referring to our preferred measure of credit constraints.

**[Table 7]**

## 7. Conclusions

We analyse in this paper whether and how the presence of financial constraints hampers firms' importing activities. We first provide some background to elucidate how the involvement in foreign activities and, in particular, participation in import markets imply extra costs of both fixed and variable type that typically have to be paid upfront. This requires further financial strength and ability to have access to finance compared to a firm relying only on domestically-produced inputs.

In the empirical analysis we rely on microeconomic data drawn from a high-quality source, including a large number of firms operating in 66 different developing countries. Using the detailed information of our data, we are able to construct a direct indicator of firm's financial constraints. In particular, we consider an in-depth self-assessment of the firm concerning its ability to have access to finance, which allows us to classify firms as credit constrained also taking into account the notion of discouraged borrower. In our estimating framework we also explicitly deal with the issue of endogeneity, possibly affecting the quantitative assessment of how credit constraints impinge on imported intermediates. In particular, we rely on an instrumental variable procedure that allows us to establish more directly the impact of financial constraints.

We show that the presence of credit constraints induces a negative and statistically significant effect on both the probability of importing intermediates (the extensive margin) and the incidence of imported intermediates in total input expenditure (the intensive margin). These estimated effects are significant also in economic terms.

Moreover, we use additional sources of data to investigate whether structural characteristics, that are specific of the country where a firm operates, induce an additional degree of difference across firms in the impact of credit rationing on importing activities. We find that the restraining effect on both the extensive and intensive margin of import is amplified for firms operating in countries where the financial system is less developed, the quality of institutions poorer and the overall level of economic freedom lower.

We also show that the effect of credit rationing on importing activities differ across firms depending on whether their import activities are undertaken directly or indirectly, through an intermediary. If inputs are imported directly, then the negative and statistically significant effect is confirmed. Conversely, if inputs are imported indirectly, then the effect, whilst negative, is statistically not significant. Finally, we conduct a simple robustness analysis and provide evidence that our findings continue to hold when an alternative indicator of credit constraints is used, still based on a firm's self-assessment.

**Table 1 – Descriptive Statistics**

| | (1) whole sample | | | | (2) importers | | | | (3) non-importers | | | | (4) ttest | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **mean** | **c.v.** | **min** | **max** | **mean** | **c.v.** | **min** | **max** | **mean** | **c.v.** | **min** | **max** | | |
| Dummy import | 0.641 | 0.748 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | | |
| Import share | 0.333 | 1.076 | 0 | 1 | 0.519 | 0.620 | 0 | 1 | 0 | 0 | 0 | 0 | | |
| Dummy export | 0.349 | 1.367 | 0 | 1 | 0.444 | 1.120 | 0 | 1 | 0.179 | 2.145 | 0 | 1 | -43.872 | *** |
| Credit rationing | 0.225 | 1.854 | 0 | 1 | 0.194 | 2.038 | 0 | 1 | 0.281 | 1.598 | 0 | 1 | 14.327 | *** |
| Employees | 115 | 4 | 0 | 26,000 | 144 | 3 | 0 | 16,000 | 64 | 6 | 0 | 26,000 | -14.376 | ** |
| Labour productivity | 36,978 | 2 | 0 | 436,229 | 42,306 | 1 | 0 | 436,229 | 27,449 | 2 | 0 | 425,949 | -19.884 | *** |
| Firm age | 22 | 0.818 | 1 | 183 | 23 | 0.817 | 1 | 183 | 19.338 | 0.794 | 1 | 146 | -15.785 | *** |
| Share of temporary workers | 0.107 | 1.966 | 0 | 1 | 0.108 | 1.876 | 0 | 1 | 0.105 | 2.128 | 0 | 1 | -1.138 | |
| Share of skilled workers | 0.495 | 0.554 | 0 | 1 | 0.474 | 0.571 | 0 | 1 | 0.532 | 0.520 | 0 | 1 | 14.818 | *** |
| National competition | 0.441 | 1.125 | 0 | 1 | 0.484 | 1.033 | 0 | 1 | 0.365 | 1.318 | 0 | 1 | -17.164 | *** |
| Capacity utilization | 0.728 | 0.300 | 0 | 1 | 0.724 | 0.297 | 0 | 1 | 0.736 | 0.305 | 0 | 1 | 3.790 | *** |
| Certification | 0.503 | 0.994 | 0 | 1 | 0.555 | 0.896 | 0 | 1 | 0.410 | 1.199 | 0 | 1 | -20.650 | *** |
| Delayed payments | 0.525 | 0.733 | 0 | 1 | 0.580 | 0.645 | 0 | 1 | 0.428 | 0.900 | 0 | 1 | -28.081 | *** |

*Note*: Panel (1) reports the descriptive statistics calculated on the whole sample. Panels (2) and (3) report the descriptive statistics calculated on the sub-samples of importers and non-importers, respectively. Panel (4) reports the value of the mean-difference test. The approximate degrees of freedom for the *t*-test are obtained from Welch's formula (1947). ** indicates significance at the 5% level, *** at the 1% level.

**Table 2 – The Effect of Credit Constraints on the Extensive Margin of Imports: Baseline Results**

| **Model** | (1)<br>**LPM** | (2)<br>**Probit** | (3)<br>**Bi-probit** |
|---|---|---|---|
| Credit rationing | -0.022** | -0.021*** | -0.125** |
| | (0.009) | (0.007) | (0.061) |
| Dummy export | 0.148*** | 0.151*** | 0.146*** |
| | (0.017) | (0.017) | (0.017) |
| Employees | 0.053*** | 0.053*** | 0.049*** |
| | (0.006) | (0.004) | (0.005) |
| Labour productivity (log) | 0.033*** | 0.031*** | 0.029*** |
| | (0.003) | (0.003) | (0.003) |
| Firm age (log) | -0.006 | -0.004 | -0.005 |
| | (0.007) | (0.006) | (0.006) |
| Share of temporary workers | 0.025 | 0.021 | 0.021 |
| | (0.021) | (0.021) | (0.020) |
| Share of skilled workers | -0.058** | -0.050** | -0.044** |
| | (0.023) | (0.021) | (0.021) |
| National competition | 0.063*** | 0.057*** | 0.056*** |
| | (0.016) | (0.015) | (0.014) |
| Capacity utilization | -0.093*** | -0.086*** | -0.095*** |
| | (0.019) | (0.020) | (0.018) |
| ***Instruments*** | | | |
| Certification | | | -0.036*** |
| | | | (0.006) |
| Delayed payments*Size (1) | | | 0.021*** |
| | | | (0.008) |
| Delayed payments*Size (2) | | | -0.012 |
| | | | (0.015) |
| Delayed payments*Size (3) | | | -0.021** |
| | | | (0.009) |
| Delayed payments*Size (4) | | | -0.031* |
| | | | (0.019) |
| corr[$\varepsilon_{ikct}$, $\mu_{ikct}$] | | | 0.204* |
| | | | (0.119) |
| $R^2$ | 0.229 | 0.197 | |
| Kleibergen-Paap first stage *F*-statistic (*p*-value) | | | 47.250 (0.000) |
| Overidentifying restrictions statistic (*p*-value) | | | 2.155 (0.707) |
| Observations | 21,713 | 21,713 | 21,713 |

*Note*: Panel 1 reports the coefficients of the LPM and Panels 2 and 3 report marginal effects of the probit and bivariate probit (bi-probit) models, obtained estimating equation (1). In Panel 3 the measure of credit rationing is instrumented using a dummy variable indicating whether the balance sheet is certified by an external auditor and the interaction between a dummy variable for firms with a share of sales paid for after delivery higher that 90 per cent (Delayed payments) and a firm size dummy. 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[$\varepsilon_{ikct}$, $\mu_{ikct}$] is the correlation coefficient ($\rho$) between the unobserved determinants of the import participation decision ($\varepsilon_{ikct}$) and those of rationing ($\mu_{ikct}$). The Kleibergen-Paap first stage *F*-statistic (*p*-value) is the value of the *F* statistic (with the *p*-value) for the hypothesis that instruments have jointly zero coefficients in the first stage regression. The over-identifying restrictions statistic (*p*-value) is the value of the Hansen statistic (and *p*-value). Kleibergen-Paap first stage *F*-statistic (*p*-value) and overidentifying restrictions statistic (*p*-value) are obtained from the two-stage least-squares estimation of the companion specification for the extensive margin of imports, where credit rationing is instrumented using our instruments. ***, **, * denote significance at 0.01, 0.05 and 0.10 levels.

**Table 3 – The Effect of Credit Constraints on the Intensive Margin of Imports: Baseline Results**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Model** | **OLS** | **Tobit** | **2SLS** | | **Heckman two stage** |
| | | | **first stage** | **second stage** | **second stage** |
| Credit rationing | -0.023*** | -0.024*** | | -0.313*** | -0.121*** |
| | (0.005) | (0.006) | | (0.069) | (0.043) |
| Dummy export | 0.072*** | 0.085*** | -0.024*** | 0.065*** | 0.020* |
| | (0.012) | (0.013) | (0.007) | (0.011) | (0.010) |
| Employees | 0.019*** | 0.027*** | -0.031*** | 0.009*** | -0.003 |
| | (0.003) | (0.004) | (0.003) | (0.003) | (0.004) |
| Labour productivity (log) | 0.024*** | 0.027*** | -0.018*** | 0.018*** | 0.015*** |
| | (0.005) | (0.005) | (0.002) | (0.005) | (0.003) |
| Firm age (log) | -0.005 | -0.007 | -0.010*** | -0.007* | -0.004 |
| | (0.004) | (0.005) | (0.004) | (0.004) | (0.005) |
| Share of temporary workers | -0.017 | -0.006 | 0.008 | -0.016 | -0.033*** |
| | (0.014) | (0.02) | (0.009) | (0.014) | (0.010) |
| Share of skilled workers | -0.022* | -0.034** | 0.043*** | -0.006 | -0.002 |
| | (0.011) | (0.016) | (0.013) | (0.010) | (0.010) |
| National competition | 0.023** | 0.035*** | 0.001 | 0.023** | 0.007 |
| | (0.011) | (0.014) | (0.006) | (0.010) | (0.005) |
| Capacity utilization | -0.054*** | -0.064*** | -0.092*** | -0.081*** | -0.041*** |
| | (0.012) | (0.016) | (0.01) | (0.012) | (0.014) |
| ***Instruments*** | | | | | |
| Certification | | | -0.034*** | | |
| | | | (0.006) | | |
| Delayed payments*Size (1) | | | 0.021** | | |
| | | | (0.009) | | |
| Delayed payments*Size (2) | | | -0.011 | | |
| | | | (0.015) | | |
| Delayed payments*Size (3) | | | -0.019** | | |
| | | | (0.008) | | |
| Delayed payments*Size (4) | | | -0.028 | | |
| | | | (0.018) | | |
| Mills ratio | | | | | 0.091*** |
| | | | | | (0.023) |
| $R^2$ | 0.243 | 0.166 | 0.136 | | |
| Kleibergen-Paap first stage *F*-statistic (*p*-value) | | | | 47.250 (0.000) | |
| Overidentifying restrictions statistic (*p*-value) | | | | 4.440 (0.350) | |
| Observations | 21,713 | 21,713 | 21,713 | | 13,869 |

*Note*: The table reports the estimates of equation (3). Panel 1 reports the coefficients obtained using the OLS model. Panel 2 reports the marginal effects obtained using the Tobit model. Panel 3 reports the marginal effects of the probit model estimated on the dummy for credit rationing and Panel 4 reports the coefficients obtained estimating a linear two-stage least-squares model on the share of imports, where credit rationing is instrumented using the predicted probability from the first stage of Panel 3. Panel 5 reports two-stage least-squares estimates on the subsample of importing firms, where credit rationing is instrumented using the predicted probability from the first stage, and includes the inverse Mills ratio. Unreported fixed effects for sector, country and year are included in all regressions. Robust standard errors are clustered by sectors and reported in parentheses. Kleibergen-Paap first stage *F*-statistic (*p*-value) is the value of the *F* statistic (with the *p*-value) for the hypothesis that instruments have jointly zero coefficients in the first stage regression. Over-identifying restrictions statistic (*p*-value) is the value of the Hansen statistic (with the *p*-value). Kleibergen-Paap first stage *F*-statistic (*p*-value) and over-identifying restrictions statistic (*p*-value) are obtained from the linear two-stage least-squares model on the share of imports, where credit rationing is instrumented using our instruments. ***, **, * denote significance at 0.01, 0.05 and 0.10 levels.

**Table 4 – The Effect of Credit Constraints on the Extensive Margin of Imports: Sample Split by Country Characteristics**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Financial development** | | **Economic freedom** | | **Trade freedom** | | **Rule of law** | | **Regulatory quality** | | **Control over corruption** | |
| **Sample** | **low** | **high** | **low** | **high** | **low** | **high** | **low** | **high** | **low** | **high** | **low** | **high** |
| Credit rationing | -0.155** | -0.123 | -0.265*** | -0.120* | -0.280*** | -0.024 | -0.179*** | -0.120 | -0.279*** | -0.114 | -0.268*** | -0.071 |
| | (0.075) | (0.087) | (0.047) | (0.066) | (0.043) | (0.082) | (0.059) | (0.76) | (0.051) | (0.070) | (0.042) | (0.091) |
| corr[$\varepsilon_{ikct}$, $\mu_{ikct}$] | 0.300** | 0.111 | 0.468*** | 0.205 | 0.500*** | 0.020 | 0.320** | 0.193 | 0.512*** | 0.185 | 0.483*** | 0.102 |
| | (0.142) | (0.161) | (0.090) | (0.133) | (0.090) | (0.161) | (0.117) | (0.147) | (0.108) | (0.139) | (0.083) | (0.184) |
| Kleibergen-Paap first stage *F*-statistic (*p*-value) | 17.400 (0.000) | 12.430 (0.000) | 40.830 (0.000) | 15.360 (0.000) | 36.880 (0.005) | 6.430 (0.000) | 19.630 (0.000) | 10.190 (0.000) | 35.720 (0.000) | 9.210 (0.000) | 9.980 (0.000) | 12.320 (0.000) |
| Overidentifying restrictions statistic (*p*-value) | 1.642 (0.801) | 4.574 (0.334) | 2.861 (0.581) | 2.277 (0.685) | 4.831 (0.305) | 1.486 (0.829) | 2.632 (0.621) | 4.393 (0.355) | 0.986 (0.912) | 2.739 (0.602) | 7.314 (0.120) | 3.265 (0.515) |
| Observations | 15,867 | 5,426 | 9,552 | 11,812 | 10,225 | 11,139 | 10,732 | 10,813 | 9,933 | 11,612 | 9,814 | 11,731 |

*Note*: The table reports the marginal effects of (instrumented) credit rationing estimated through the bivariate probit model (equation (1)) on sub-samples of countries that differ depending on whether the value of the specific characteristic is above or below the median. Unreported control variables and fixed effects for sector, country and year are included in all regressions. Robust standard errors are clustered by sectors and reported in parentheses. corr[$\varepsilon_{ikct}$, $\mu_{ikct}$] is the correlation coefficient ($\rho$) between the unobserved determinants of the import participation decision ($\varepsilon_{ikct}$) and those of rationing ($\mu_{ikct}$). Kleibergen-Paap first stage *F*-statistic (with the *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. Over-identifying restrictions statistic (*p*-value) is the value of the Hansen statistic (with the *p*-value). Kleibergen-Paap first stage *F*-statistic (*p*-value) and over-identifying restrictions statistic (*p*-value) are obtained from the two-stage, least-squares companion specification of the extensive margin of imports, where credit rationing is instrumented using our instruments. ***, **, * denote significance at 0.01, 0.05 and 0.10 levels.

**Table 5 – The Effect of Credit Constraints on the Intensive Margin of Imports: Sample Split by Country Characteristics**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Financial development** | | **Economic freedom** | | **Trade freedom** | | **Rule of law** | | **Regulatory quality** | | **Control over corruption** | |
| **Sample** | **low** | **high** | **low** | **high** | **low** | **high** | **low** | **high** | **low** | **high** | **low** | **high** |
| Credit rationing | -0.273*** | -0.143 | -0.391*** | -0.229*** | -0.396*** | -0.116 | -0.267*** | -0.270*** | -0.379*** | -0.210** | -0.635*** | -0.074 |
| | (0.074) | (0.099) | (0.076) | (0.087) | (0.080) | (0.091) | (0.092) | (0.100) | (0.090) | (0.084) | (0.151) | (0.066) |
| Kleibergen-Paap first stage *F*-statistic (*p*-value) | 17.400 (0.000) | 12.430 (0.000) | 40.830 (0.000) | 15.360 (0.000) | 36.880 (0.000) | 6.430 (0.000) | 19.630 (0.000) | 10.190 (0.000) | 35.720 (0.000) | 9.210 (0.000) | 9.980 (0.000) | 12.320 (0.000) |
| Overidentifying restrictions statistic (*p*-value) | 5.502 (0.240) | 2.286 (0.683) | 5.187 (0.269) | 5.938 (0.204) | 4.633 (0.327) | 4.092 (0.394) | 2.878 (0.578) | 5.533 (0.237) | 2.844 (0.584) | 6.774 (0.148) | 7.430 (0.115) | 6.901 (0.141) |
| Observations | 15,867 | 5,420 | 9,532 | 11,781 | 10,225 | 11,139 | 10,732 | 10,813 | 9,933 | 11,587 | 9,814 | 11,720 |

*Note*: The table reports the marginal effects of credit rationing obtained from the estimation of equation (3) on sub-samples of countries based on whether the value of the specific characteristic is above or below the median. Unreported control variables and fixed effects for sector, country and year are included in all regressions. Robust standard errors are clustered by sectors and reported in parentheses. Kleibergen-Paap first stage *F*-statistic (with the *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. Over-identifying restrictions statistic (*p*-value) is the value of the Hansen statistic (with the *p*-value). Kleibergen-Paap first stage *F*-statistic (*p*-value) and over-identifying restrictions statistic (*p*-value) are obtained from the linear two-stage, least-squares model on the share of imports, where credit rationing is instrumented using our instruments. ***, **, * denote significance at 0.01, 0.05 and 0.10 levels.

**Table 6 – Distinguishing between Direct and Indirect Imports**

| **Import**<br>**Import Margin** | (1)<br>**Direct**<br>**Extensive margin** | (2)<br>**Indirect**<br>**Extensive margin** | (3)<br>**Direct**<br>**Intensive margin** | (4)<br>**Indirect**<br>**Intensive margin** |
|---|---|---|---|---|
| Credit rationing | -0.319*** | -0.004 | -0.546*** | -0.042 |
| | (0.017) | (0.176) | (0.111) | (0.118) |
| Dummy export | 0.165*** | 0.096*** | 0.098*** | 0.043*** |
| | (0.008) | (0.030) | (0.012) | (0.016) |
| Employees | 0.068*** | 0.014* | 0.022*** | -0.004 |
| | (0.004) | (0.008) | (0.003) | (0.005) |
| Labour productivity (log) | 0.038*** | 0.017*** | 0.025*** | 0.006 |
| | (0.003) | (0.004) | (0.005) | (0.005) |
| Firm age (log) | -0.010** | -0.004 | -0.011** | -0.004 |
| | (0.005) | (0.008) | (0.005) | (0.004) |
| Share of temporary workers | -0.004 | 0.036 | -0.032** | -0.002 |
| | (0.018) | (0.023) | (0.015) | (0.016) |
| Share of skilled workers | -0.065*** | -0.021 | -0.029*** | 0.011 |
| | (0.017) | (0.025) | (0.009) | (0.013) |
| National competition | 0.066*** | 0.050*** | 0.023** | 0.020*** |
| | (0.015) | (0.012) | (0.010) | (0.008) |
| Capacity utilization | -0.063*** | -0.132*** | -0.074*** | -0.075*** |
| | (0.015) | (0.026) | (0.013) | (0.013) |
| ***Instruments*** | | | | |
| Certification | -0.052*** | -0.033*** | -0.040*** | -0.033*** |
| | (0.007) | (0.005) | (0.008) | (0.005) |
| Delayed payments*Size (1) | 0.025*** | 0.024** | 0.016 | 0.024** |
| | (0.010) | (0.012) | (0.010) | (0.012) |
| Delayed payments*Size (2) | -0.009 | -0.016 | -0.009 | -0.016 |
| | (0.022) | (0.019) | (0.023) | (0.019) |
| Delayed payments*Size (3) | -0.034** | -0.018 | -0.025* | -0.018 |
| | (0.013) | (0.015) | (0.014) | (0.016) |
| Delayed payments*Size (4) | -0.037 | -0.020 | -0.025 | -0.020 |
| | (0.014) | (0.028) | (0.018) | (0.027) |
| corr[$\varepsilon_{ikct}$, $\mu_{ikct}$] | 0.609*** | 0.017 | | |
| | (0.045) | (0.292) | | |
| $R^2$ | | | | |
| Kleibergen-Paap first stage *F*-statistic (*p*-value) | 25.740 (0.000) | 27.090 (0.000) | 25.740 (0.000) | 27.090 (0.000) |
| Overidentifying restrictions statistic (*p*-value) | 2.126 (0.713) | 3.114 (0.539) | 1.700 (0.791) | 6.061 (0.195) |
| Observations | 15,290 | 14,453 | 15,290 | 14,453 |

*Note*: Panels 1 and 3 include firms that import directly and firms that do not import, while Panels 2 and 4 include firms that import through an intermediary and firms that do not import. Panels 1 and 2 report the marginal effects obtained estimating equation (1) through the bivariate probit; Panels 3 and 4 report coefficients obtained estimating equation (3) using a 2SLS. 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[$\varepsilon_{ikct}$, $\mu_{ikct}$] is the correlation coefficient ($\rho$) between the unobserved determinants of the import participation decision ($\varepsilon_{ikct}$) and those of rationing ($\mu_{ikct}$). The Kleibergen-Paap first stage *F*-statistic (*p*-value) is the value of the *F* statistic (with the *p*-value) for the hypothesis that instruments have jointly zero coefficients in the first stage regression. The over-identifying restrictions statistic (*p*-value) is the value of the Hansen statistic (and *p*-value). Kleibergen-Paap first stage *F*-statistic (*p*-value) and overidentifying restrictions statistic (*p*-value) are obtained from the two-stage least-squares estimation of the companion specification for the extensive margin of imports, where credit rationing is instrumented using our instruments. ***, **, * denote significance at 0.01, 0.05 and 0.10 levels.

**Table 7 – An Alternative Measure of Credit Rationing**

| **Import Margin** | (1)<br>**Extensive margin** | (2)<br>**Intensive margin** |
|---|---|---|
| Access to finance | -0.245*** | -0.471*** |
| | (0.038) | (0.182) |
| Dummy exports | 0.136*** | 0.071*** |
| | (0.014) | (0.012) |
| Employees | 0.044*** | 0.011** |
| | (0.006) | (0.005) |
| Labour productivity (log) | 0.025*** | 0.017*** |
| | (0.003) | (0.006) |
| Firm age (log) | -0.008 | -0.010*** |
| | (0.0'6) | (0.003) |
| Share of temporary workers | 0.027 | -0.002 |
| | (0.021) | (0.024) |
| Share of skilled workers | -0.063*** | -0.058** |
| | (0.021) | (0.023) |
| National competition | 0.055*** | 0.027** |
| | (0.013) | (0.010) |
| Capacity utilization | -0.120*** | -0.130*** |
| | (0.021) | (0.030) |
| ***Instruments*** | | |
| Certification | -0.009 | 0.003 |
| | (0.009) | (0.008) |
| Delayed Payments*Size (1) | -0.030** | -0.032** |
| | (0.013) | (0.014) |
| Delayed Payments*Size (2) | -0.016 | -0.015 |
| | (0.012) | (0.011) |
| Delayed Payments*Size (3) | -0.009 | -0.004 |
| | (0.010) | (0.012) |
| Delayed Payments*Size (4) | -0.053*** | -0.043*** |
| | (0.014) | (0.014) |
| corr[$\varepsilon_{ikct}$, $\mu_{ikct}$] | 0.558*** | |
| | (0.082) | |
| Kleibergen-Paap first stage *F*-statistic (*p*-value) | 3.970 (0.000) | 3.970 (0.010) |
| Overidentifying restrictions statistic (*p*-value) | 7.200 (0.126) | 5.884 (0.208) |
| Observations | 20,739 | 20,739 |

*Note*: Panels 1 and 2 report the results obtained using as a measure of credit rationing based on access to finance. In particular, we use a dummy variable equal to one if the firm declares that access to finance is a "*moderate obstacle*", "*major obstacle*" or "*very severe obstacle*" to its current operations and equal to zero if the firm's perception about access to finance is one of the following "*no obstacle"* or "*minor obstacle"* to its operations. 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[$\varepsilon_{ikct}$, $\mu_{ikct}$] is the correlation coefficient ($\rho$) between the unobserved determinants of the import participation decision ($\varepsilon_{ikct}$) and those of rationing ($\mu_{ikct}$). The Kleibergen-Paap first stage *F*-statistic (*p*-value) is the value of the *F* statistic (with the *p*-value) for the hypothesis that instruments have jointly zero coefficients in the first stage regression. The over-identifying restrictions statistic (*p*-value) is the value of the Hansen statistic (and *p*-value). Kleibergen-Paap first stage *F*-statistic (*p*-value) and overidentifying restrictions statistic (*p*-value) are obtained from the two-stage least-squares estimation of the companion specification for the extensive margin of imports, where credit rationing is instrumented using our instruments. ***, **, * denote significance at 0.01, 0.05 and 0.10 levels.

**Appendix A1 – The WBES variables used in the analysis**

| Variable | Question in the WBES | Code |
|---|---|---|
| Dummy import<br><br>Import share | In fiscal year [*insert last complete fiscal year*], as a proportion of all material inputs or supplies purchased that year, what percentage of this establishment's material inputs or supplies were material inputs or supplies of foreign origin | d12b |
| Dummy export | In fiscal year [insert last complete fiscal year], what percentage of this establishment's sales were: Indirect exports; Direct exports | d3b, d3c |
| Credit rationing | At this time, does this establishment have a line of credit or a loan from a financial institution? | k8 |
| | Referring again to the last fiscal year [*insert last complete fiscal year*], did this establishment apply for any loans or lines of credit? | k16 |
| | What was the main reason why this establishment did not apply for any line of credit or loan in fiscal year [*insert last complete fiscal year*]? {No need for a loan - establishment has sufficient capital, Application procedures for loans or lines of credit are complex, Interest rates are not favorable, Collateral requirements are too high, Size of loan and maturity are insufficient, Did not think it would be approved, Other} | k17 |
| Employees | At the end of fiscal year [*insert last complete fiscal year*], how many permanent, full-time employees did this establishment employ? Please include all employees and managers | l1 |
| Labour productivity | In fiscal year [*insert last complete fiscal year*], what were this establishment's total annual sales? Please also write out the number (i.e. 50,000 as Fifty Thousand) | d2 |
| Firm age | In what year did this establishment begin operations? | b5 |
| Share of temporary workers | How many full-time temporary employees did this establishment employ in fiscal year [*insert last complete fiscal year*]? | l6 |
| Share of skilled workers | At the end of fiscal year [insert last complete fiscal year], how many permanent, full-time employees were: Skilled production workers | l4a |
| National competition | In fiscal year [insert last complete fiscal year], which of the following was the main market in which this establishment sold its main product? {Local, National, International} | e1 |
| Capacity utilization | At the end of fiscal year [*insert last complete fiscal year*], what was the net book value, that is the value of assets after depreciation, of the following: {Machinery, vehicles, and equipment} | n6a, n6b |
| Certification | In fiscal year [*insert last complete fiscal year*], did this establishment have its annual financial statements checked and certified by an external auditor? | k21 |
| Delayed payments | In fiscal year [*insert last complete fiscal year*], what percentage of this establishment's total annual sales of its goods or services were paid for after delivery? | k2c |
| Political instability | 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. | j30e |
| Direct imports | Were any of the material inputs or supplies purchased in fiscal year [*insert last complete fiscal year*], imported directly? | d13 |
| Access to finance | Is access to finance, which includes availability and cost, interest rates, fees and collateral requirements, No Obstacle, a Minor Obstacle, a Moderate Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment? | k30 |

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