# Intermediated Trade and Credit Constraints: The Case of Firm's Imports*

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**Abstract**

Growing evidence suggests that a large share of international trade transactions are made through intermediaries and that whether firms use them or not depends on different factors. The aim of this paper is to empirically investigate if credit constraints introduce a degree of difference among firms in their mode of importing. Building on the intuition provided by a simple theoretical framework, we use firm-level data from 66 developing and developed countries to test the possible links between credit constraints and reliance on import intermediaries. Our results show that indeed credit-constrained firms exhibit a higher probability of importing their inputs using an intermediary, while unconstrained firms are more likely to import directly. Our results also establish that the impact of credit constraints on the probability of indirect importing is amplified for firms with a higher distance from their international sourcing network. Moreover, if firms face other types of frictions to import, then the probability that credit-constrained firms rely on intermediaries is estimated to be higher. Remarkably, credit rationing affects the probability of indirect importing no matter what the mode of exporting is.

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# 1 Introduction

A large body of literature has emphasized the role of trade intermediaries in supporting firms engaged in foreign transactions (see e.g., Antràs and Costinot, 2011; Ahn et al., 2011). Growing evidence suggests that a substantial share of trade flows are conducted through wholesalers, retailers or trading companies rather than through a direct interaction between firms and foreign suppliers or firms and foreign consumers. For example, Bernard et al. (2010) document that 35 per cent of U.S. exporters are wholesalers and they account for 10 per cent of the value of the country's exports, while, according to Blum et al. (2010), intermediaries handle about 35 per cent of Chilean imports. Ahn et al. (2011) report that in 2005 Chinese exports through intermediaries represented 22 per cent of the country's total exports, whilst Abel-Koch (2013) cites evidence from Jones (1998) that in the 1990s trading companies in Japan exported more than 40 per cent and imported more than 70 per cent of the country's products.

When deciding whether to conduct import and export activities directly or indirectly, each firm faces a trade-off. Under a direct internationalization mode, firms incur a variety of fixed costs specific to foreign activities, such as those for collecting information on foreign suppliers and destination markets, or establishing and maintaining international source and distribution networks. By contrast, under an indirect mode, a large part of these costs are borne by trade intermediaries, who charge higher variable costs per unit of output in exchange for their services (see e.g., Bai et al., 2017; Akerman, 2018).

With few exceptions, such as Grazzi and Tomasi (2016), Bernard et al. (2010) and Blum et al. (2010), existing contributions on the role of intermediaries in facilitating international trade have focused exclusively on export activities, thus ignoring imports. This is surprising because import market participation impacts on many aspects of a firm's performance and a large share of firms apparently access imported inputs only through trade intermediaries.[1]

In analysing the factors that prompt firms to rely on trade intermediaries, almost all contributions focus on productivity as the key dimension along which firms sort into alternative internationalization modes.[2] But other firm characteristics are extremely likely to impact

[1]For example, Amiti and Konings (2007), Kugler and Verhoogen (2009) and Halpern et al. (2015) document how importing intermediate inputs enables firms to increase their productivity. Similarly, a study by Goldberg et al. (2010) shows that firms' reliance on imported inputs results in an expansion of their domestic product scope via the introduction of new product varieties, leading to dynamic gains from trade.

[2]The main finding in theoretical and empirical literature is that the least productive firms are not engaged in international trade; at the same time, among the remaining firms, those that are relatively unproductive are more likely to trade indirectly, whilst relatively productive ones favor direct trade. The rationale for this

on such choice.

In fact, motivated by the seminal contributions of Jaffee and Russell (1976) and Stiglitz and Weiss (1981) and by a massive empirical literature showing that firms are often credit rationed (see, e.g., Drakos and Giannakopoulos, 2011), a recent strand of research has studied the impact that financial constraints have in impeding firms' participation to international trade.[3] It is therefore very likely that credit constraints also influence the self-selection of heterogeneous firms into alternative trade modes. However, only one contribution analyses this potential channel: a recent paper by Chan (2019) who documents that, when engaged in export activities, credit-constrained firms are more likely to rely on trade intermediaries compared to unconstrained ones. In his study, however, firms' import activities are not taken into consideration.

The aim of this paper is to investigate whether and how financial constraints affect a firm's mode of participation to import markets. Our empirical analysis hinges on a simple theoretical framework where each firm chooses between paying higher fixed costs to import directly and higher variable costs to import indirectly, according to their access to finance. To study this choice we rely on a large sample of establishment-level data for 66 countries, drawn from the World Bank Enterprise Surveys (hereby WBES). These data contain information on whether any of the material inputs or supplies purchased by a firm were imported directly in a given year. Moreover, the database provides valuable information to detect the presence of credit constraints in each firm. In particular, in the WBES, each firm is asked a number of questions regarding its ability to have access to credit. The responses provide a comprehensive self-assessment on the matter, similar to that used by (Drakos and Giannakopoulos, 2011; Nucci et al., 2020) and Pietrovito and Pozzolo (2019).

In our empirical analysis we provide robust evidence of a statistically significant effect of credit constraints on the firm's decision of whether to import directly or indirectly. In particular, we show that unconstrained firms tend to directly source in international markets, whilst firms with financial restraints are more likely to acquire imported inputs through

sorting pattern is intuitive: only high-productivity firms can afford the fixed costs of direct participation to foreign markets; low-productivity firms resort to intermediaries as a conduit for trade (see e.g., Ahn et al., 2011; Crozet et al., 2013; Abel-Koch, 2013).

[3]The role of access to finance as a dimension along which firms self-select into foreign activities has been largely emphasized in international trade literature (see, e.g., Manova, 2013; Minetti and Zhu, 2011; Muûls, 2015). Indeed, to cover fixed and variable costs associated with participation to international trade, a firm must have routine access to external capital and/or be endowed with sufficient liquidity. Numerous theoretical and empirical contributions have shown that financial constraints restrain firm participation to export and import markets (see e.g., Chaney, 2016; Berman and Héricourt, 2010), as well as affecting the impact of exchange rate fluctuations on international trade (see e.g., Li et al., 2020; Dai et al., 2021).

an intermediary. In the estimation on firm-level data we rely on methodologies based on instrumental variables, which allow us to get around the endogeneity problems which may have otherwise plagued our results. In particular, we control for potential reverse causation in the relationship between financial constraints and the mode of imports, for example if a direct participation in import markets signalled high product quality and productivity, inducing a softening of credit restraints. In addition, instrumental variable estimation also allows to control for common omitted factors, such as unobservable features which may affect both the firm's ability to access credit and its decision on the mode of importing. In light of these aspects, we believe that our estimation approach enables us to properly identify causal effects and establish more directly how financial constraints impact the mode of import participation.

We also analyse whether the effect of credit constraints on the likelihood of importing indirectly is amplified for firms facing other types of frictions to imports. In this respect, we first consider the geographical distance of the firm from its international sourcing network. We combine information on imported intermediates across different source countries with that on bilateral distance between the capital cities of any pair of countries, and we then derive, for the industry to which a firm belongs, a country-specific measure of the weighted average distance between the firm's country and the countries of the foreign sources of its intermediate inputs. A higher geographical distance is found to reduce the likelihood of importing directly and to enhance the impact of financial constraints on the firm's decision to import directly or through an intermediary. We also allow for other frictions in importing activities by using information on the degree of regulatory burden and other fixed costs to imports. We rely on a number of indicators at the country level: a) the extent of the documentary compliance, b) the amount of time to import and c) the costs involved in import activities. We show that, if these obstacles to trade are more severe, the effect of credit constraints on the probability of a firm sourcing its foreign inputs through an intermediary is higher.

We also focus on two-way trade and investigate if the effect of credit rationing on the mode of importing differs depending on whether or not firms use an intermediary to export their products. Credit constraints are found to influence the probability of indirect importing irrespective of the mode of export. The opposite is true for the mode of exporting which is affected by credit constraints but only if firms are indirect importers.

The rest of the paper is organized as follows. Section 2 presents some background literature. Section 3 illustrates a simple theoretical framework providing motivation for the empirical analysis. Section 4 focuses on econometric methodology, data and descriptive statistics. Section 5 presents the empirical findings of the baseline specification, while Section 6 deals

with extensions and robustness checks. Section 7 draws concluding remarks.

## 2 Background literature

To the best of our knowledge, this is the first contribution that investigates the effect of credit constraints on firms' sorting into different import modes. However, it is important to frame the issue in the context of various strands of literature to which our paper is related.

In general, to understand the reasons why resorting to a trade intermediary can be convenient for a firm engaged in international trade, one must recall that participation in export and import markets implies specific fixed and variable costs which, in general, must be paid upfront (Melitz, 2003). These extra costs result, for example, from: a) establishing and maintaining international source and distribution networks, b) collecting information on the reputation of foreign suppliers, the quality and technological features of their products (in the case of imports) as well as on local tastes in the foreign destination markets (in the case of exports); c) the regulatory burden on product standards and custom compliance and d) the difficulties in enforcing international contractual agreements (Manova, 2013; Nucci et al., 2020).

From a theoretical perspective, an insightful theory of intermediation in international trade has been proposed by Antràs and Costinot (2011), who develop a dynamic general equilibrium model where the role of intermediaries originates from the presence of search frictions. Their analysis shows how intermediaries contribute in generating gains from international trade and in affecting their distribution. Against this backdrop, resorting to trade intermediaries can be beneficial, as they are able to pool the fixed costs of exporting and/or importing and spread them across firms, product varieties and source and destination markets.[4]

The literature has emphasized how international trade through an intermediary implies a saving in fixed costs compared to direct trade, but also higher variable costs. As elucidated by Akerman (2018) for the case of exports, such higher variable costs reflect the fact that a trade intermediary introduces a markup between the procurement price of the good and what it charges the final consumer in the foreign country. For the case of imports, of course, the markup would be between the procurement price of the foreign input and the price charged to the firm that imports the inputs through a wholesaler. This trade-off between

[4] Hessels and Terjesen (2010) provide an overview of the roles that intermediaries perform in international trade. Chen and Li (2014) highlight a number of interesting findings regarding the role of intermediaries in China's exports from 2000 to 2006.

lower fixed costs and higher variable costs induces firms to partition into different trade modes according to some of their characteristics. In general, sounder firms (according to a number of characteristics described below) are more likely to be able to afford the payment of the fixed costs of participation in export and import markets, and are therefore more likely to engage directly in foreign activities. Weaker firms, on the contrary, tend to rely on trade intermediaries.

Many contributions establish, both theoretically and empirically, that firms endogenously select into specific modes of trading internationally based on their productivity. Firms with no international exposure are less productive than those that rely on a trade intermediary, while the latter firms are in turn less productive than direct exporters and/or importers. Ahn et al. (2011) develop a theoretical model whose main prediction is that more productive firms are able to access foreign consumers directly, while less productive firms prefer to rely on intermediaries. Using firm-level Chinese data, they confirm this sorting pattern at the empirical level. Akerman (2018) proposes a theoretical framework that predicts a sorting based on productivity: the most productive firms tend to export directly, firms with intermediate productivity tend to export via wholesalers and the least productive firms serve only the domestic market. Moreover, if fixed costs increase, more products are exported through intermediaries because of their ability to generate economies of scope by spreading the extra costs of trade across many goods. Akerman (2018) also provides empirical support to this latter prediction by using information on Swedish firms.

Békés and Muraközy (2018) also propose a model in which more productive firms self-select into trade modes that, whilst imposing higher fixed costs, imply lower marginal costs. Using survey data of EFIGE project (European Firms in a Global Economy), they show that firms with a higher total factor productivity are more likely to trade directly (see, also, for similar theoretical frameworks and empirical results, Fujii et al., 2017; Lu et al., 2017). Some contributions focus on learning-by-exporting mechanisms and show that they largely differ across export mode. According to Bai et al. (2017), for example, direct exporters learn more than indirect exporters as productivity and demand evolve more favorably under direct exporting (as in Davies and Jeppesen (2015)). Defever et al. (2020) use Chinese data and find that productivity of both direct and indirect importers increases following a trade liberalization, but this effect is stronger for firms involved in direct importing. Toshimitsu (2019) provides theoretical and empirical support to the view that indirect exporters learn how to enter foreign markets and eventually become direct exporters. Crozet et al. (2013) adds one dimension to this picture, proposing a theoretical model which also accounts for the accessibility of foreign markets in terms of trade costs and market size. Within this

framework, they show both theoretically and empirically (using French firm-level customs data) how intermediaries support the least productive firms in accessing overseas markets – the more so for those located in more distant and smaller countries. A related result is that of Abel-Koch (2013), who emphasizes the role of firm's size in the choice of export mode and documents how larger firms prefer to export their products directly, while smaller firms tend to reach overseas markets through an intermediary. Interestingly, Yaşar (2015) finds a positive effect of exporting on productivity only for firms which export directly, and not for those that use an intermediary. The study by Grazzi and Tomasi (2016) is one of the few that focus not only on exports but also on imports. Remarkably, it also lends empirical support to the hypothesis of productivity sorting, based on survey data at firm level from the World Bank Business Environment Enterprise Performance Survey (BEEPS).

A different perspective is taken by Dasgupta and Mondria (2018), who argue that, since uncertainty on product quality is widespread in international trade, intermediaries perform the important role of screening the quality of products and revealing it to consumers. Using a model with trade intermediation and incomplete information about product quality, they show that firms with the highest levels of quality find it optimal to export directly, while those with intermediate quality tend to export through intermediaries, and firms with the lowest levels of quality do not serve foreign markets (see also, Tang and Zhang, 2012).[5]

Blum et al. (2010) study transaction-level data on Chilean imports between 2004 and 2008, uncovering two interesting stylized facts. First, intermediaries achieve economies of scale by specializing in imports of large volumes of few specific products from a limited number of countries. Second, imports to Chile from countries with the lowest total export value are typically made by large Chilean firms, many of which are intermediaries.

The study by Chan (2019) is especially relevant for our purposes, as it analyses the role of credit frictions in the firm's decision on the mode of export. He shows theoretically and empirically that firms facing credit constraints are more likely to pursue intermediated export compared to unconstrained firms.

As emerges from this overview section, the literature on the role of intermediaries in international trade has focused almost exclusively on export activities (exceptions include Bernard et al., 2010; Blum et al., 2010; Grazzi and Tomasi, 2016). We also recall that an array of

[5]There are other factors that affect the endogenous sorting into alternative trade modes. In China, having political connections, as shown by Zhang et al. (2020), significantly increases the probability of being direct exporters. Bernard et al. (2015) find that a weaker quality of governance and contracting increases the degree of reliance on trade intermediation. A similar effect has been uncovered by Felbermayr and Jung (2011) in case of more severe country-specific expropriation risks.

literature has focused on credit constraints as an important characteristic severely impeding firm's participation to foreign markets. Many theoretical and empirical contributions have shown that firms with access to credit are more likely to enter export and import markets compared to credit-constrained firms and, in the pool of importing and/or exporting firms, unconstrained firms tend to be engaged in these foreign activities more intensively (see, e.g., Berman and Héricourt, 2010; Manova, 2013; Minetti and Zhu, 2011; Muûls, 2015; Chaney, 2016; Pietrovito and Pozzolo, 2019). Against this background, it is surprising that, with the sole exception of Chan (2019), there are no studies that attempt to investigate the impact of financial constraints on the mode of participation to international trade. Our contribution seeks to fill this gap.

Whilst our paper relates closely to the work by Chan (2019), there are two essential differences. First, we focus on imports while he analyses exports. Second, we also investigate whether the effect of credit constraints on the probability of importing indirectly is amplified when a firm faces other types of frictions to imports – such as market distance, the extent of regulatory burden, and other fixed costs.

Before presenting the empirical results, to provide neater motivation and guidance for the empirical analysis we propose a simple theoretical model, to which we now turn.

# 3 A simple theoretical framework

To motivate our empirical analysis, in the following we present a simple theoretical model which applies the framework of Manova (2013) and, especially, Chan (2019) to the study of imports.[6]

We characterize a firm's trade-off between direct and indirect imports by examining how the interplay of fixed and variable costs contributes to shape the pattern of its profits under each mode of importing. We model the presence of credit constraints in a firm through a positive wedge between the cost of external finance and that of internal finance. We assume that a firm relies on internal funds to pay its costs for imported inputs, but, if these funds are not sufficient, then it relies on bank credit to cover the remaining financial needs. Such external funds, however, require the payment of a premium. The choice between importing directly or indirectly (i.e. through an intermediary) thus depends on three factors: a) the fixed costs of

[6]Admittedly, while the model by Chan (2019) is richer than our framework, the implications are quite similar.

acquiring foreign inputs directly, b) a variable cost premium to be paid in the case of indirect importing, to reward the activity of the intermediary, and c) the credit constraints faced by the firm, which affect its ability to pay ex-ante the fixed costs of importing directly. Based on these assumptions, the model identifies a set of combinations of fixed costs and variable costs premium where the level of firm profits is the same under both import modes, which single out those combinations in which direct importing is more profitable than indirect importing and vice-versa. Importantly, the configuration of this set depends on the severity of financial constraints. The key theoretical prediction is that a credit-constrained firm is expected to import indirectly under a wider set of circumstances compared to an unconstrained firm.

More formally, we assume that each firm $i \in [1, N]$ produces a single variety of a differentiated product, as in Melitz (2003). Without loss of generality, and to focus only on imported inputs, we make the hypothesis that manufacturing one unit of output requires a firm-level expenditure of $ca_i$, where $c$ denotes the cost of a bundle of imported inputs that are necessary to produce one unit of output, and $a_i$ is the inverse of the firm's productivity level $(1/a_i)$. Following the literature, we assume that $a_i$ is drawn from a distribution $G(a)$ that is common among all firms and has a support in the interval $[a_L, a_H]$. To source its inputs abroad, the firm must pay a firm-specific up-front fixed cost, which is equal to $F_i^D$ if it imports directly and to $F_i^I$ if it acquires them through an intermediary.

Crucially, we assume that intermediaries allow firms to access import markets with smaller fixed costs compared to direct importing, i.e. $F_i^D > F_i^I$. However, to reward the activity of the intermediary, the firm must pay ex-ante a variable cost premium, $\gamma_i > 1$.

Each firm pays up-front costs using its available liquid assets, $L_i$. However, if these funds are insufficient, then it must recur to external sources, which are more costly than the internally generated funds because of financial market imperfections. We model this by assuming that a financial premium, $\varphi_i > 0$, relative to the cost of internal funds (which, for simplicity, is set equal to zero) has to be paid on external resources. The premium on external financing is firm-specific and reflects the severity of credit constraints faced by the firm. Whilst simple, this way of modeling financial constraints is in line with the approach by Kaplan and Zingales (1997), who classify firms as credit constrained if they face a wedge between the internal and external costs of funds; a firm is considered more financially constrained if this wedge is higher.

A firm chooses its price and quantity to maximize profits (in the following, we drop the index $i$ to streamline the exposition):

$$\pi(p, q, \gamma, F^j) = pq - q\gamma ca - F^j - (q\gamma ca + F^j - L)\varphi, \tag{1}$$

where $F^j = F^D$ if the firm imports its inputs directly and $F^j = F^I$ if, instead, it relies on an intermediary.

Assuming that consumers have preferences over the set of goods produced, as in Melitz (2003), each firm faces the following demand function for its product:

$$q(p) = \frac{p^{-\epsilon} Y}{P^{1-\epsilon}} \tag{2}$$

where: $q(p)$ is the quantity demanded of a specific variety, $p$ is its price, $\epsilon > 1$ is the elasticity of substitution between goods in the representative consumer's utility function, $Y$ is total expenditure in the economy and $P = \sum_{i=1}^{N} p_i^{\frac{\epsilon}{\epsilon-1}}$ is the aggregate price level.

Maximizing Eq. (1) subject to the consumers' demand function (Eq. (2)), we obtain the following expressions for the optimal price and quantity produced by each firm:

$$p = \frac{\epsilon}{\epsilon - 1}(1 + \varphi)\gamma ca, \tag{3}$$

$$q = \left[\frac{\epsilon}{\epsilon - 1}(1 + \varphi)\gamma ca\right]^{-\epsilon} \frac{Y}{P^{1-\epsilon}}. \tag{4}$$

Note that, in previous expressions, $\gamma > 1$ if the firm uses inputs imported through an intermediary and $\gamma = 1$ if the firm is importing directly.

Substituting Eqs. (3) and (4) into Eq. (1) yields the following profit function:

$$\Pi(\gamma, F^j) = [\mu(1 + \varphi)\gamma ca]^{-\epsilon} \frac{Y}{P^{1-\epsilon}}(\mu - 1)(1 + \varphi)\gamma ca - (1 + \varphi)F^j + \varphi L, \tag{5}$$

where: $\mu$ is the firm's price mark-up (i.e. $\mu = \frac{\epsilon}{\epsilon-1} > 1$), and $F^j = F^D$ and $\gamma = 1$ if the firm imports directly, while $F^j = F^I$ and $\gamma > 1$ if the firm uses an intermediary.

Equating to zero the profit function in Eq. (5), it is possible to determine the threshold level of productivity, $\frac{1}{a^*}$, below which a firm does not produce because it would incur a loss:

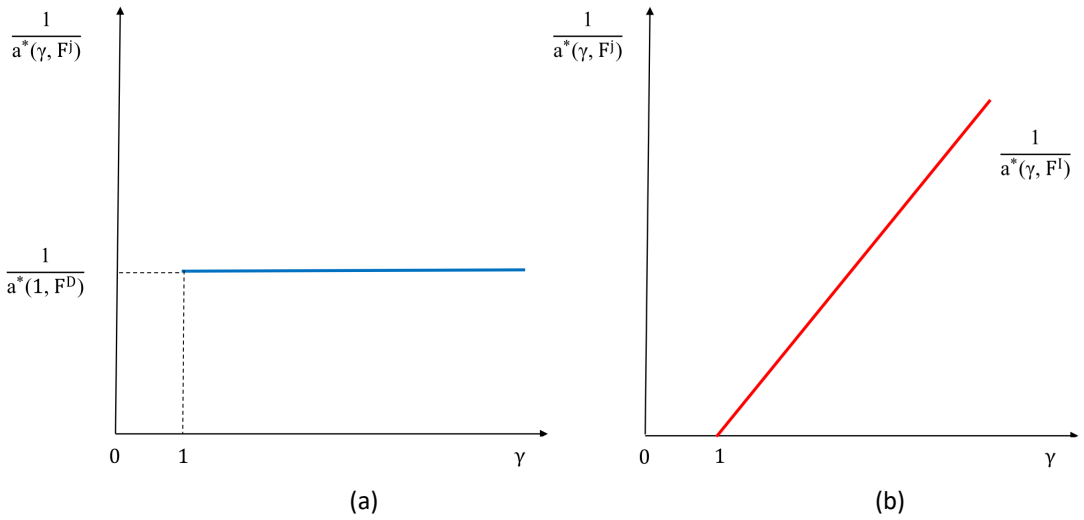


Figure 1

$$\frac{1}{a^*} = \left[\frac{(1+\varphi)F^j - \varphi L}{Y(\mu-1)}\right]^{\frac{1}{\epsilon-1}} \frac{\mu^\mu(1+\varphi)\gamma c}{P}, \tag{6}$$

where, as above, $\gamma = 1$ if the firm is importing directly, and $\gamma > 1$ if it uses an intermediary.

Clearly, if the firm imports directly, then the threshold productivity value, $\frac{1}{a^*}$, is independent of $\gamma$, as shown in panel (a) of Figure 1, while it is an increasing function of $\gamma$ if it uses an import intermediary, and $\gamma > 1$, as shown in panel (b).

Merging panels (a) and (b) of Figure 1, one obtains Figure 2. The two lines for the threshold productivity levels, the one associated with direct importing, $\frac{1}{a^*|_D}$, and the other associated with indirect importing, $\frac{1}{a^*|_I}$, intersect at a given level of $\gamma$, which we call $\gamma^*_{ZP}$. Since

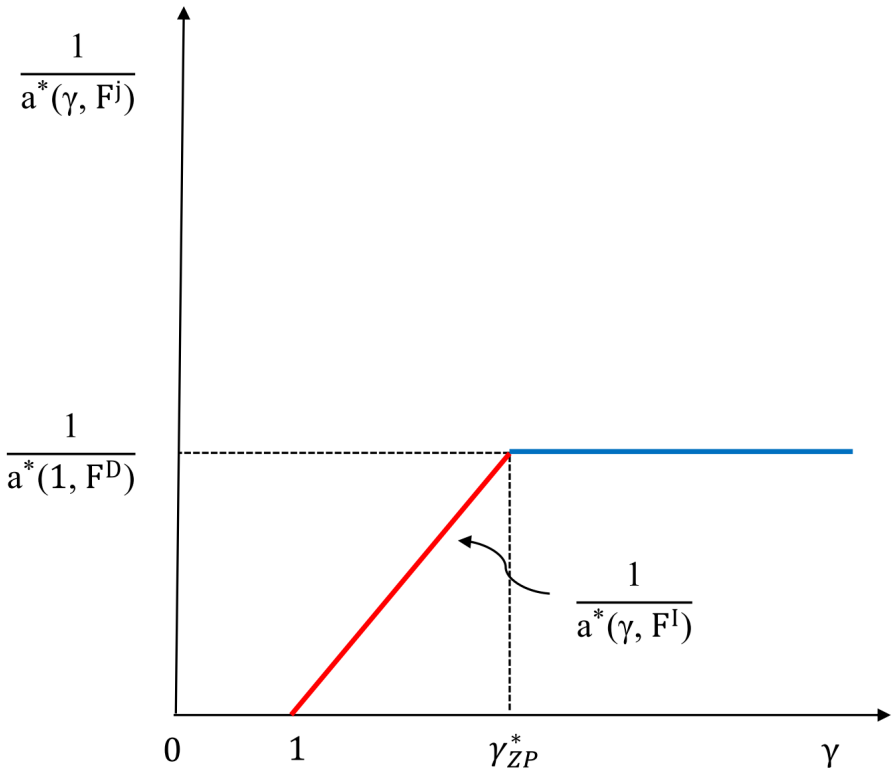


Figure 2

for $\gamma = \gamma^*_{ZP}$ the two threshold productivity levels coincide, it follows that $\Pi(1, F^D) = \Pi(\gamma^*_{ZP}, F^I) = 0$, because both thresholds are obtained from the zero profits condition applied to Eq. (5).

Having characterized the threshold productivity level as a function of $\gamma$ (see Figure 2), we now characterize how a firm decides whether to import directly or to rely instead on an intermediary. From Eq. (5), it will import directly if $\Pi(1, F^D) > \Pi(\gamma, F^I)$, it will import indirectly if the opposite holds true, and it will be indifferent between the two alternatives if $\Pi(1, F^D) = \Pi(\gamma, F^I)$. Whenever the firm is at the threshold productivity level and is thus having zero profits, it will be indifferent if $\gamma$ equals $\gamma^*_{ZP}$, i.e. the level identified in Figure 2.

For the more general case of firms registering positive profits because they drew a higher level of productivity than the threshold, we can still determine the expression for $\gamma$, which

we call $\gamma^*$, from the condition that $\Pi(1, F^D) = \Pi(\gamma^*, F^I)$. This is the threshold level of $\gamma$ that makes any firm, given its level of productivity, indifferent between the two import modes:

$$\gamma^* = \left[1 - Aa^{\epsilon-1}(1+\varphi)^{\epsilon}(F^D - F^I)\right]^{\frac{1}{1-\epsilon}}, \tag{7}$$

where $A = \frac{c\mu^{\epsilon}}{\mu-1}\frac{P^{1-\epsilon}}{Y} > 0$.[7]

We first establish from the above expression that $\frac{\partial\gamma^*}{\partial(F^D-F^I)} > 0$. In other words, when the fixed costs under direct importing, $F^D$, increase compared to those under indirect importing, $F^I$, the threshold variable costs premium, $\gamma^*$, that the firm is willing to accept without switching to direct importing is higher. That is, as $(F^D - F^I)$ rises, under a larger set of circumstances it is convenient for the firm to rely on intermediated, rather than direct, trade.

Moreover, we also establish that $\frac{\partial\gamma^*}{\partial\varphi} > 0$. For any given level of all other firm specific characteristics, including $\gamma$, more severe credit constraints thus raise the threshold level, $\gamma^*$, therefore expanding the set of cases for which indirect importing is more convenient than direct importing. Empirically, we should therefore find that firms facing credit constraints are more likely to import indirectly than otherwise identical firms not facing such constraints.

Using Eq. (7), the curve in Figure 3 represents the combination of values of $\gamma$ and $(F^D - F^I)$ at which, for a given level of credit constraints, $\varphi_1$, and productivity, $\frac{1}{a}$, profits are the same under direct and indirect import modes: $\Pi^I(\varphi_1, a) = \Pi^D(\varphi_1, a)$. At any combination of $\gamma$ and $F^D - F^I$ which lies above (below) that curve it is convenient to import directly (indirectly). Crucially, as credit constraints become stronger ($\varphi_2 > \varphi_1$), the curve shifts upward and this induces an expansion of the parameter space with combinations of $\gamma$ and $(F^D - F^I)$ at which indirect importing is more profitable than direct importing.

Thus, the simple model outlined above establishes that a firm facing more severe credit constraints is more likely to use a trade intermediary. In the following, we will put this prediction under empirical scrutiny.

[7] Clearly, for a firm making zero profits, $\gamma^* = \gamma^*_{ZP}$. It is also worth emphasizing that $\gamma^* > 1$, because the term in square brackets is bounded between 0 and 1 (for plausible values of $Y$ at the denominator of the expression for $A$), and its exponent, $\frac{1}{1-\epsilon}$, is negative and its absolute value is lower than unity.

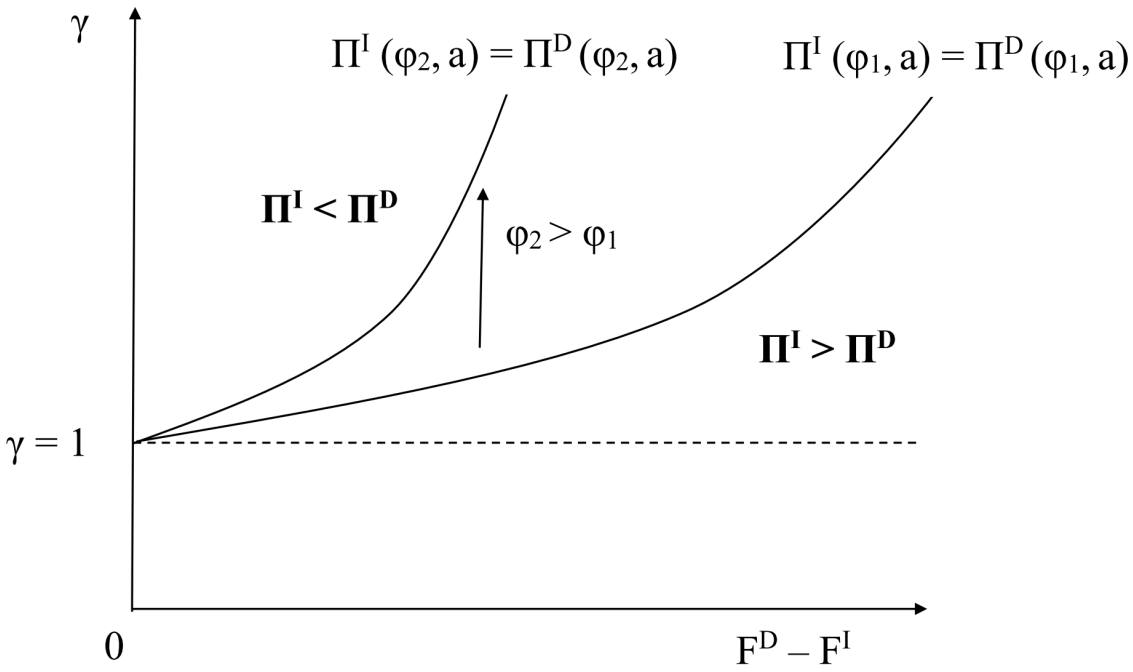


Figure 3

# 4 The Empirical Framework

## 4.1 Firm-Level Methodology

This section describes the empirical models adopted to test the hypotheses originated from our theoretical framework. The first model is the following binomial specification, where firms are indexed by $i$, industries by $k$, countries by $c$ and time by $t$:

$$\begin{aligned} Pr\left(indirect\_import_{ikct}=1\right) &= \alpha+\beta CR_{ikct}+\gamma Z_{ikct}+\nu_k+\lambda_c+\eta_t+\epsilon_{ikct} \\ &= Pr\left(\alpha+\beta CR_{ikct}+\gamma Z_{ikct}+\nu_k+\lambda_c+\eta_t+\epsilon_{ikct}>0\right) \\ &= \varphi\left(\beta CR_{ikct}+\gamma Z_{ikct}+\nu_k+\lambda_c+\eta_t+\epsilon_{ikct}\right). \end{aligned} \tag{8}$$

The dependent variable is a dummy, $indirect\_import_{ikct}$, that takes the value of one if the firm uses an intermediary to import its inputs, and zero otherwise. The main explanatory variable is a dummy that takes the value of one if the firm is credit-constrained and zero if it is not, $CR_{ikct}$ (in Section 4.2 we discuss in detail how we identify credit-constrained firms).[8] The explanatory variables include a set of firm characteristics, $Z_{ikct}$, such as number of employees, age, productivity, capacity utilization, the share of skilled and temporary workers, foreign ownership, the share of imported intermediate inputs, the relevance of domestic market, and the export status (the entire set is described in detail in Section 4.2). To control for potential omitted variables in this specification, we include fixed effects that account for: (i) the time-invariant industry characteristics, to capture for example the level of upstreamness or downstreamness ($\nu_k$); (ii) the time-invariant country-level characteristics, that control for aspects such as the development of a country's financial system ($\lambda_c$); and (iii) the time effects, accounting for the fact that our sample period spans from before to after the financial crisis ($\eta_t$).

First, we estimate Eq. 8 using a Linear Probability Model (LMP), which considers our dichotomous dependent variable ($indirect\_import_{ikct}$) as continuous. While this is not the most efficient estimator, it is consistent and robust to potential mispecification errors (Chiburis et al., 2012). Its main shortcoming is that it may yield predicted probabilities that lay outside the $[0,1]$ interval (Caudill et al., 1988). For this reason, we then estimate Eq. (8) also adopting a probit model, accounting for the constraint that the predicted probability must lie between zero and one.

[8] It is worth emphasizing that our analysis is based on a pooled cross-section and not on a panel data set, because in the WBES database very few firms are observed in consecutive years.

From an econometric perspective, a crucial problem to assess the causal impact of the presence of credit constraints on a firm's choice of import mode is that such a relationship 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 mode of participation to import markets. For instance, if a firm faces a negative shock that induces a contraction in its level of economic activities, this would determine a drop in external financing, making it more likely for the firm to be credit-constrained, and thus inducing a decrease in the firm's imports. The incidence of the fixed costs of importing would thus increase and the benefits of operating directly in international markets would drop, making it more likely for the importing firm to use an intermediary. More simply, firms whose managers are members of an established international network might be better able to access both external finance and foreign suppliers. The second endogeneity problem may be caused by reverse causation, as firm's direct access to foreign markets might be seen as a positive signal that makes it easier to obtain external funding, reducing the extent of credit rationing.

Since both the dependent variable and the proxy for credit constraints are dichotomous, we address the endogeneity problem estimating a bivariate probit model, which includes two equations: the first estimates the probability that the firm is credit-constrained, and the second estimates the probability of importing through an intermediary, conditional on being credit-constrained. Intuitively, this method replicates an instrumental variable (IV) approach, where the first stage estimates the probability that a firm is credit constrained. The identification of the first equation in the bi-probit model is made possible by the inclusion of some explanatory variables excluded from the second equation, which play the same role of the instruments in a standard IV estimation (see e.g., Minetti and Zhu, 2011; Minetti et al., 2019). We use two such instruments: 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; and a measure of limited availability of internal sources of funds, constructed as a dummy variable that takes the value of one for firms with a share of payment inflows after delivery higher than 90% and zero otherwise, interacted with four firm size dummies corresponding to the quartiles of the distribution of firms by employment size. We allow the impact of late payments (i.e., commercial credits granted by the firm) to vary depending on firm size because abundant evidence highlights significant differences between large and small firms in their policies on late payments. As we consider the quartiles of the distribution of firm size, we include four interactions as instrumental variables.[9]

[9]The choice of these instruments is consistent with the literature on the determinants of credit constraints (see, for example, Drakos and Giannakopoulos, 2011; Nucci et al., 2020).

The second equation of the bi-probit model is identical to Eq. (8), while the first equation is the following:

$$\begin{aligned} Pr\left(CR_{ikct}=1\right) &= \delta I_{ikct} + \lambda Z_{ikct} + \nu_k + \lambda_c + \eta_t + \mu_{ikct} \\ &= Pr\left(\delta I_{ikct} + \lambda Z_{ikct} + \nu_k + \lambda_c + \eta_t + \mu_{ikct} > 0\right) \\ &= \varphi\left(\delta I_{ikct} + \lambda Z_{ikct} + \nu_k + \lambda_c + \eta_t + \mu_{ikct},\right) \end{aligned} \tag{9}$$

where $I_{ikct}$ is the set of instrumental variables, excluded from Eq. (8). The set of control variables, $Z_{ikct}$, and the three sets of fixed effects are the same as those in Eq. (8). The bivariate probit model controls for endogeneity by allowing the error terms $\epsilon_{ikct}$ and $\mu_{ikct}$ of Eq. (8) and Eq. (9) to be correlated. The baseline bi-probit model is estimated including the three sets of fixed effects mentioned above; additionally we provide results including the interaction of year, country and sector fixed effects (*year*country*sector*).

One of the main characteristics for an instrumental variable is its exogeneity. In our specification, instruments should affect the import mode only through our measure of credit constraints; they should not directly affect our dependent variable. In other terms, our instruments should prove not to be correlated with some omitted variables that might affect both the likelihood of importing with an intermediary and that of being credit constrained. To verify the validity of our instruments, we provide the Hansen test, obtained by estimating the companion second stage regression (8) with a linear model and instrumenting credit rationing with the instruments mentioned above. The Hansen test of overidentifying restrictions verifies the joint null hypothesis that the instruments are valid, i.e., uncorrelated with the error term, and that the instruments in Eq. (9) are correctly excluded from the estimated Eq. (8).

These models are estimated on the sub-sample of importing firms, distinguishing between those importing indirectly and those that import directly. To control for the possible bias caused by the selection of only those firms which import at least some of their inputs, we also estimate an Heckman selection model (with instrumental variables). To this end, we jointly estimate the likelihood that a firm: (i) is an importer, (ii) is credit-constrained, and (iii) uses an import intermediary. Identification of the first equation is obtained by including a variable related to the firm's perception of the influence of political instability on its business operations (which is excluded from the other two equations). Identification of the second equation is obtained as in the bi-probit model, excluding from the third equation the dummy variable indicating whether the firm's financial statement is checked and certified by an external auditor as well as the measure of limited availability of internal sources of

funds.[10]

## 4.2 Data and sources

To test the predictions of the model, we analyse a pooled cross-section sample retrieved from the WBES, including 13,808 observations on 13,515 private firms from 66 countries, mostly emerging and developing, in years 2003 and 2006-2014. Firms belong to 22 manufacturing industries, classified according to the 2 digit level of ISIC.

These data contain information not only on the origin of material inputs and supplies used in the production process (domestic or foreign), but also on the mode of sourcing inputs from abroad: directly or through an intermediary.

To measure credit constraints – our key explanatory variable in the empirical model – we use specific questions included in the WBES. A large strand of empirical research identifies credit-constrained firms based on characteristics ranging from firms' riskiness (see, for instance, Muûls, 2015; Wagner, 2015) to leverage and liquidity ratios (see, e.g., Bas and Berthou, 2012; Fauceglia, 2015). However, since several concerns have been raised on the ability of these indicators to identify credit-constrained firms (see, for instance, Farre-Mensa and Ljungqvist, 2016), we prefer to exploit the firm's self-assessment available in WBES and define as credit-constrained those firms that obtained a credit denial or characterize themselves as discouraged borrowers, and approach pioneered by Jappelli (1990) and adopted in several papers on credit constraints and international trade (see, for instance, Drakos and Giannakopoulos, 2011; Nucci et al., 2020).

In practice, we define a firm as credit-constrained, and identify it with a dummy variable taking the value of one, if it either: (i) applied for a loan or a credit line but did not obtain it for reasons related to the credit rationing policy of the financial intermediary, or (ii) self-excluded from the credit market, not applying for a loan because of the complexity of the application procedures, the expected unfavorable conditions on interest rates, collateral, size, duration, among others, or the expectation that the application would be rejected. All firms that, at the time of the survey, have a loan or a credit line or state that they do not need a loan are considered as unconstrained (and the dummy is therefore set to zero).

Information on importing activities and credit rationing is supplemented with other firm characteristics, used as control variables in our econometric specification to reduce the po-

[10]Estimation are conducted using the CMP routine for Stata made available by Roodman (2011).

tential omitted variables bias (see, for instance, Grazzi and Tomasi, 2016). In particular, we assume that the mode of import may be affected by structural characteristics of the firm, such as: size, measured by the number of permanent full-time employees; labour productivity, approximated by the ratio of total sales to the number of employees; the share of skilled workers over the number of permanent full-time employees; age, measured by the number of years since the firm's foundation; the share of temporary employees over total employees; a self-reported measure of capacity utilization; the incidence of foreign shareholders, on the grounds that foreign ownership of a firm may affect the propensity to access international markets (Grazzi and Tomasi, 2016); the degree of reliance on imported intermediate inputs, measured as the ratio of the latter to total intermediate inputs. Finally, since the empirical literature has provided ample evidence of interconnection and complementarity between exporting and importing (Castellani et al., 2010; Muûls and Pisu, 2009), we also control for the firm's exporting status, with a dummy that takes the value of one if the firm sells its products to foreign markets and zero otherwise, and for the relevance of its domestic market, with a dummy taking the value of one if the firm states that the main market for its leading product is national and zero otherwise.

## 4.3 Summary statistics

Table 1 presents the descriptive statistics, showing that 46% of the firms in our sample import using an intermediary, and slightly less than 20% are credit-constrained. Interestingly, the share of credit-constrained firms is larger for indirect importers (26%) than for direct importers (14%), and the difference is statistically significant at the 1% level, as shown by the t-test in the last column of the table. Similar differences are shown for *Access to finance*, an alternative measure of credit rationing.

Firm structure shows a high degree of heterogeneity within our sample, with size ranging for example from 5 employees at the $5th$ percentile to 550 employees at the $95th$ percentile. Firms that import indirectly show: (i) a lower reliance on imported inputs (48%) than firms importing directly (55%); (ii) a lower probability of exporting (26%) than firms importing directly (60%), and (ii) a lower share of foreign ownership (4%) than firms importing directly (15%). This may be explained by the fact that importers, exporters and foreign-owned firms face lower costs to import directly, because of their better knowledge of how to trade internationally. Firms importing indirectly are smaller, less productive and younger than firms importing directly.

Table 2 presents the correlations between variables. Reassuringly, our dependent variable is positively correlated with both measures of credit rationing, suggesting that credit-constrained firms are more likely to import through an intermediary than directly. In the following, we will show that this finding is confirmed by a more rigorous econometric analysis.

# 5 Baseline Empirical Results

Table 3 presents the estimation results of Eq. (8) and (9), obtained using a linear probability model (LPM, column 1), a probit specification (column 2), and two bi-probit specifications with different sets of dummy variables (columns 3-6). To make the results comparable, while using different estimation methods, columns 2-6 report marginal effects calculated at the observed values of explanatory variables in the sample.

Consistent with the predictions of our theoretical framework, firms that are credit constrained are significantly more likely to acquire imported inputs through an intermediary. The estimated marginal effects – which coincide with the estimated coefficient only in the case of the LPM – are very similar using the three different estimation methods, and they are in all cases statistically significant at the 1% level. Since in the following we will present results solely obtained using binomial models, we will consider the results in column 2 as our baseline specification. The estimated marginal effect of credit rationing is in this case 0.072, with a very small standard error of 0.009. Since the unconditional share of firms which use import intermediaries is 46% (see Table 1), the effect of credit constraints is to increase the probability of using intermediaries by about 16% – a sizable economic impact.

The estimated impact of the other control variables is as expected. The marginal effect of the logarithm of the total number of employees is estimated to be $-0.090$, and it is statistically significant at the 1% level. Larger firms are thus less likely to use import intermediaries, as predicted by the theoretical model. Firms with better access to foreign markets, such as exporters and local subsidiaries of multinational firms, are also less likely to import inputs using an intermediary. The estimated marginal effect of the dummies for exporting firms and for foreign owned firms are both negative, respectively $-0.145$ and $-0.001$, and also statistically significant at the 1% level. In general, firms which are more productive are less likely to use import intermediaries. This is shown by the negative and statistically significant estimated marginal effects of labour productivity ($-0.053$, statistically significant at the 1% level), the degree of competition faced in the domestic market ($-0.044$, significant a the 1% level) and the degree of capacity utilization ($-0.055$, significant a the 1% level), and by the

positive estimated marginal effect of the share of temporary workers (0.038, significant at the 10% level). The positive estimated marginal effect of the share of skilled workers (0.102, also statistically significant at the 1% level) is admittedly less intuitive, especially if one assumes that skilled workers are better at handling complicated import procedures, thus reducing the need to employ an intermediary. However, firms with a high share of skilled workers are also more likely to import sophisticated inputs, which they prefer to be thoroughly screened by specialized import intermediaries.

As argued in section 4.1, the presence of financial constraints and the choice to use an intermediary to acquire imported inputs may be affected by an endogeneity bias. Estimates using a bi-probit specification allow to control for this possibility.[11] As discussed in 4.1, the identification of the equation for the event that a firm is credit constrained is obtained by including five additional variables. The results obtained estimating Eq. (8) using the bi-probit specification, reported in column 3, show that we cannot reject the hypothesis that the dummy for credit-constrained firms is endogenous with respect to the use of import intermediaries. Column 4 reports the results of the estimation of Eq. (9) within the bi-probit specification. Aside from the estimated marginal effects of the characteristics included in Eqs. (8) and (9) – which are not the focus of the current analysis, and all have the expected sign – it is reassuring that the five regressors included for identification are highly jointly statistically significant (with a value of the chi-square statistics of 77.67), and four of them are also individually significant at the 1% or 5% level.[12]

The negative correlation coefficient between the estimated error terms of the two equations of the bi-probit specification, $Corr(\epsilon_{ikct}, \mu_{ikct})$, is statistically significant at the 5% level. It implies that, after controlling for observable characteristics, credit-constrained firms are less likely to use import intermediaries. Thus, the endogeneity bias works against finding a significant effect of credit rationing on the import mode, as confirmed by the fact that, in this case, the estimated marginal effect of the dummy for credit rationing is 0.342 (also statistically significant at the 1% level) – more than four times larger than that estimated using the probit specification. Reassuringly, the marginal effects of the other firm characteristics are broadly comparable to those obtained with the LMP and the probit specifications (with the only exception of the effect of the degree of capacity utilization, which diminishes in absolute value and becomes statistically insignificant).

[11] As we already discussed in section 4.1, this mimics an instrumental variable approach in a binomial specification setting.

[12] Unfortunately, the literature on weak instruments is much less developed with regard to diagnostics for nonlinear IV models (Mikusheva, 2013).

The IV least-squares estimates of the companion model provide indirect evidence that our specification is robust. The Hansen test of overidentifying restrictions has a value of 3.84, with an associated p-value of 0.43, which does not allow to reject the joint null hypothesis that instruments are valid (i.e., that they are uncorrelated with the error term, and that the excluded instruments are correctly excluded from the second-stage equation).

The results presented in columns 3 and 4 refer to a bi-probit specification including year, country and sector fixed effects. In columns 5 and 6 we present the results of the estimates of an alternative specification, which includes a larger set of dummies, obtained from the interaction of year, country and sector fixed effects (*year*country*sector*). Adopting this specification amounts to comparing rationed and non-rationed firms within the same sector, country and year, significantly reducing the total variability, and absorbing large degrees of freedom. Nonetheless, the estimated marginal effect of credit rationing is 0.246 and it remains statistically significant at the 1% level. This provides support to our previous findings. According to our estimates, all else being equal, credit constrained firms are about 20% to 30% more likely to use import intermediaries. Also in this case, the Hansen test confirm the soundness of the econometric specification.

# 6 Extensions and Robustness Analysis

## 6.1 Controlling for Sample Selection Bias

The results reported in Table 3 are obtained estimating Eq. (8) on the sample of importing firms. As such, they cannot be used to infer the behavior of a non-importing firm that decides to begin acquiring foreign inputs. To address this issue, we have estimated Eq. (8) using a two-stage Heckman correction model on all 20,870 firms and 21,498 observations in our sample.[13] Columns 1-3 of Table 4 report the estimated marginal effects. Column 1 refers to the equation where the dependent variable is a dummy indicating the firm's import status (importer or non importer). In that column, the measure of perceived political instability, the included regressor used to identify the equation, is statistically significant at the 1% level. Column 2 refers to the equation where the dependent variable is a dummy indicating whether the firm has access to credit (credit-constrained or unconstrained firms).

[13] As explained above, we have estimated an instrumental variables Heckman correction model using the CMP routine developed by Roodman (2011); this allows us, also in this case, to control for the endogeneity of credit rationing with respect to the choice of import mode.

The estimated results in that column show that, also in this case, each of the five additional controls included in the estimation of Eq. (9) is in general statistically significant and their joint statistical significance at the 1% level confirms the validity of our specification.

Column 3 refers to the equation in which the dependent variable is a dummy indicating the mode of import of each firm (direct or indirect). Our results corroborate the findings of the bi-probit specification. The estimated marginal effect of credit rationing is 0.328, almost identical to that reported in column 3 of Table 3. All other estimated effects are also very similar to those obtained with the bi-probit specification. We therefore provide more generality to our findings, by establishing that they also apply to firms that are not using foreign inputs, but decide to begin acquiring them.

## 6.2 Alternative Definition of Credit Rationing

In our baseline specification, firms are classified as credit-constrained if they either: (i) applied for a loan, but did not obtain it; or (ii) did not apply for a loan because they were discouraged from doing so. To check the robustness of our results in relation to this measure, we made use of another question in the WBES survey, in which firms are asked whether access to finance is an obstacle to their current operations.[14] We defined as credit-constrained all firms which answered that access to finance is a moderate, major or very severe obstacle to their operations. Table 5 presents the results obtained estimating the bi-probit model defined by Eqs. (8) and (9) using this alternative definition. Since they are obtained using an identical specification, these results are fully comparable with those of columns 3 and 4 of Table 3. Reassuringly, the estimated marginal effect of the dummy for credit constrained firms is 0.399 – even larger in absolute value than that in column 3 of table 3 (0.342) – and also in this case it is statistically significant at the 1% level. All other controls have comparable effects. As in the previous cases, the five additional controls included in the estimation of Eq. (9) are jointly statistical significant, confirming the soundness of our specification.

[14]The specific question is the following: "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?".

## 6.3 Geographical Distance

Abundant empirical literature on gravity equations has provided evidence that geographical distance has a first-order effect on international trade flows. Typically, distance creates a host of physical, administrative and informational barriers, which increase costs and hamper the amount of bilateral trade among country pairs. Physical and information barriers are also likely to impact differently on direct and indirect importers, because intermediaries can spread the fixed costs component of importing across a larger volume of imports. This leads to two testable implications. First, firms importing inputs from more distant countries are more likely to use intermediaries. Second, since credit-constrained firms are less able to sustain fixed costs, the impact of rationing on the probability that a firm uses an intermediary is higher if it imports from more distant countries.

To test this hypothesis, we need a measure of the distance of the countries from which the firms import their inputs. Since WBES does not include such information, we compute a weighted distance indicator combining country- and sector-specific information on imported inputs from the International Use tables in the WIOD with data on the geographical distance between pairs of countries from the *Centre d'Études Prospectives et d'Informations Internationales* (CEPII).[15] The Use WIOD tables are product-by-industry type tables, including 35 industries covering the overall economy and roughly corresponding to the two-digit ISIC rev.4 level (Timmer et al., 2015). They report the values of foreign purchases of each product, distinguishing whether it is used: as an intermediate input by domestic industries, to satisfy domestic final demand, or for re-exporting. For the purpose of this paper, we focus on the value of imports used as intermediate inputs by domestic industries. We first calculate total imports of firms belonging to industry $k$ in country $c$ ($imports_{kc}$), summing imports from any partner country $j$. We then compute the share of imports by firms in industry $k$ in country $c$ from source country $j$ ($imports_{kcj}$), over total imports of firms in country $c$ operating in sector $k$ ($imports_{kc}$). After selecting 22 sectors and 66 countries included in our sample for each importing industry $k$ in country $c$, we construct the following weighted average distance measure ($weighted\_distance_{kc}$):

$$weighted\_distance_{kc} = \sum_{j=1}^{N} distance_{cj} \frac{imports_{kcj}}{imports_{kc}}, \tag{10}$$

[15]The use tables are the core statistical sources from which statistical institutes derive national input-output tables. Data are accessible at: http://www.wiod.org/database/int_suts16; data on distance are accessible at: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6.

where $distance_{cj}$ is the distance between capitals cities of countries $c$ and $j$. The weighted distance is then associated to each firm operating in industry $k$ of country $c$.

Table 6 presents the results controlling for the average distance of the countries from which firms import in a given sector. Unfortunately, data from International Use tables produced by WIOD allow to build the indicator only for 15 of the countries included in our original data set, causing a reduction in our sample size from 13,808 to 3,229 observations. Column (1) of Table 6 reports the results of the estimation of Eq. (8), using the same bi-probit model adopted to obtain the baseline results reported in columns 3 and 4 of Table 3.[16] The only difference in the specification is that, in both equations of the bi-probit model, among the regressors we also include the logarithm of the weighted average distance from the countries from which inputs are imported. Reassuringly, despite the reduction in the size of the sample, the coefficient of the dummy for credit constrained firms is 0.298 – very similar to the 0.342 estimated from the baseline bi-probit specification (column 3 of Table 3) – and also in this case it is statistically significant at the 1% level. As expected, the coefficient of the logarithm of the weighted distance is positive (0.149) and it is statistically significant at the 1% level. The distance from the countries from which inputs are imported has therefore a significant positive impact on the probability that a firm uses an intermediary. However, omitting to control for this feature does not seem to introduce a sizable bias in our estimates.

Columns 2 and 3 of Table 6 report the estimates obtained splitting the sample depending on whether the distance of the importers from the countries where the imported inputs are produced is above or below the sample median (calculated across sectors and countries). Consistent with our hypothesis, credit-constrained firms that are on average more distant from the countries where their imported inputs are produced are more likely to rely on import intermediaries. This is shown by the coefficient of 0.384, which is larger than that estimated on the entire sample, and is statistically significant at the 1% level (column 3). For firms that are closer to the countries where their imports are produced, the effect of credit rationing is instead statistically insignificant (column 2). All other estimated coefficients, including that of distance, are broadly similar in the two specifications (with the only exception of that of the share of temporary workers).

[16] Results of the estimation of the other equation of the bi-probit model are omitted for space reasons, but are available from the authors upon request.

## 6.4 Other Frictions to Imports

Sourcing inputs from abroad and, in general, conducting international trade is subject to a variety of obstacles other than distance, which can impact on a firm's choice of import mode, and possibly magnify the effect of credit constraints on the probability of importing indirectly. To investigate this issue, we use a number of indicators on impediments to imports drawn from the World Bank Doing Business project. These indicators appraise, at the country level, the time and costs associated with three steps in the overall process of importing a shipment of products: documentary compliance, border compliance and domestic transport.[17] The first proxy for frictions to imports that we adopt is the number of documents per import shipment that are required by public authorities (including government ministries, customs, port authorities and other control agencies) and by banks for the issuance of a letter of credit. The second measure refers to the costs, expressed in deflated US dollars, associated with importing a container of goods by sea transport through four predefined stages: document preparation, customs clearance and inspections, inland transport and handling, port and terminal handling. These expenditures include, but are not limited to, costs for documents, administrative fees for customs clearance and inspection, customs broker fees, port-related charges and inland transport costs. The third measure is the time associated with importing a container by sea transport through the three above-mentioned predefined stages. For each of the three indicators, we construct the average value over the period 2004-2014. In addition, since all three indexes proxy for the degree of frictions to imports, we also construct a synthetic index calculating their first principal component (i.e., the one explaining the highest variance). We estimate our baseline equation separately for different sub-samples, each defined on the basis of the value of each of these indexes, and of their first principal component. For each indicator, the sample is split using the median as threshold value.

Table 7 reports the results of the estimates of the equation for the probability that a firm imports using an intermediary (Eq. (8)), obtained from the bi-probit specification. The columns labeled with an odd number refer to the sample of countries with lower frictions to imports – that is, those with the value of the corresponding index below the sample median – while those labeled with an even number refer to countries with higher frictions.

Results confirm that credit rationing has a stronger impact on a firm's likelihood to use an intermediary in countries where frictions to imports are higher.[18] The marginal effect of

[17] Data are accessible at: https://www.doingbusiness.org/en/data/exploretopics/trading-across-borders/what-measured.

[18] These specifications do not include the level of friction index in each country because, in absence of information on its sector variability, it would be perfectly collinear with the country fixed effects.

being credit constrained is always statistically significant at the 1% level; it is higher for firms in countries with higher indexes of documentary compliance (0.417 vs. 0.306), time to import (0.416 vs. 0.260), costs of importing (0.366 vs. 0.353), and with a higher level of the principal component of the three measures (0.412 vs. 0.316).

Overall, these additional findings are consistent with those obtained splitting the sample according to geographical distance, strengthening our interpretation that credit constrains have a higher impact on forcing firms to use intermediaries when the fixed costs of importing are more substantial.

## 6.5 Credit Rationing and the Mode of Two-way Trade

A body of literature has provided evidence that two-way traders – i.e., firms involved in both export and import activities – tend to exhibit productivity premia compared to firms that only import, only export, or are not engaged in international trade (Castellani et al., 2010; Muûls and Pisu, 2009). The model by Kasahara and Lapham (2013) shows that only firms with higher productivity self-select into two-way trade, because they need to afford the payment of both the fixed costs of importing and those of exporting. On the other hand, if there are fixed cost complementarities between exporting and importing, for example because part of the fixed costs are common, then the firms already engaged in one-way trade are more likely to become two-way traders.

In considering firms simultaneously involved in imports and exports, Grazzi and Tomasi (2016) distinguish between direct and indirect two-way traders. In their empirical analysis, they detect performance premia for direct two-way traders compared to firms that trade indirectly on both sides of trade (indirect two-way traders) or only on one of them (mixed two-way traders).

In this section, we also analyse the import-export nexus, along two different perspectives. First, we focus on firms that are two-way traders and compare the effect of credit rationing on the probability of exporting indirectly and that of importing indirectly. The results are presented in Table 8 and they are all obtained using the bi-probit model adopted thus far. The first column refers to estimation of an equation similar to Eq. (8), where the dependent variable is a dummy that takes the value of one if the firm uses an intermediary for exporting its products, and zero otherwise. The second column refers to estimation results of the same equation, but where the dependent variable is a dummy variable equal to one if the firm imports indirectly and zero otherwise. The sample in this case includes only two-way

traders (6,110 firms) and the specification comprises the export share of sales (and excludes the export status dummy variable, which would be always equal to one). Interestingly, the estimated effects of credit constraints on the probability of importing indirectly and on the probability of exporting indirectly are virtually identical (0.288 and 0.286 respectively) and are both statistically significant at the 1% level.

Next, we investigate whether credit rationing has a different effect on the import mode depending on the mode of exporting, and vice-versa. We then divide the sample using the mode of exporting (direct vs. indirect) as a splitting criterion and analyse whether credit constraints affect the probability of being indirect importers in a way that depends on the export mode. The estimation results are reported in columns 3 and 4. For both direct and indirect exporters, credit rationing increases the probability of importing through an intermediary to a statistically significant extent. Not surprisingly, the effect is stronger in the sub-sample of firms exporting indirectly than in the other: the estimated marginal effects are, respectively, 0.355 and 0.230 and are statistically significant at the 5% level in both cases. Symmetrically, we then split the sample of two-way trading firms based on the mode of import (direct vs. indirect) and investigate whether credit constraints affect the probability of being indirect exporters differentially depending on the mode of import.

Different from the import case, in columns 5 and 6 we report that credit rationing increases the probability of exporting through an intermediary only if the firm is a direct importer, while it does not affect such probability if the firm relies on an intermediary for importing its inputs. The estimated marginal effect is 0.360 in the first case and is statistically significant at the 5% level, while the estimated effect is positive but not statistically different from zero in the second case. Put it differently, if firms rely on an intermediary to source its foreign inputs, then credit rationing has no effect on the mode of exporting their products. If they import directly, credit constraints increase the probability of using an export intermediary.

Overall, the estimates reported in this section show that the presence of credit rationing influences the mode of importing under a broader range of circumstances than it does for the mode of exporting.

# 7 Concluding Remarks

A large literature has established that, to conduct international trade and pay the associated fixed costs, firms must own sufficient liquidity or have access to external finance. Growing ev-

idence suggests that a substantial share of trade transactions are made indirectly, i.e. through wholesalers or retailers. The latter are able to pool the fixed costs of trade across several firms, allowing producers who rely on intermediaries to avoid these extra expenses. Against this backdrop, we show both theoretically and empirically that credit constraints have a first order effect on firms' mode of participation to import markets, and that credit-constrained firms exhibit a higher likelihood of importing their inputs through a trade intermediary. Moreover, the impact of credit constraints on the mode of import is amplified for firms that face stronger frictions to importing, such as a higher geographical distance from their foreign sources and longer and costly administrative procedures.

Our results have two relevant policy implications. First, they uncover an additional channel through which credit constraints can negatively impact on a firm's performance, by increasing the indirect costs that it needs to pay to acquire foreign inputs. Second, they show that reducing the frictions affecting import activities can be comparatively more beneficial for firms which are credit constrained than for their unconstrained counterparts.

Our analysis also uncovers some directions for future research, to better understand the extent and characteristics of the impact of credit constraints on import mode. Better quality data, often available at the country level, may allow to investigate the heterogenous impact of credit constraints on the intensive margin of import, depending on the type of product varieties and input providers.

Table 1: Descriptive Statistics

| | All sample | | | | | Indirect importers | | | | | Direct importers | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variables | mean | p5 | p50 | p95 | s.d. | mean | p5 | p50 | p95 | s.d. | mean | p5 | p50 | p95 | s.d. | t-test |
| Indirect imports | 0.46 | 0 | 0 | 1 | 0.50 | | | | | | | | | | | |
| Credit rationing | 0.19 | 0 | 0 | 1 | 0.40 | 0.26 | 0 | 0 | 1 | 0.44 | 0.14 | 0 | 0 | 1 | 0.34 | -18.72 *** |
| Access to finance | 0.09 | 0 | 0 | 1 | 0.28 | 0.13 | 0 | 0 | 1 | 0.33 | 0.05 | 0 | 0 | 1 | 0.22 | -14.94 *** |
| Export status | 0.44 | 0 | 0 | 1 | 0.50 | 0.26 | 0 | 0 | 1 | 0.44 | 0.60 | 0 | 1 | 1 | 0.49 | 43.40 *** |
| Share of imports | 0.52 | 0.05 | 0.50 | 1 | 0.32 | 0.48 | 0.05 | 0.50 | 1 | 0.32 | 0.55 | 0.05 | 0.55 | 1 | 0.32 | 12.61 *** |
| Foreign ownership | 0.10 | 0 | 0 | 1 | 0.28 | 0.04 | 0 | 0 | 0.25 | 0.18 | 0.15 | 0 | 0 | 1 | 0.33 | 25.15 *** |
| Employees | 143.63 | 5 | 34 | 550 | 435.08 | 65.04 | 4 | 18 | 250 | 209.19 | 210.11 | 6 | 62 | 800 | 550.27 | 21.07 *** |
| Labour productivity | 42,202 | 408 | 21,026 | 163,319 | 60,298 | 27,484 | 357 | 14,500 | 95,378 | 42,231 | 54,652 | 482 | 30,147 | 199,561 | 69,750 | 28.14 *** |
| Age | 23.06 | 5 | 17 | 60 | 18.87 | 20.08 | 5 | 16 | 52 | 15.94 | 25.57 | 5 | 19 | 65 | 20.71 | 17.57 *** |
| Share of temporary workers | 0.11 | 0 | 0 | 0.58 | 0.20 | 0.12 | 0 | 0 | 0.60 | 0.22 | 0.10 | 0 | 0 | 0.50 | 0.19 | -5.28 *** |
| Share of skilled workers | 0.47 | 0.04 | 0.50 | 0.89 | 0.27 | 0.50 | 0.02 | 0.52 | 0.90 | 0.27 | 0.45 | 0.05 | 0.45 | 0.87 | 0.27 | -10.98 *** |
| National competition | 0.48 | 0 | 0 | 1 | 0.50 | 0.44 | 0 | 0 | 1 | 0.50 | 0.52 | 0 | 1 | 1 | 0.50 | 9.34 *** |
| Capacity utilization | 0.72 | 0.30 | 0.75 | 1 | 0.21 | 0.70 | 0.30 | 0.70 | 1 | 0.22 | 0.74 | 0.30 | 0.80 | 1 | 0.21 | 10.34 *** |
| Certification | 0.55 | 0 | 1 | 1 | 0.50 | 0.42 | 0 | 0 | 1 | 0.49 | 0.67 | 0 | 1 | 1 | 0.47 | 29.66 *** |
| Late payments | 0.58 | 0 | 0.68 | 1 | 0.37 | 0.52 | 0 | 0.50 | 1 | 0.38 | 0.63 | 0 | 0.75 | 1 | 0.37 | 16.14 *** |
| No. observations | | | 13,808 | | | | | 6,328 | | | | | 7,480 | | | |

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Table 2: Pairwise Correlations

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | Indirect imports | 1 | | | | | | | | | | | | | | |
| (2) | Credit rationing | 0.16 | 1 | | | | | | | | | | | | | |
| (3) | Access to finance | 0.13 | 0.63 | 1 | | | | | | | | | | | | |
| (4) | Share of imports | -0.11 | 0.00 | 0.02 | 1 | | | | | | | | | | | |
| (5) | Export status | -0.34 | -0.13 | -0.11 | -0.02 | 1 | | | | | | | | | | |
| (6) | Foreign ownership | -0.20 | -0.04 | -0.04 | 0.07 | 0.18 | 1 | | | | | | | | | |
| (7) | Employees | -0.17 | -0.08 | -0.06 | -0.05 | 0.21 | 0.13 | 1 | | | | | | | | |
| (8) | Labour productivity | -0.22 | -0.11 | -0.10 | -0.03 | 0.19 | 0.16 | 0.08 | 1 | | | | | | | |
| (9) | Age | -0.14 | -0.07 | -0.05 | -0.07 | 0.14 | 0.03 | 0.19 | 0.15 | 1 | | | | | | |
| (10) | Share of temporary workers | 0.05 | 0.03 | 0.02 | -0.03 | -0.03 | 0.00 | -0.05 | 0.01 | -0.02 | 1 | | | | | |
| (11) | Share of skilled workers | 0.09 | 0.06 | 0.04 | 0.05 | 0.00 | -0.03 | 0.02 | -0.09 | -0.09 | -0.06 | 1 | | | | |
| (12) | National competition | -0.08 | -0.02 | -0.02 | -0.01 | -0.02 | -0.02 | 0.02 | 0.09 | 0.06 | -0.03 | -0.03 | 1 | | | |
| (13) | Capacity utilization | -0.09 | -0.08 | -0.07 | -0.01 | 0.09 | 0.05 | 0.09 | 0.09 | -0.03 | -0.05 | 0.07 | 0.03 | 1 | | |
| (14) | Certification | -0.25 | -0.10 | -0.08 | -0.03 | 0.19 | 0.15 | 0.18 | 0.16 | 0.17 | 0.00 | -0.05 | 0.07 | 0.07 | 1 | |
| (15) | Late payments | -0.14 | -0.11 | -0.08 | 0.00 | 0.17 | 0.06 | 0.02 | 0.19 | 0.12 | -0.04 | -0.12 | 0.06 | 0.00 | 0.11 | 1 |

Table 3: Credit Constraints and Import Mode: The Baseline Estimates

| | LPM | Probit | bi-probit | | | |
|---|---|---|---|---|---|---|
| | | | Indirect importing | Credit rationing | Indirect importing | Credit rationing |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Credit rationing | 0.078*** | 0.072*** | 0.342*** | | 0.246*** | |
| | (0.010) | (0.009) | (0.041) | | (0.053) | |
| Share of imports | -0.116*** | -0.115*** | -0.095*** | -0.035*** | -0.089*** | -0.030*** |
| | (0.023) | (0.024) | (0.023) | (0.009) | (0.021) | (0.008) |
| Export status | -0.168*** | -0.145*** | -0.127*** | -0.015** | -0.127*** | -0.015* |
| | (0.019) | (0.016) | (0.020) | (0.008) | (0.016) | (0.009) |
| Foreign ownership | -0.001*** | -0.001*** | -0.001*** | 0.000 | -0.001*** | 0.000** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Employees (log) | -0.093*** | -0.090*** | -0.072*** | -0.029*** | -0.070*** | -0.030*** |
| | (0.005) | (0.004) | (0.007) | (0.004) | (0.005) | (0.004) |
| Labour productivity (log) | -0.054*** | -0.053*** | -0.042*** | -0.016*** | -0.053*** | -0.017*** |
| | (0.004) | (0.003) | (0.005) | (0.002) | (0.002) | (0.003) |
| Age (log) | -0.000 | -0.001 | 0.002 | -0.007** | -0.001 | -0.011*** |
| | (0.009) | (0.008) | (0.007) | (0.003) | (0.008) | (0.003) |
| Share of temporary workers | 0.041* | 0.038* | 0.034* | -0.003 | 0.024 | -0.010 |
| | (0.022) | (0.021) | (0.018) | (0.011) | (0.021) | (0.008) |
| Share of skilled workers | 0.112*** | 0.102*** | 0.075*** | 0.048*** | 0.063*** | 0.046*** |
| | (0.023) | (0.023) | (0.024) | (0.015) | (0.024) | (0.013) |
| National competition | -0.043*** | -0.044*** | -0.041*** | 0.006 | -0.038*** | 0.006 |
| | (0.014) | (0.012) | (0.012) | (0.007) | (0.011) | (0.007) |
| Capacity utilization | -0.056** | -0.055*** | -0.018 | -0.100*** | -0.031 | -0.101*** |
| | (0.021) | (0.019) | (0.020) | (0.015) | (0.026) | (0.016) |
| Balance sheet certification | | | | -0.038*** | | -0.031*** |
| | | | | (0.008) | | (0.009) |
| Late payments * 1st qt. | | | | 0.031*** | | 0.033*** |
| | | | | (0.010) | | (0.010) |
| Late payments * 2nd qt. | | | | -0.009 | | -0.008 |
| | | | | (0.011) | | (0.012) |
| Late payments * 3rd qt. | | | | -0.038*** | | -0.039*** |
| | | | | (0.012) | | (0.011) |
| Late payments * 4th qt. | | | | -0.036** | | -0.030* |
| | | | | (0.015) | | (0.016) |
| Year fixed effects | X | X | X | X | | |
| Country fixed effects | X | X | X | X | | |
| Industry fixed effects | X | X | X | X | | |
| Year*Country*Sector fixed effects | | | | | X | X |
| Corr($\epsilon, \mu$) | | | -0.572** | | -0.445** | |
| | | | (0.064) | | (0.130) | |
| Overidentifying restrictions statistic (p-value) | | | 3.843 (0.428) | | 5.752 (0.218) | |
| Observations | 13,808 | 13,808 | 13,808 | | 13,808 | |

Notes: In columns $(1)-(3)$ and (5) the dependent variable is a dummy which takes the value of one if the firm imports through and intermediary and zero if it imports directly; in columns (4) and (6) the dependent variable is a dummy that takes the value of one if the firm declares to be credit constrained and zero otherwise. $corr(\epsilon, \mu)$ is the correlation coefficient ($\rho$) between the unobserved determinants of the import participation decision ($\epsilon$) and those of rationing ($\mu$). The overidentifying restrictions statistic (p-value) is the value of the Hansen statistic (and p-value). Overidentifying restrictions statistic (p-value) is 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. Standard errors, clustered at the sector level, are reported in parenthesis; *** denotes significance at the 1% confidence level; ** at the 5% confidence level and * at the 10% level.

Table 4: Controlling for Sample Selection

| | Heckman IV | | |
|---|---|---|---|
| | Importing | Credit rationing | Indirect importing |
| | (1) | (2) | (3) |
| Credit rationing | | | 0.328*** |
| | | | (0.031) |
| Share of imports | | -0.031*** | -0.097*** |
| | | (0.010) | (0.024) |
| Export status | 0.142*** | -0.020*** | -0.120*** |
| | (0.018) | (0.007) | (0.018) |
| Foreign ownership | 0.001*** | 0.000 | -0.001*** |
| | (0.000) | (0.000) | (0.000) |
| Employees (log) | 0.044*** | -0.029*** | -0.071*** |
| | (0.005) | (0.004) | (0.004) |
| Labour productivity (log) | 0.029*** | -0.017*** | -0.041*** |
| | (0.003) | (0.002) | (0.003) |
| Age (log) | -0.003 | -0.009** | 0.002 |
| | (0.006) | (0.003) | (0.007) |
| Share of temporary workers | 0.019 | 0.005 | 0.033 |
| | (0.021) | (0.009) | (0.020) |
| Share of skilled workers | -0.050** | 0.041*** | 0.077*** |
| | (0.020) | (0.014) | (0.022) |
| National competition | 0.056*** | 0.001 | -0.037*** |
| | (0.014) | (0.006) | (0.011) |
| Capacity utilization | -0.083*** | -0.090*** | -0.028 |
| | (0.019) | (0.009) | (0.021) |
| Political instability | 0.008*** | | |
| | (0.003) | | |
| Balance sheet certification | 0.032*** | -0.042*** | |
| | (0.007) | (0.006) | |
| Late payments * 1st qt. | 0.001 | 0.028*** | |
| | (0.016) | (0.009) | |
| Late payments * 2nd qt. | 0.007 | -0.012 | |
| | (0.010) | (0.013) | |
| Late payments * 3rd qt. | 0.020 | -0.027*** | |
| | (0.014) | (0.009) | |
| Late payments * 4th qt. | 0.045*** | -0.036** | |
| | (0.015) | (0.017) | |
| Corr[(1),(2)] = | −0.007 (0.021) | | |
| Corr[(2),(3)] = | −0.546 (0.072) | | |
| Corr[(1),(3)] = | 0.107 (0.224) | | |
| Observations | | 21,498 | |

Notes: Results refer to a system sample selection model with instrumental variables, estimated using the CMP procedure of Roodman (2011). In column (1) the dependent variable is a dummy which takes the value of one if the firm is an importer and zero otherwise; in column (2) the dependent variable is a dummy that takes the value of one if the firm declares to be credit constrained and zero otherwise; in column (3) the dependent variable is a dummy which takes the value of one if the firm imports through an intermediary and zero if it imports directly. $corr[(1),(2)]$ is the correlation coefficient ($\rho$) between the unobserved determinants in equations (1) and (2); $corr[(2),(3)]$ and $corr[(1),(3)]$ between those in equations (2) and (3) and (1) and (3). All specifications include year, country and industry fixed effects. Standard errors, clustered at the industry level, are reported in parenthesis.*** denotes significance at the 1% confidence level; ** at the 5% confidence level and * at the 10% level.

Table 5: Alternative Measure of Credit Rationing

| | bi-probit | |
|---|---|---|
| | Indirect importing | Access to finance |
| | (1) | (2) |
| Access to finance (Alternative measure of credit rationing) | 0.399*** | |
| | (0.053) | |
| Share of imports | -0.107*** | -0.009 |
| | (0.022) | (0.010) |
| Export status | -0.131*** | -0.018*** |
| | (0.019) | (0.005) |
| Foreign ownership | -0.001*** | -0.000 |
| | (0.000) | (0.000) |
| Employees (log) | -0.082*** | -0.013*** |
| | (0.006) | (0.002) |
| Labour productivity (log) | -0.046*** | -0.011*** |
| | (0.004) | (0.001) |
| Age (log) | 0.001 | -0.005 |
| | (0.008) | (0.003) |
| Share of temporary workers | 0.041* | -0.016 |
| | (0.022) | (0.010) |
| Share of skilled workers | 0.093*** | 0.011 |
| | (0.023) | (0.009) |
| National competition | -0.041*** | 0.003 |
| | (0.012) | (0.007) |
| Capacity utilization | -0.027 | -0.069*** |
| | (0.019) | (0.010) |
| Balance sheet certification | | -0.023*** |
| | | (0.006) |
| Late payments * 1st qt. | | 0.014*** |
| | | (0.005) |
| Late payments * 2nd qt. | | -0.005 |
| | | (0.006) |
| Late payments * 3rd qt. | | -0.005 |
| | | (0.007) |
| Late payments * 4th qt. | | -0.030*** |
| | | (0.009) |
| Corr($\epsilon, \mu$) | -0.605*** | |
| | (0.092) | |
| Overidentifying restrictions statistic (p value) | 4.737 (0.315) | |
| Observations | 13,808 | |

Notes: In column (1) the dependent variable is a dummy which takes the value of one if the firm imports through and intermediary and zero if it imports directly; in column (2) the dependent variable is a dummy that takes the value of 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, and zero otherwise. $corr(\epsilon, \mu)$ is the correlation coefficient ($\rho$) between the unobserved determinants of the import participation decision ($\epsilon$) and those of rationing ($\mu$). The overidentifying restrictions statistic (p-value) is the value of the Hansen statistic (and p-value). Overidentifying restrictions statistic (p-value) is 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. All specifications include year, country and industry fixed effects. Standard errors, clustered at the sector level, are reported in parenthesis; *** denotes significance at the 1% confidence level; ** at the 5% confidence level and * at the 10% level.

Table 6: Geographical Distance

| | bi-probit | | |
|---|---|---|---|
| | Indirect importing | | |
| | Full sample | Low distance | High distance |
| | (1) | (2) | (3) |
| Credit rationing | 0.298*** | -0.060 | 0.384*** |
| | (0.099) | (0.466) | (0.094) |
| Distance (log) | 0.149*** | 0.193** | 0.180*** |
| | (0.048) | (0.088) | (0.056) |
| Share of imports | -0.097** | -0.107** | -0.055 |
| | (0.044) | (0.055) | (0.038) |
| Export status | -0.140*** | -0.155*** | -0.121*** |
| | (0.018) | (0.027) | (0.020) |
| Foreign ownership | -0.001* | -0.001 | -0.001 |
| | (0.000) | (0.000) | (0.001) |
| Employees (log) | -0.052*** | -0.064*** | -0.049*** |
| | (0.009) | (0.014) | (0.011) |
| Labour productivity (log) | -0.037*** | -0.037*** | -0.040*** |
| | (0.006) | (0.013) | (0.010) |
| Age (log) | -0.011 | -0.002 | -0.019 |
| | (0.012) | (0.021) | (0.015) |
| Shre of temporary workers | 0.071*** | 0.112** | 0.030 |
| | (0.024) | (0.051) | (0.043) |
| Share of skilled workers | 0.084** | 0.127* | 0.065*** |
| | (0.037) | (0.065) | (0.025) |
| National competition | -0.018* | -0.024 | -0.020 |
| | (0.010) | (0.016) | (0.022) |
| Capacity utilization | -0.094* | -0.095 | -0.099 |
| | (0.054) | (0.069) | (0.065) |
| Balance sheet certification | | | 0.000 |
| | | | (.) |
| Late payments * 1st qt. | | | 0.000 |
| | | | (.) |
| Late payments * 2nd qt. | | | 0.000 |
| | | | (.) |
| Late payments * 3rd qt. | | | 0.000 |
| | | | (.) |
| Late payments * 4th qt. | | | 0.000 |
| | | | (.) |
| Corr($\epsilon, \mu$) | -0.536** | 0.072 | -0.650** |
| | (0.201) | (0.932) | (0.194) |
| Overidentifying restrictions statistic (p-value) | 3.545 (0.471) | 6.843 (0.144) | 3.889 (0.565) |
| Observations | 3,229 | 1,620 | 1,609 |

Notes: The dependent variable is a dummy which takes the value of one if the firm imports through and intermediary and zero if it imports directly. Results are obtained using a bi-probit specification similar to that of columns (3) and (4) of table 3, but the estimates for the credit rationing equation are not reported. The weighted distance indicator has been constructed adopting the International Use tables produced by WIOD. $corr(\epsilon, \mu)$ is the correlation coefficient ($\rho$) between the unobserved determinants of the import participation decision ($\epsilon$) and those of rationing ($\mu$). The overidentifying restrictions statistic (p-value) is the value of the Hansen statistic (and p-value). Overidentifying restrictions statistic (p-value) is 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. All specifications include year, country and industry fixed effects. Standard errors, clustered at the sector level, are reported in parenthesis;

*** denotes significance at the 1% confidence level; ** at the 5% confidence level and * at the 10% level.

Table 7: Other Frictions to Imports

| | Documentary compliance | | Time to import | | Costs of importing | | Principal component | |
|---|---|---|---|---|---|---|---|---|
| | low | high | low | high | low | high | low | high |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Credit rationing | 0.306*** | 0.417*** | 0.260*** | 0.416*** | 0.353*** | 0.366*** | 0.316*** | 0.412*** |
| | (0.041) | (0.021) | (0.066) | (0.025) | (0.032) | (0.035) | (0.038) | (0.027) |
| Share of material imports | -0.075*** | -0.188*** | -0.090*** | -0.101*** | -0.050* | -0.142*** | -0.062** | -0.122*** |
| | (0.026) | (0.031) | (0.030) | (0.019) | (0.026) | (0.023) | (0.028) | (0.018) |
| Export status | -0.142*** | -0.084*** | -0.148*** | -0.100*** | -0.123*** | -0.129*** | -0.153*** | -0.090*** |
| | (0.019) | (0.023) | (0.019) | (0.019) | (0.023) | (0.014) | (0.019) | (0.020) |
| Foreign ownership | -0.001*** | -0.001*** | -0.001*** | -0.001*** | -0.001*** | -0.001*** | -0.001*** | -0.001*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Employees (log) | -0.080*** | -0.047*** | -0.074*** | -0.070*** | -0.078*** | -0.065*** | -0.077*** | -0.063*** |
| | (0.006) | (0.006) | (0.005) | (0.006) | (0.005) | (0.008) | (0.005) | (0.004) |
| Labour productivity (log) | -0.049*** | -0.032*** | -0.050*** | -0.027*** | -0.047*** | -0.025*** | -0.053*** | -0.020*** |
| | (0.005) | (0.004) | (0.006) | (0.006) | (0.006) | (0.005) | (0.005) | (0.005) |
| Age (log) | -0.003 | 0.022*** | -0.005 | 0.013 | -0.011 | 0.011 | -0.010 | 0.015** |
| | (0.009) | (0.007) | (0.007) | (0.009) | (0.009) | (0.010) | (0.009) | (0.007) |
| Share of temporary workers | 0.074*** | -0.090*** | 0.081*** | -0.004 | 0.079** | -0.003 | 0.090*** | -0.013 |
| | (0.016) | (0.032) | (0.021) | (0.020) | (0.036) | (0.019) | (0.019) | (0.023) |
| Share of skilled workers | 0.071*** | 0.088*** | 0.089*** | 0.071*** | 0.097*** | 0.068*** | 0.079*** | 0.079*** |
| | (0.027) | (0.024) | (0.026) | (0.025) | (0.022) | (0.026) | (0.026) | (0.020) |
| National competition | -0.038*** | -0.028** | -0.036*** | -0.035** | -0.038*** | -0.043*** | -0.039*** | -0.036*** |
| | (0.013) | (0.012) | (0.009) | (0.016) | (0.014) | (0.015) | (0.012) | (0.012) |
| Capacity utilization | -0.036 | -0.017 | -0.048 | 0.022 | -0.032 | -0.002 | -0.056 | 0.025 |
| | (0.027) | (0.030) | (0.035) | (0.015) | (0.035) | (0.014) | (0.039) | (0.024) |
| $corr(\epsilon, \mu)$ | -0.492*** | -0.759*** | -0.415*** | -0.720*** | -0.611*** | -0.616*** | -0.526*** | -0.726*** |
| | (0.094) | (0.050) | (0.134) | (0.064) | (0.061) | (0.080) | (0.085) | (0.061) |
| Overidentifying restrictions statistic (p-value) | 3.330 (0.504) | 3.087 (0.543) | 6.822 (0.146) | 3.207 (0.524) | 7.652(0.105) | 4.130 (0.389) | 0.837 (0.933) | 2.484 (0.647) |
| Observations | 9,208 | 4,600 | 8,360 | 5,448 | 6,859 | 6,949 | 7,274 | 6,534 |

Notes: The dependent variable is a dummy which takes the value of one if the firm imports through and intermediary and zero if it imports directly. Results are obtained using bi-probit specifications similar to that of columns (3) and (4) of table 3, but the estimates for the credit rationing equation are not reported. $corr(\epsilon, \mu)$ is the correlation coefficient ($\rho$) between the unobserved determinants of the import participation decision ($\epsilon$) and those of rationing ($\mu$). The overidentifying restrictions statistic (p-value) is the value of the Hansen statistic (and p-value). Overidentifying restrictions statistic (p-value) is 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. All specifications include year, country and industry fixed effects. Standard errors, clustered at the sector level, are reported in parenthesis;

*** denotes significance at the 1% confidence level; ** at the 5% confidence level and * at the 10% level.

Table 8: Credit Rationing and the Mode of Two-way trade

| | Indirect exporters | Indirect importers | Indirect importers subsample of direct exporters | Indirect importers subsample of indirect exporters | Indirect exporters subsample of direct importers | Indirect exporters subsample of indirect importers |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Credit rationing | 0.286*** | 0.288*** | 0.230** | 0.355** | 0.360*** | 0.024 |
| | (0.105) | (0.058) | (0.093) | (0.150) | (0.091) | (.) |
| Share of imports | 0.017 | -0.083*** | -0.084*** | -0.090** | 0.030 | 0.037 |
| | (0.021) | (0.029) | (0.026) | (0.038) | (0.021) | (.) |
| Share of exports | 0.036 | -0.025 | -0.031 | -0.039 | 0.045** | 0.014 |
| | (0.025) | (0.020) | (0.034) | (0.029) | (0.019) | (.) |
| Foreign ownership | -0.001*** | -0.001*** | -0.001*** | -0.002*** | -0.001*** | -0.002 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (.) |
| Employees (log) | -0.044*** | -0.062*** | -0.050*** | -0.067*** | -0.029*** | -0.043 |
| | (0.008) | (0.007) | (0.006) | (0.018) | (0.006) | (.) |
| Labour productivity (log) | -0.030*** | -0.034*** | -0.031*** | -0.031*** | -0.020** | -0.033 |
| | (0.008) | (0.003) | (0.005) | (0.007) | (0.008) | (.) |
| Age (log) | -0.009 | -0.009 | -0.003 | -0.018 | 0.002 | -0.022 |
| | (0.007) | (0.011) | (0.012) | (0.012) | (0.009) | (.) |
| Share of temporary workers | 0.069** | 0.069*** | 0.041 | 0.095 | 0.030 | 0.076 |
| | (0.027) | (0.019) | (0.026) | (0.059) | (0.041) | (.) |
| Share of skilled workers | 0.065*** | 0.071*** | 0.037*** | 0.063 | 0.032 | 0.133 |
| | (0.018) | (0.020) | (0.013) | (0.056) | (0.021) | (.) |
| National competitio n | 0.007 | -0.023* | -0.031** | -0.004 | 0.002 | 0.026 |
| | (0.013) | (0.012) | (0.013) | (0.019) | (0.011) | (.) |
| Capacity utilization | 0.041 | -0.023 | -0.015 | -0.058 | 0.051 | 0.005 |
| | (0.032) | (0.023) | (0.032) | (0.059) | (0.033) | (.) |
| $corr(\epsilon, \mu)$ | -0.402*** | -0.492*** | -0.473*** | -0.563*** | -0.600*** | 0.078*** |
| | (0.190) | (0.122) | (0.205) | (0.336) | (0.161) | (0.395) |
| Overidentifying restrictions statistic (p-value) | 3.211 (0.523) | 3.822 (0.431) | 2.963(0.564) | 1.482 (0.830) | 1.546 (0.818) | 2.131 (0.712) |
| Observations | 6,110 | 6,110 | 4,110 | 2,000 | 4,484 | 1,626 |

Notes: In columns (1), (3) and (4) the dependent variable is a dummy which takes the value of one if the firm exports through and intermediary and zero if it exports directly. In columns (2), (5) and (6) the dependent variable is a dummy which takes the value of one if the firm imports through and intermediary and zero if it imports directly. Results are obtained using bi-probit specifications similar to that of columns (3) and (4) of table 3, but the estimates for the credit rationing equation are not reported. $corr(\epsilon, \mu)$ is the correlation coefficient ($\rho$) between the unobserved determinants of the import participation decision ($\epsilon$) and those of rationing ($\mu$). The overidentifying restrictions statistic (p-value) is the value of the Hansen statistic (and p-value). Overidentifying restrictions statistic (p-value) is 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. All specifications include year, country and industry fixed effects. Standard errors, clustered at the sector level, are reported in parenthesis;
*** denotes significance at the 1% confidence level; ** at the 5% confidence level and * at the 10% level.

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