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# Working Paper Export activities under financial constraints: Margins, quantities and prices

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# LEM

# **Working Paper Series**

# Export activities under financial constraints: margins, quantities and prices

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# Export activities under financial constraints: margins, quantities and prices\*

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#### Abstract

This paper provides a comprehensive analysis of the role that financial constraints play in shaping firms' export activities. We use custom information on cross borders transactions for Italian firms, together with an informative measure of financing constraints based on an official credit rating issued by an independent institution. Controlling for potential selection bias our results confirm that limited access to external capital narrows the scale of foreign sales, the exporters' product scope and the number of trade partners. We enrich previous analyses showing that financial problems influence firms' strategies of switching among products or destinations, and also affect firms' pricing decisions. Constrained firms have a reduced probability of adding new products or destinations and a higher probability of dropping products or destinations. Moreover, they attempt to offset, via higher prices, the negative impact on foreign revenues induced by the decreased physical quantity associated with financial constraints.

**JEL codes**: F10, F14, F30, G20

Keywords: Financial constraints, margins of export, export prices

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# **1** Introduction

Informational asymmetries and imperfect screening in capital or credit markets can often give raise to situations where financing constraints prevent potentially successful and growth enhancing projects or businesses to be undertaken. A rapidly growing body of research emphasizes that external finance may play an even more important role in international activities of firms. Selling to international markets indeed involves specific fixed and variable costs, higher than those required for the domestic market, that are often to be paid up-front. Following this idea recent theoretical studies incorporating financing problems into heterogeneous firms trade models predict that financial frictions affect both the extensive and intensive margins of export: constrained firms are less likely to entry foreign markets and, conditional on entry, they export sub-optimal volumes. Moreover, if trade costs are specific to each product shipped and to each geographical market served, similar distorting mechanisms work also along the product/country extensive margins, with constrained firms exporting less products to less countries. Empirical evidence, although relatively scant, tend to corroborate these intuitions.

This paper contributes to this literature using detailed information on international activities of a large and representative sample of Italian manufacturing firms. These data are well suited to pursue our aim for different reasons. First, by exploiting custom information on cross borders transactions, the data provide precise information on products sold and countries served, widening the scope of possible investigations. Second, our data include an informative measure of financing constraints based on an official credit rating issued by an independent institution and available for all firms covered by the dataset. Compared to other measures based on balance sheets variables or surveys, credit ratings incorporate the credit markets' view on the creditworthiness of a firm, thus getting close to the actual way investors' decide to provide external finance. The specific rating index that we use is heavily relied upon by Italian banks, and is tightly linked with availability and cost of credit. Third, the richness of our dataset along the company, product, country and time dimensions allow to explicitly address potential selection bias and to fully control for diverse sources of unobserved heterogeneity.

Within the general aim of dissecting the impact of financing problems on the export activities of firms, this paper provides three distinctive advancements to the existing literature. First, beyond confirming previous results that financial constraints are not only associated with lower levels of export, narrower range of exported products and narrower range of served destinations, we show that constrained firms have a reduced probability of adding new products or destinations and a higher probability of dropping products or destinations. Second, we consider the so far unexplored effects of financing problems on transaction level quantity and unit values. We provide evidence that constrained firms tend to export lower quantity and to charge higher prices for their products, but we do not observe any significant evidence of a possible correlation between financial conditions and quality of the goods exported. Third, we show that while financing constraints interact with gravity-like destination country characteristics in determining a reduction in the quantity shipped per transaction, pricing only depends on the distance of destination countries, with a higher sensitivity among constrained firms. All the results are robust to correction for self-selection into export, implemented with two stage econometric procedures that allows for unobserved heterogeneity in both the main and selection equations.

The paper is organized as follows. Existing empirical work is reviewed in Section 2. In Section 3 we outline the theoretical framework guiding the empirical analysis. In Section 4 we present the data, while Section 5 describes the econometric strategy. Section 6 provides preliminary evidence on the role of financing constraints on export performance. Section 7 presents the evidence on the relation of financing constraints with firms' intensive margin and with product/country extensive margins. Section 8 reports results on the impact of financing constraints on product/country switching. Section 9 shows the findings on financing constraints and transaction level price-quantity decision. We conclude in Section 10.

## 2 Related empirical literature

In exploring the relationship between firm level financing constraints and export activities, this work relates with three strands of literature in the micro empirics of international trade.<sup>1</sup>

The first reference literature regards the recent works that directly address the link between financial frictions and the margins of export at the firm level. The available evidence supports that financing constraints affect the extensive margin, as firms with financing problems are less likely to entry foreign markets. Consistent results are found in Muuls (2008) for Belgium, in Bellone et al. (2010) for France, in Berman and Hricourt (2010) for a sample of nine developing and emerging economies, in Minetti and Zhu (2011) for a cross-section of Italian firms, and in Li and Yu (2009) and Manova et al. (2011) for Chinese firms. The only contrasting evidence is in Greenaway et al. (2007) for UK. All the above studies, with a notable exception in Berman and Hricourt (2010), also agree that financing constraints phenomena reduce the value of firms' export. All together these results suggest that financial constraints provide an important barrier in the financing of both fixed and variable export costs. The vast majority of these studies does not control for possible selection bias in their samples, though.

Second, we refer to the works that study the possible distorting effect that financing problems might have on product and country extensive margins. Due to the only recent availability of detailed transaction level datasets, these aspects are less investigated and very limited attention is given to the role that financing problems might have over time in mediating the dynamics of firms' switching along the product or destination margins. Muuls (2008) show that less credit constrained firms export more products to more destinations, also documenting that firms with easier access to finance are more likely to expand the number of destinations they serve. Similarly, Askenazy et al. (2011) confirms that better financial conditions are positively associated with expansion and survival in export markets. Manova et al. (2011), although using measures of sectoral financial dependence in place of firm-level proxy for financing problems, show that limited access to outside capital restricts both the number of destinations on the probability of adding and dropping exported products.

Finally, this work relates to the few recent papers that, with the specific objective of drawing inference about the role of quality sorting in export markets, provide evidence on the variation in export prices across firms, products and trade partners. Bastos and Silva (2010), using Portuguese data, show that free on board (f.o.b) unit values increase systematically with the bilateral distance and with the income of the destination country. Manova and Zhang (2011) find that Chinese firms set higher prices also in larger and less remote countries. Crozet et al. (2011), using a direct proxy of quality, show that quality sorting plays a major role in shaping international trade patterns. Relatedly, Kugler and Verhoogen (2011) finds that on average, within narrowly defined sectors, larger plants charge higher price for their output and pay more for their inputs. However, none of these studies analyzes the interaction between quality or pricing decisions and financing problems.

# **3** Theoretical framework

While the theoretical literature has extensively studied why firms needs external financial resources to run their business and why imperfect credit markets might have a distorting impact on firms behavior (cfr. for instance Cooley and Quadrini, 2001; Clementi and Hopenhayn, 2006), the main motivation to investigate the effect of financing constraints on international trade activities lies in the specificities involved in operating on international markets. There are indeed a few reasons to

<sup>&</sup>lt;sup>1</sup>At a more aggregate level, early evidence on a negative effect of financial development on aggregate exports was delivered by Beck (2002) and Svaleryd and Vlachos (2005), among others.

believe that international business operations are more dependent on external capital than domestic activities (cfr. for instance Amiti and Weinstein, 2009; Feenstra et al., 2011). First, producing and selling goods in international markets involve higher fixed and variable costs that arise from establishing ad-hoc distributional networks, acquiring novel and precise information on destination markets, achieving finer customization of products and facing higher transportation costs. Second, the time lag lasting from production to the actual realization of the corresponding revenues is longer for international than for domestic sales. Third, international sales contracts are more complex, more risky and less enforceable, thus often requiring some form of external credit insurance.

The theoretical framework underlying our empirical investigations draws from the recent attempts to incorporate financing constraints into the standard Melitz model of international trade with heterogeneous firms (Melitz, 2003). Among few others (see Chaney, 2005; Muuls, 2008; Feenstra et al., 2011), the model outlined in Manova (2008) provides the key intuitions guiding the empirical analysis. The two basic assumptions are that the extra costs required to operate in international markets must be financed via external capital and that financial contracts are not perfectly enforceable. Investors operate in a competitive credit market, and external finance is granted only to those firms able to generate enough revenues to guarantee investors' break-even and with enough collateral to be pledged in case of default.<sup>2</sup> As in the Melitz's model, there is a mechanism of selection into exporting driven by heterogeneous productivities. However, since in this framework revenues depend on productivity, financial constraints reinforce selection: the productivity level required to enter and operate in international markets must be high enough also to meet investors' participation constraint. The extent to which financing constraints impact on trade behavior depends on the assumptions about the scope of the credit problems faced by the firms. If external resources are only needed to cover the fixed costs of export, then credit constraints only affect the probability to become an exporter (i.e. the extensive margin), with constrained firms less likely to enter foreign markets. If, instead, external funds are needed to cover both fixed and variable export costs, then financing constraints also affect the overall value of foreign sales (i.e. the intensive margin): constrained firms that enter foreign markets export less then the first best. In addition, if one allows for the existence of multi-products and multi-destination firms and assumes that export costs are product and country specific, as in Chaney (2008) and Bernard et al. (2011), then the prediction is that constrained firms export a narrower range of products and serve a smaller number of countries. Finally, since in this framework prices are set as a constant markup over marginal cost, constrained firms are expected to set higher prices.

Although this framework provides the key channels through which access to external finance can play a role in exporting activity, it is worth to extend it in several directions.

A first major interpretative limitation is that financing problems simply reflect productivity: high productive firms more easily meet investors participation constraint and elicit more external finance than less productive firms. However, the availability and the cost of external resources depend on many other factors. Indeed, credit institutions make an overall assessment of firms' capacity to repay loans, looking at their ability to generate profits, digging into their financial structures and in their past history as debtors. Moreover, an effective screening of the different credit seekers is severely limited by substantial informational imperfections characterizing credit markets and by the investors' unwillingness to take high perceived risk, especially when economic conditions are very uncertain.<sup>3</sup> As a consequence, in interpreting our results we may consider the possibility that financing problems can also arise for otherwise well performing firms.

In addition to this broader interpretation of financing constraints, it is also important to go beyond the static view of the model sketched above. In the spirit of the closed economy model developed in Bernard et al. (2010), the decision to export a product to a given destination market can be modeled

<sup>&</sup>lt;sup>2</sup>Due to the assumption of perfect competitive credit markets financial constraints in this model bind only whenever firms need to borrow more than what they can offer in terms of collateral.

<sup>&</sup>lt;sup>3</sup>In extending the model presented in Manova (2008) to encompass a broader definition of financing constraints, Feenstra et al. (2011) introduce also an informational asymmetry where banks do not observe firms' productivities.

dynamically as driven by the interaction of time varying firm specific characteristics (ability, productivity, competences) and time varying product specific attributes, with the latter possibly idiosyncratic also across export destinations (technology, demand for product characteristics). Changes to firm characteristics affect the profitability of all the products or destinations in the firms' trade portfolio. This implies that a positive (negative) shock to a firm's ability increases the probability of adding (dropping) products or countries. Instead, shocks to product or destination attributes only modify the profitability of that specific product or destination. *Ceteris paribus*, the number of product or destination markets served remains unchanged, but firms undertake a reallocation of resources from products and destinations made unprofitable by the shock to newly profitable markets. Adding financing constraints to this framework is relatively straightforward. By absorbing resources needed to meet the cost of external finance, financing constraints tend to exacerbate negative shocks and to depress the benefit from positive shocks. Constrained firms are then expected to drop more frequently and to add less frequently both products and destinations.

The possibility of product quality differentiation is a further important element not included in the basic framework, but that may influence the relationship between financial constraints and export activities. In absence of financing problems Kugler and Verhoogen (2011) show that, with enough scope for quality differentiation, better firms produce high quality products for consumers willing to pay higher prices. Since quality entails extra costs, either because of new fixed costs or required to purchase of higher quality inputs, and that these costs cannot be fully covered by internal resources, then one expects that financial constraints should induce firms to export lower quality goods at lower prices, thus obtaining lower revenues. Note that this prediction is opposite with respect to models where selection is only driven by productivity (cfr. for instance Manova, 2008). In those frameworks financially constrained firms, being less productive, operate at higher marginal costs and thus tend to set higher prices than unconstrained firms exporting in the same product-destination market.

In both quality or efficiency sorting models, however, prices are not modeled as a strategic variable that firms directly manipulate.<sup>4</sup> In contrast, as suggested in models developed outside the international trade literature, prices represent an important decision variable *per se* under financing problems. The intuition common to models of pricing under financial constraints (cfr. Dasgupta and Titman, 1998, among others) is that firms facing financial distress have an incentive to raise short term revenues to keep operations going and to provide enough guarantees to creditors. Between the two alternative strategies to increase revenues, i.e. attracting new demand via price cuts or raising the price per unit sold, the latter appears to be more likely under financing constraints.<sup>5</sup> Indeed, in order to produce an effect, attracting new demand quickly reacts to price cuts. Relatedly, expanding production often involves the acquisition of additional capital that it is difficult to obtained for already constrained firms. On the other hand, the success of the alternative strategy based on higher prices crucially depends on the elasticity of demand. The more a firm believes that demand is somewhat rigid, at least in the short run, and the more likely that setting higher prices will generate extra revenues, and allow to relax financing constraints.<sup>6</sup>

<sup>&</sup>lt;sup>4</sup>Existing versions of efficiency sorting or quality sorting models with endogenous mark-ups (see, respectively, Melitz and Ottaviano, 2008; Kneller and Yu, 2008) make firm prices vary across destinations in relation to factors outside direct control of the firm, such as strength of competition and other destination country characteristics.

<sup>&</sup>lt;sup>5</sup>Pichler et al. (2008) also show that this incentive depends, among other factors, on the maturity structure of the debt: the higher the burden of short term payment the higher the incentive to increase short term prices.

<sup>&</sup>lt;sup>6</sup>Limiting to models of pricing under financing constraints, there are few reason why we could expect demand rigidities in the short run. Customer market models (Phelps and Winter, 1991; Lundin et al., 2009) assume firms have substantial power to vary their prices in the short run due to imperfect knowledge of the available prices. Gottfries (2002) incorporates this idea in a study of macro export prices under financing problems. Similarly, Gagnon (1989) assumes that there are explicit adjustment costs for changing quantities, while prices are assumed to be varied more flexibly.

## **4** Data and measurement

Our analysis draws upon different sources of data, combining information on export transaction flows and firms' characteristics. In this section we describe the data, define our proxy of financial constraints and present the other main variables that we exploit in the empirical exercises.

#### **Data and sample**

We exploit 3 sources of data: the Italian Foreign Trade Statistics (COE), the Italian Register of Active Firms (ASIA) and a firm level accounting dataset (CEBI-CERVED). The first two datasets are collected by the Italian Statistical Office (ISTAT), while the latter is available through ISTAT but collected by the Italian Company Account Data Service (CADS).<sup>7</sup>

The COE dataset is the official source for trade flows of Italy. It covers all cross-border transactions performed annually by Italian firms, detailed by type of product exported and destination country. These data covers the period 2000-2003.

The ASIA register covers the universe of Italian firms active in the same time span, irrespectively of their export status. It reports annual figures on number of employees, sector of main activity, and information about geographical location of the firms. Total sales are available only in 2000 and 2003.

The CEBI-CERVED-CADS dataset collects annual reports for all Italian *limited liability* firms. Centrale dei Bilanci (CEBI) was founded as a joint agency of the Bank of Italy and the Italian Banking Association in the early 1980s to assist in supervising risk exposure of the Italian banking system. Today part of CERVED, the leading group in business information services in Italy, CEBI was a private company during the sample period, owned by major Italian banks which exploited its services in gathering and sharing information about firms. The long term institutional role of CEBI ensures high data quality, substantially limiting measurement errors.

The sample exploited in the analysis results from merging the three data sources and virtually covers the entire population of Italian limited firms (exporters and non exporters), active in manufacturing over the years 2000-2003. The panel is open and includes a total of 149, 414 firms. The representativeness of the sample with respect to the whole Italian manufacturing is quite satisfactory, with only a very mild over-representation of bigger and more productive firms: although about 20% of the total number of Italian manufacturing firms is included, we cover about 60% of all exporting firms and about 84% of the total value of exports.<sup>8</sup>

#### **Exports**

The COE dataset records separately the f.o.b. value (in Euros) and the quantity (in kilos) involved in each export and import transaction performed by a firm. This allow us to compute export and import prices (unit values). Traded products are classified at six digit level of the Harmonized System (HS6), for a total of 5, 329 product categories. Moreover, 236 different destination countries are involved over the sample period.

#### **Financing constraints**

Our measure of financing constraints is based on the credit rating index available through the CEBI-CERVED-CADS dataset. In fact, credit ratings enjoy those features which are considered as crucial for a good measure of financial constraints (Cleary, 1999; Lamont et al., 2001). First, credit ratings

<sup>&</sup>lt;sup>7</sup>The datasets have been made available for work after careful screening to avoid disclosure of individual information. The data were accessed at the ISTAT facilities in Rome.

<sup>&</sup>lt;sup>8</sup>See Appendix A for further details.

usually result from a multivariate score, thus summarizing a wide range of firms' financial and nonfinancial characteristics. Second, they vary over time, thus allowing for the identification of time effects. Third, and more generally, credit ratings represents "the opinion [of the markets] on the future obligor's capacity to meet its financial obligations" (Crouhy et al., 2001), thus capturing the actual propensity of investors to grant credit. While these features are common to CEBI ratings and other ratings issued by well known international agencies or other institutions – such as the index exploited in Muuls (2008) –, the ratings exploited in this work also enjoy three specific advantages. Firstly, they are intended to give an assessment of the *overall* situation of a firm, rather than a judgment on the quality of a single liability of a company. Second, all the firms included in the dataset in every year receive a rating, while rating files from international rating institutions typically bias the scope of analysis towards a much less representative sub-sample of firms. Third, our index is perceived as an official rating, due to the long lasting relationship of CEBI with the Italian banking and credit systems. This motivates the heavy reliance of banks on this specific rating index, and the tight link between the index and the availability and cost of external finance: it is very unlikely that a firm with poor rating can receive any credit (cfr. Bottazzi et al., 2008; Pistaferri et al., 2010), and there is clear evidence that bad ratings have a strong association with higher cost of credit (Panetta et al., 2009).

The way we exploit the rating information is the following. The original index is a score based on multivariate discriminant analysis which ranks firms in 9 categories of creditworthiness: 1-high reliability, 2-reliability, 3-ample solvency, 4-solvency, 5-vulnerability, 6-high vulnerability, 7-risk, 8high risk, and 9-extremely high risk.<sup>9</sup> In keeping with the binary categorization traditionally employed in the literature, we distinguish between Non Financially Constrained (NFC) firms, rated from 1 to 7, and Financially Constrained (FC) firms, with rating 8 or 9. Accordingly, we build a FC dummy that takes value 1 if a firm is rated 8 or 9, and 0 otherwise.<sup>10</sup> It is important to note that the index is updated at the end of each year. It is therefore the rating in t - 1 that is relevant for credit suppliers' present decisions on credit provision.

#### **Control variables**

While the method to construct the rating index is proprietary information of CEBI, it is known that the index is based on balance sheet figures, which do not exploit direct information on firms' international activities. Other firm characteristics are instead likely to enter the computation of scores. In the empirical analysis it is, therefore, important to include a set of firm level control variables that might help in identifying a link between financing constraints and export behavior. First, given the well established result that smaller and younger firms tend to be more prone to financing problems (Cabral and Mata, 2003; Angelini and Generale, 2008), it is particularly important to control for size and age of the firms. We use the number of employees (labeled as Employment hereafter, available through ASIA) as a proxy for firm size, and compute age by year of foundation (from CEBI-CERVED-CADS). Secondly, one needs to control for other financial factors that may interact with external financing constraints in determining the overall amount of financial resources available to a firm. In keeping with the vast literature on financing constraints and firm dynamics (cfr. for instance Fazzari et al., 1988; Kaplan and Zingales, 2000; Almeida et al., 2004), a key dimension is represented by the amount of internally generated resources. As argued in the theoretical framework above, firms' able to generate more internal funds are less likely to need external finance, and also more likely to obtain larger and less expensive credit lines. Among several alternatives suggested

<sup>&</sup>lt;sup>9</sup>These definitions are valid over the sample time period. Changes in the definition and the number of score classes occurred afterwards, following subsequent changes in CEBI ownership and updates in rating procedures.

<sup>&</sup>lt;sup>10</sup>In exploratory exercises we broke down the sample in three categories, inserting an intermediate class of Mildly Financially Constrained (MFC) firms, defined as those rated 5 to 7. This attempt could in principle helps to explore the relationship between exporting activities and different degrees of financing constraints. However, the results for the group of MFC firms did not displayed significant differences as compared to NFC firms. This is in line with the results reported in Bottazzi et al. (2010) in the context of size-growth dynamics of firms.

in previous studies, we proxy internal resources with the Gross Operating Margin (GOM, available from CEBI-CERVED-CADS, and equivalent to the EBIDTA). This allows to focus on the resources originated from the mere operational activities of a firm, at the same time getting rid of confound-ing factors related to external debt service, taxation and amortization policies. A further important control variable, again in line with both the literature on financing constraints to firm dynamics and with the theoretical framework on financing constraints and export, concerns availability of collateral. Contractual guarantees on some of the assets of a firm are often required, by potential lenders or sometimes even by the law, as a pre-condition which can ease the access to and reduce the cost of external financing. Given the available variables, we proxy collateral with the stock of Total Assets (ASSETS, from CEBI-CERVED-CADS data).<sup>11</sup> Also notice that, in all the following regression analysis, we introduce fixed effects controlling for other unobserved characteristics. Given the short time dimension of the data, this gives enough confidence of proper identification of the key parameters with respect to other potentially important dimensions which we cannot directly control for.

Finally, we consider a measure of fixed costs of entry into foreign markets. This is constructed starting from the concept of Local Labour Systems (LLS). LLSs are geographical areas defined by the Italian Statistical Office as an aggregation of municipalities according to the degree of connectivity of labour market, and thus identifying local areas where production-labour relationships are tight. Tight connections at the local level are likely characterized by activities such as sharing same trade services, accessing pools of established distribution networks, exploiting knowledge of neighbors' experience in dealing with foreign contracts and foreign legislations, and possibly other factors which can all tend to facilitate the entry into export markets. Accordingly, we define a measure (of the inverse of) the sunk cost of entry into exports, ExpCost, computed as the ratio of exporters over the total number of manufacturers in each LLS. We use the ISTAT definition on their geographical location (municipality of principal activity or legal address), available from the ASIA dataset. This variable provides the exclusion restriction required to correct for selection bias in some of the econometric analyses, as described in the next section.

# 5 Econometric strategy

A well known issue with estimating export equations arises from the observation that export performance (export values, number of products and destinations, quantity and prices across products and destinations) is only known for those firms which do export. Economic theory suggests however that hidden factors affecting firms' decision to enter foreign markets are likely correlated with unobserved factors influencing trade activities. This is likely to create self-selection which might produce inconsistent estimates of the parameters of interest.

In the first part of our empirical exercise we exploit firm-level observations, and address potential selection bias through the 2-stage Heckman-type procedure developed in Wooldridge (1995) and refined in Semykina and Wooldridge (2010). This strategy provides consistent estimation of panel data models with selection controlling for heterogeneity also in presence of correlated unobserved effects. The model includes two equations

$$\ln Y_{ft} = \gamma_1 F C_{ft-1} + \beta \mathbf{Z}_{ft-1} + c_{1f} + \epsilon_{1ft}$$
(1)

$$s_{ft} = 1 \left[ \gamma_2 F C_{ft-1} + \boldsymbol{\delta}_t \mathbf{W}_{ft-1} + c_{2f} + \epsilon_{2f,t} \right] \quad . \tag{2}$$

Equation (1) is the equation of interest where the dependent variable  $Y_{ft}$  is the performance of firm f at time t along the different export margins (alternatively, the value of foreign sales, the number of

<sup>&</sup>lt;sup>11</sup>All the nominal variables are deflated with appropriate sectoral price indexes collected by the Italian statistical office. Complete deflator series are available only at the 2-digit level. We therefore perform deflation at this level of aggregation. The base year is 2000.

exported products or the number of destination countries, in logs),  $FC_{ft-1}$  is our indicator variable for constrained firms,  $\mathbf{Z}_{ft-1}$  is a set of predetermined control variables,  $c_{1f}$  is an unobserved firm fixed effect possibly correlated with the other regressors, and  $\epsilon_{1ft}$  is a standard error term. Equation (2) is a Probit selection equation, where  $s_{ft}$  is a binary variable capturing firms' export status (1 if firm f is exporter in t, 0 otherwise), 1 [·] is the indicator function,  $\mathbf{W}_{ft}$  is a set of predetermined explanatory variables,  $c_{2f}$  is an unobserved firm fixed effect, and  $\epsilon_{2ft}$  a usual error term. Note that  $\mathbf{W}_f \supset \mathbf{Z}_f$ , since  $\mathbf{W}_f$  also includes our proxy of sunk cost of exports,  $ExpCost_f$ , as the exclusion variable.<sup>12</sup>

Because of the presence of unobserved effects also in the selection equation (2), adding the inverse Mills ratio and using Fixed Effects does not produce consistent estimates of equation (1). In such a case, however, a correction of the selection bias is available through adding time averages of all the explanatory variables in the main equation (FC dummy and controls), and in the selection equation (FC dummy, controls, and  $ExpCost_f$ ). In details, the 2-stage procedure goes as follows: first, for each t, obtain the inverse Mills ratio  $\hat{\lambda}_{ft}$  from a Probit estimate of equation (2) augmented with the time averages of the FC dummy and of the controls in  $\mathbf{W}_f$ ; second, estimate via pooled OLS equation (1), augmented with the time averages of the FC dummy, with the time averages of the explanatories in  $\hat{\mathbf{Z}}_f$ , and with the inverse Mills ratio  $\hat{\lambda}_{ft}$  obtained in the first step Probit.<sup>13</sup>

In the second part of the analysis we exploit the high level of disaggregation of the data to explore the role of financing constraints on the switching strategies along products and destinations. While adding products or destinations does not suffer from selection problems (adding is in itself a decision to entry), the decision to drop products or countries might do. In this different framework, modeling selection as the outcome of a Tobit on the transaction level value of export allows to fully exploit the better information available. The model still consists of two equations

$$Y_{fp} = \gamma_1 F C_f + \beta \mathbf{Z}_f + c_{1p} + \epsilon_{1fp}$$
(3)

$$\ln \operatorname{Exp}_{fp} = \operatorname{Max}\left[0, c_{2p} + \gamma_2 F C_f + \delta_p \mathbf{Z}_f + \epsilon_{2fp}\right] \quad . \tag{4}$$

In the primary equation the dependent variable is the probability of dropping a product,  $Y_{fp}$  (or, alternatively, of dropping a country,  $Y_{fc}$ ), while the explanatory variables include the FC proxy, the controls  $Z_f$ , and an unobserved product fixed effect  $c_{1p}$  (or, alternatively, a country fixed effect  $c_{1c}$ ). The selection equation is a Tobit on the (log of the) value of transaction level export of firm f in product p (or to country c), including among the explanatory variables our FC dummy and the set of controls  $Z_f$ . In this case there is no need for an exclusion restriction, since the variability in  $\ln \text{Exp}_{fp}$  (or in  $\ln \text{Exp}_{fc}$ ) is used to identify the parameters in the main equation, and a pure fixed effects approach is more appropriate. Accordingly, consistent estimates can be obtained, under common assumptions, by following the two-stage procedure presented in Wooldridge (1995). In the first stage, the Tobit equation (4) is estimated separately product by product (or country by country); in the second stage, one estimates via Fixed Effects the main equation (3) augmented with the residuals obtained from the first stage regression. This routine is then iterated over the three years available in our data.

The same procedure is then applied in the last part of the empirical analysis, when we explore the role of financing constraints on the quantity and the unit value components of each transaction. In this case the two equations of the model become

<sup>&</sup>lt;sup>12</sup>This is meant to obtain proper standard errors in estimating equation (1), avoiding the severe multicollinearity induced by an almost linear inverse Mills ratio when  $\mathbf{Z}_f = \mathbf{W}_f$ .

<sup>&</sup>lt;sup>13</sup>More precisely (see Semykina and Wooldridge, 2010, for details), we are modeling  $c_{2f} = \xi \bar{F}C_f + \bar{W}_f \xi + a_{2f}$ , where a bar indicates time averages of a variable, and modeling  $a_{2f}|FC_f$ ,  $W_f \sim \text{Normal}(0, \sigma_a^2)$ . This is equivalent to assume that  $c_{2f}$  is related to  $FC_f$  and to  $W_f$  only through their time averages, while the remainder is independent of  $FC_f$  and  $W_f$ . Likewise, the other implicit assumption is that the main equation unobserved effect is modeled as  $c_{1f} = \eta \bar{F}C_f + \bar{Z}_f \eta + a_{1f}$ . This transformation, similar in spirit to fixed effects estimator discussed in Mundlak (1978), uses time averages of the explanatories computed over the entire sample of exporters and non-exporters, and it is therefore free of selection bias.

$$\ln Y_{fpc} = \gamma_1 F C_f + \beta \mathbf{Z}_f + c_{pc} + \epsilon_{1fpc}$$
<sup>(5)</sup>

$$\ln \operatorname{Exp}_{fpc} = \operatorname{Max}\left[0, c_{2p} + \gamma_2 FC + \boldsymbol{\delta}_p \mathbf{Z}_f + \epsilon_{2fpc}\right] \quad , \tag{6}$$

where the primary equation now has either the unit value or the physical quantity involved in a transaction of firm f in product p to country c as the dependent variable  $(\ln Y_{fpc})$ , and includes a productcountry fixed effects,  $c_{pc}$ , among the regressors. The Tobit selection equation is still on the (log of the) transaction level value of exports, as before including product level unobserved effects  $c_{2p}$ .

While some of our empirical analysis on the relation between financing constraints on firms' performance in international markets are not new *per se*, none of the previous works control for unobserved heterogeneity both in the selection and primary equation. The methodologies we adopt, instead, fully exploits the panel dimension by allowing for arbitrary correlation between unobserved heterogeneity and regressors in the two stages of the procedure.

#### 6 A first glance at the data

Before proceeding to the econometric analysis we present some preliminary evidence, comparing behavior of constrained and unconstrained firms along the different export performances that we investigate in this work. These evidences constitute a quick but indicative overview of the main results we obtain in the rest of the paper.

Figure 1 reports empirical densities of export values, number of exported products and number of destination countries per firm (all in logs), broken down by constrained and unconstrained firms in 2003. For the same year, we also report empirical densities of physical quantities and unit values per transaction, again comparing constrained and unconstrained firms. Two phenomena emerge. First, financing constraints appear to have a clear depressing effect on foreign activities: constrained firms export less (both overall and per each transaction), ship less products and serve less countries. Second, constrained firms tend to set higher prices than firms which do not face financing problems. The visual impression is statistically confirmed with a Fligner-Policello test of stochastic dominance.<sup>14</sup>

Next, in Table 1 we provide a first quantitative assessment, controlling that the above evidence does not emerge as a statistical artifact originated from pooling together firms in different phases of their life-cycle.<sup>15</sup> While financing constraints are more common among younger firms (19.2% of young firms are FC firms in contrast with only 3% of older ones), we observe that, irrespectively of the age class, constrained firms are characterized by significantly downsized export performance. Indeed, the average value of export of FC firms is more than 40% lower than that of NFC firms with the highest reduction (53%) observed for firms in the 5 - 10 age class. A similarly strong effect emerges when we look at the scope of diversification in terms of both products and destinations. FC firms export on average almost half products and serve half destinations with respect to NFC firms. As expected this effect becomes stronger as age increases, reaching a peak for firms more than 30 years old. Finally, Table 1 also shows that FC firm export on average 35% less than NFC firms in quantity, and their unit values are 25% higher. With this respect the strongest effect is observed for FC middle age firms (11 - 20 years old): the average quantity per transaction is almost 55% smaller and 40% more expensive than that of NFC firms of the same age class.

In what follows we show, using selection-corrected regression models, that these unconditional results are not due confounding factors at the firm, product and destination country level.

<sup>&</sup>lt;sup>14</sup>This test is presented in Fligner and Policello (1981) and can be interpreted as a test of stochastic dominance in the case of asymmetric samples. Results are consistent in the other years of the sample period. Test statistics and p-values are obtained using the open source software *gbutils* available at http://www.cafed.sssup.it/software/gbutils/gbutils.html.

<sup>&</sup>lt;sup>15</sup>The figures are computed on the group of exporting firms in the sample. As before, reported results refer to 2003 data, but figures are stable over the sample period.



Figure 1: Figures report kernel density estimates of export value, number of destinations and number of exported products at firm level, and physical quantity and unit values at transaction level, comparing financially constrained vs. unconstrained firms – year 2003. Solid lines represent kernel density estimates, with 1% confidence band in dashed. Kernel is the standard Epanenchnikov for continuous variables, and a compact rectangular kernel for the discrete variables. The bandwidth is set according to the optimal rule presented in Silverman (1986).

	Whole Sample				Non Financially Constrained				Financially Constrained									
Firm's age (years)	Obs.	Exp. value: mean (median)	Products mean (median)	: Countries: mean (median)	log Q: mean (median)	log UV: mean (median)	Obs. (%)	Exp. value: mean (median)	Products mean (median)	: Countries: mean (median)	log Q: mean (median)	log UV: mean (median)	Obs. (%)	Exp. value: mean (median)	Product mean (median	s: Countries: mean ) (median)	log Q: mean (median)	log UV: mean (median)
0-4	5,325	1,218.79	7.02	6.90	5.74	2.94	4,302	1,321.30	7.31	7.19	5.78	2.92	1,023	787.71	5.79	5.68	5.53	3.10
		(104.22)	(3.00)	(3.00)	(5.70)	(2.90)	(80.8)	(118.05)	(3.00)	(3.00)	(5.73)	(2.86)	(19.2)	(64.00)	(3.00)	(2.00)	(5.44)	(3.16)
5-10	8,529	2,074.65	8.15	8.73	5.80	2.93	7,672	2,192.11	8.37	9.02	5.82	2.92	857	1,023.07	6.24	6.16	5.45	3.01
		(192.00)	(4.00)	(4.00)	(5.76)	(2.86)	(90.0)	(215.95)	(4.00)	(4.00)	(5.78)	(2.86)	(10.0)	(69.01)	(3.00)	(2.00)	(5.42)	(2.91)
11-20	13,100	3,398,35	10.73	11.95	5.88	2.91	12,340	3,507.76	10.95	12.26	5.90	2.90	760	1,621.87	7.17	6.86	5.30	3.39
		(412,19)	(5.00)	(6.00)	(5.83)	(2.84)	(94.2)	(445.22)	(5.00)	(6.00)	(5.86)	(2.83)	(5.8)	(97.73)	(3.00)	(3.00)	(5.19)	(3.19)
21-30	9,029	4,624.59	12.62	15.05	5.99	2.82	8,705	4,690.40	12.78	15.28	6.00	2.82	324	2,856.26	8.40	8.87	5.47	3.19
		(774.57)	(7.00)	(9.00)	(5.97)	(2.77)	(96.4)	(815,52)	(7.00)	(9.00)	(5.98)	(2.76)	(3.6)	(163,62)	(4.00)	(4.00)	(5.35)	(3.14)
$30-\infty^*$	5,838	9,762.80	15.31	18.08	6.21	2.75	5,661	9,887.17	15.50	18.33	6.20	2.75	177	5,785.01	9.47	10.12	6.51	2.70
		(1,247.18)	(8.00)	(12.00)	(6.10)	(2.73)	(97.00)	(1,315.28)	(8.00)	(12.00)	(6.10)	(2.73)	(3.0)	(209.43)	(3.00)	(4.00)	(6.37)	(2.61)
Total*	41,821	4,004.06 (403.73)	10.78 (5.00)	12.18 (6.00)	5.97 (5.91)	2.85 (2.80)	38,680 (92.5)	4,203.69 (458.88)	11.11 (5.00)	12.62 (6.00)	5.98 (5.93)	2.84 (2.79)	3,141 (7.5)	1,548.74 (82.46)	6.72 (3.00)	6.68 (3.00)	5.54 (5.44)	3.13 (3.05)

#### Table 1: EXPORT PERFORMANCE and FINANCIAL CONSTRAINTS BY AGE CLASSES - 2003

Export values in thousands of euro, quantities in (log) Kg and UV in (log) euro/Kg.

\*Statistics in these lines are computed removing one very large firm in the FC class. Including this observation, mean values of export, number of products, number of countries, (log) quantity and (log) unit value are 10,735, 15.35, 18.10, 5.97 and 2.86 for the whole sample and 37,719.60, 10.87, 10.61, 5.59 and 3.12 for the FC firms older than 30 years (cfr. line '30-∞'). If we pool together different age class (cfr. line 'Total') for the whole sample we get 4,140.19, 10.79, 12.18, 5.97 and 2.86 while for FC firms 3,359.24, 6.80, 6.70, 5.59 and 3.12.

	$\ln Exports_{ft}$	$\ln Exports_{ft}$	$\ln Exports_{ft}$
	POLS	FE	Selection
	(1)	(2)	(3)
$FC_{ft-1}$	-0.228***	-0.091***	-0.062**
	(0.028)	(0.028)	(0.028)
$\ln Empl_{ft-1}$	0.212***	0.130***	0.030
u u	(0.012)		(0.019)
$\ln Age_{ft}$	-0.117***	_	0.360***
•	(0.012)	(0.076)	(0.089)
$\ln ASSETS_{ft-1}$	0.943***	0.513***	0.465***
·	(0.011)	(0.030)	(0.028)
$\ln GOM_{ft-1}$	0.063***	0.022***	0.021***
v	(0.0044)	(0.004)	(0.004)
$\hat{\lambda}_{ft}$			0.299***
J -			(0.076)
Year FE	Yes	Yes	Yes
Firm FE	No	Yes	Yes
R-squared	0.443	0.911	0.400
N.Observations	123597	123597	123597
N.Firms	53173	53173	53173

Table 2: Within-Firm Financial Constraints and Total Exports

Note: Table reports regression using data on 2001-2003. The dependent variable used is reported at the top of each column.  $FC_{ft-1}$  is a dummy for financially constrained firms. Column 1 includes sectoral and province fixed effects. In column 3 we correct for selection through Semykina and Wooldridge (2010) estimator. Robust standard errors clustered at firm level are reported in parenthesis below the coefficients: asterisks denote significance levels (\*\*\*:p<1%; \*\*: p<5%; \*: p<10%).

# 7 Financing constraints and firm export margins

This section presents regression analysis on how financing constraints relates with export values, number of exported products and number of destination countries at the firm level.

We start by exploring the relation of financing constraints with the value of firm level exports (*Exports*). The equation of interest is

$$\ln Exports_{ft} = \alpha + \gamma F C_{ft-1} + \beta \mathbf{Z}_{ft-1} + c_f + \epsilon_{ft}$$
(7)

where FC<sub>f</sub> is our dummy variable identifying constrained firms, **Z** is the set of firm level control variables, and  $c_f$  is a firm fixed effect capturing differences in firm export due to time invariant firm specific characteristics. The controls (in logs) include Employment, Age, ASSETS and GOM.<sup>16</sup> With the only exception of Age which is taken at time t, all variables are measured at year t - 1.<sup>17</sup> By taking lagged values we reduce simultaneity problems.

Columns 1-2 of Table 2 report pooled OLS (POLS) and Fixed Effects (FE) estimates. These results provide a clear picture: financing constraints are significantly associated with reduced export values. In column 3 we directly address selection bias by adding to the equation the term  $\hat{\lambda}_{ft}$ , i.e. the inverse Mills ratio estimated in the first stage of the Semykina and Wooldridge (2010) procedure described in Section 5. Significance of the coefficient on  $\hat{\lambda}_{ft}$  confirms that selection is indeed an issue. However, our main conclusions remain valid: limited or no access to external financing is associated with a significant downward distortion in export flows, with constrained firms exporting about 6% less then unconstrained firms, *ceteris paribus*. Controls are statistically significant with the expected

<sup>&</sup>lt;sup>16</sup>Here and in the following, negative GOMs (corresponding to about 30% of the observations) are changed into 1 before taking logs: within the context of our research, negative or zero operating revenues equivalently signal the inability of firms to rely on internal resources and thus a strong need of outside capital.

<sup>&</sup>lt;sup>17</sup>As a matter of compact notation, here and in the following equations we use the subscript t - 1 for the set of controls, bearing however in mind that Age is measured at time t.

$\begin{array}{c c c c c c c c c c c c c c c c c c c $	(6) 030*** 0.012) 023*** 0.008) 09***
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(6) 030*** ).012) )23*** ).008) 09***
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	030*** ).012) )23*** ).008)  09***
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.012) 023*** 0.008) 109***
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	)23*** ).008)  09***
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	).008) \09***
$\ln Age_{ft} = \begin{array}{cccc} 0.025^{***} & - & 0.212^{***} \\ (0.007) & & (0.043) \\ \end{array} = \begin{array}{cccc} -0.031^{***} & - & 0.1 \\ (0.006) & & (0.066) \\ \end{array}$	109***
(0.007) $(0.043)$ $(0.006)$ $(($	
(0.043) $(0.000)$ $(0.000)$	).041)
$\ln ASSETS_{ft-1} \qquad 0.350^{***} \qquad 0.20^{2**} \qquad 0.139^{***} \qquad 0.339^{***} \qquad 0.193^{***} \qquad 0.193^{**} $	178***
(0.006) $(0.013)$ $(0.013)$ $(0.005)$ $(0.014)$ $(0.014)$	).012)
$\ln GOM_{ft-1} \qquad 0.029^{***} \qquad 0.005^{***} \qquad 0.003^{**} \qquad 0.019^{***} \qquad 0.006^{***} \qquad 0.10^{***} \qquad 0.006^{***} \qquad 0.10^{***} \qquad 0.10^{**} \qquad 0.10^{***} \qquad 0.10^{***} \qquad 0.10^{**} \qquad 0.10^{**} \qquad 0.10^{**} \qquad 0.10^{***} \qquad 0.10^{**} \qquad 0.10^{***} \qquad 0.10^{**} \qquad 0.10^{*} \qquad 0.10$	004**
(0.002) $(0.002)$ $(0.002)$ $(0.002)$ $(0.002)$ $(0.002)$ $(0.002)$	).002)
$\hat{\lambda}_{ft-1}$ 0.008 0.2	258***
(0.043) (0	).038)
Year FE Yes Yes Yes Yes Yes	Yes
Firm FE No Yes Yes No Yes	Yes
R-squared 0.364 0.929 0.303 0.342 0.876 0	).249
N.Observations 123597 123597 123597 123597 123597 12	23597
N.Firms 53173 53173 53173 53173 53173 5	3173

Table 3: Within-Firm Financial Constraints and the Extensive Margins of Trade

Note: Table reports regressions using data on 2001-2003. The dependent variable is reported at the top of each column.  $FC_{ft-1}$  is a dummy for financially constrained firms. Columns 1 and 4 include sectoral and province fixed effects. In Columns 3 and 6 we correct for selection through Semykina and Wooldridge (2010) estimator. Robust standard errors clustered at firm level are reported in parenthesis below the coefficients: asterisks denote significance levels (\*\*\*:p<1%; \*\*: p<5%; \*: p<10%).

positive sign. If anything, age and collateral display a stronger correlation, while the elasticities of exports to size and internal resources have a second order effect.

In unreported regressions (available upon request), we check the robustness of our results to alternative specifications and consistently find our results unchanged. The negative relationship between financial constraints and exports still holds when we add a measure of TFP among the controls, accounting for the role played by productivity in theoretical models of heterogeneous firms and trade.<sup>18</sup> Also, our results remain valid when we restrict the analysis to those firms which always export over the sample period, and when we use export volumes in place of export values as the dependent variable. Finally, we explore the relationship between financing constraints and firms' domestic sales: in line with the theoretical predictions, we establish that financing constraints reduce domestic sales much less than they do for exports.

Our second exercise investigates the role of financing constraints along the product and destination margins. We take equation (7) and replace export values with either the number of exported products (#Products) or the number of served destinations (#Countries), aggregated at the level of each firm. The primary equations are

$$\ln \# Products_{ft} = \alpha + \gamma FC_{ft-1} + \beta \mathbf{Z}_{ft-1} + c_f + \epsilon_{ft}$$
(8)

and

$$\ln \#Countries_{ft} = \alpha + \gamma F C_{ft-1} + \beta \mathbf{Z}_{ft-1} + c_f + \epsilon_{ft} \quad , \tag{9}$$

while selection is still modeled as the export participation decision detailed above.

Table 3 reports the results again for POLS, FE and selection corrected estimates. The main findings do not vary much across different estimation methods. We comment on the more reliable estimates in Columns 3 and 6. Three considerations are due. First, we find that FC problems hamper

<sup>&</sup>lt;sup>18</sup>TFP is computed as the residual of a FE estimate of a 2 inputs production function, taking value added as a proxy for output, and employees and gross tangible assets to proxy labour and capital inputs. This choice is imposed by lack of proper data on intermediate inputs and investment required by more careful estimation of production functions (see Olley and Pakes, 1996; Levinsohn and Petrin, 2003). Due to this limitation, after checking that the main results are not affected, we do not include this control in the following analysis.

	Surviving firms	Surviving firms	Surviving firms	Surviving firms	Surviving firms	Surviving firms
	$Drop \overset{\circ}{P}_{fpt}$	$Drop \overset{\circ}{P}_{fpt}$	$Drop P_{fpt}$	$Drop C_{fct}$	$Drop \overset{\circ}{C}_{fct}$	$Drop C_{fct}$
	Probit	FE	Selection	Probit	FE	Selection
	(1)	(2)	(3)	(4)	(5)	(6)
$FC_{ft-1}$	0.035***	0.042***	0.029***	0.042***	0.051***	0.065***
	(0.005)	(0.005)	(0.006)	(0.004)	(0.004)	(0.004)
$\ln Empl_{ft-1}$	-0.003	-0.003*	-0.001	-0.014***	-0.016***	-0.073***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
$\ln Age_{ft}$	-0.002	-0.004**	-0.007***	0.004***	0.004***	-0.008***
-	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
$\ln ASSETS_{ft-1}$	-0.013***	-0.020***	-0.038***	-0.013***	-0.021***	-0.078***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
$\ln GOM_{ft-1}$	-0.005***	-0.006***	-0.004***	-0.010***	-0.011***	-0.019***
v	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
$\hat{\epsilon}_2$			-0.032***			-0.031***
			(0.000)			(0.000)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Product FE / Country FE	No	Yes	Yes	No	Yes	Yes
R-squared	0.004	0.066	0.101	0.018	0.089	0.127
N.Observations	1257193	1257193	1193509	1414292	1414292	1414051
N.H6 Products /N.Countries	5296	5296	3338	235	235	208
Firms	45722	45722	45244	45722	45722	45722

Table 4: Product-Country dropping and firm's financial constraints

Note: Table reports regression using data on 2001-2003. Dependent variable is a dummy indicating a firm-product drop or firm-country drop between t-1 and t.  $FC_{ft-1}$  is a dummy for constrained firms. The regression sample in columns 1 to 6 is firms that export at least one product in year t-1 and t (Surviving firms). Robust standard errors clustered at firm level are reported in parenthesis below the coefficients: asterisks denote significance levels (\*\*\*:p<1%; \*\*: p<5%; \*: p<10%).

the ability of firms to operate along both margins: financing constraints associate with a 3.6% reduction in the number of destination countries, and with a 3% reduction in the number of exported products. Second, selection does not seem to be an issue in relation to the number of destination countries served by firms ( $\hat{\lambda}$  is not significant in Column 3), while it does when considering the number of exported products (Column 6). This suggests that unobservable characteristics underlying export participation decisions are more related to the choice of the scope of export product variety, than to the extent of geographical diversification. Finally, control variables preserve their positive and significant correlation with export activity: firms that are bigger, older, more collateralized and with more internal resources tend to export more products and serve more countries. As before, size and internal resources are found to play a second order effect, however.

To sum up, these results are consistent with the theoretical predictions. The evidence confirms that external funds are needed to cover both fixed and variable costs, as indeed constrained firms that enter foreign markets export second best values. The findings are also supportive of the existence of country and product specific fixed costs of exporting, implying that FC firms export a narrower range of products to a smaller number of countries.

# 8 Financing constraints and product/country switching

The analysis above explored the relationship between financing constraints and the overall product/destination extensive margins. In this section we take a dynamic perspective and investigate if firm-level financing constraints play a role in the process of dropping or adding products and destinations.

#### **Product-Country dropping**

In examining dropping dynamics we exploit the firm-product and firm-destination dimensions of the data, over time. We define two indicator variables of dropping. For product dropping, the indicator

 $DropP_{fpt}$  takes value 1 if product p is exported by firm f at time t-1, but not exported in year t, and 0 otherwise. Symmetrically, for destination dropping we define the indicator  $DropC_{fct}$ , that equals 1 if country c is served by firm f at time t-1, but not served in year t, and 0 otherwise.

Then, we explore the impact of being constrained in the initial year on the probability of dropping products

$$Pr(DropP_{fpt} = 1) = \alpha + \gamma FC_{ft-1} + \beta \mathbf{Z}_{ft-1} + c_p + \epsilon_{fpt}$$
(10)

or dropping destinations

$$Pr(DropC_{fct} = 1) = \alpha + \gamma FC_{ft-1} + \beta \mathbf{Z}_{ft-1} + c_c + \epsilon_{fct}$$
(11)

where  $\mathbb{Z}_f$  is our usual set of firm characteristics, and we also include product or country fixed effects. We consider only those firms that, in two consecutive years, do not drop all their products or withdraw from all the destinations, and thus do not completely exit from export markets.<sup>19</sup>

Columns 1 to 3 of Table 4 presents results of the product dropping equation. In column 1 we report marginal effects of Probit estimates that ignore product fixed effects. Then, in column 2, we follow Bernard et al. (2010) and employ a linear probability model so that product fixed effects are also added in the regression, accounting for any time invariant product characteristics that may influence the decision to drop a product. Finally, in column 3 we address the problem of selection. As detailed in Section 5, we estimate a first stage Tobit selection equation on the (log of) firms' export values, separately product by product and for each year in the sample period.<sup>20</sup> In the second stage, we estimate via Fixed Effects equation (10) augmented with the residuals obtained from the first stage regression.

The findings across the different estimation methods agree in indicating that FC firms are more likely to discard products. Controlling for selection, financing constraints increase of 2.9 percentage points the probability of firm-product drop. Given an average drop rate of 42.7% among unconstrained firms, this means that the probability of product dropping is 6.7% higher for constrained firms. Also, and quite intuitively, all the other firm level characteristics reduce the probability to drop a product: firms that are bigger, older, more collateralized and with more internal funds are more likely to maintain their current product scope, *ceteris paribus*. We perform robustness checks, not reported here but available upon request. First, we include the number of products exported in t - 1 among the regressors. Second, we add firm fixed effects into the main equation, controlling for any other unobserved factor influencing the product-drop decision. In both the exercises we confirm that financing problems increase the likelihood of a product drop, and the magnitude of the coefficient on the FC dummy is comparable across the different specifications.

Columns 4 to 6 of Table 4 show the corresponding findings from the destination dropping equation (11). The results do not change significantly if we estimate a linear probability model with country fixed effects (column 5) and if we control for selection bias (column 6). In line with findings on product dropping, constrained firms have a significantly higher probability to leave a destination market. Taking selection corrected estimates, financing constraints increase the probability of country dropping by 6.5 percentage points, which means that the probability of country drop is 29% higher for constrained firms (given an average country drop rate of 21.8% among unconstrained firms). Estimates on control variables reveal that size, age, availability of collateral and internal resources all have a negative impact. As in the product dropping specification, we perform two robustness exercises: the coefficient on the FC dummy remains positive and significant even when we control for the number of countries served by a firm at t - 1, and also when we include firm fixed effects.

<sup>&</sup>lt;sup>19</sup>Dropping products or countries, of course, can have very different motivation and determinants as compared to complete exit, and we want to get rid of confounding factors. Results must be therefore interpreted as informative on dropping conditional on survival.

<sup>&</sup>lt;sup>20</sup>To be sufficiently confident in first step results, we only consider products for which 50 or more transactions are considered, meaning that the product by product estimates in the first step involves at least 50 observations. Modifications of this threshold does not substantially change our results.

Table 5. Adding new Froducts-Country and Infin 5 infanctar constraints									
	Incumbent firms	Incumbent firms	Incumbent firms	Incumbent firms					
	$AddP_{ft}$	$AddP_{ft}$	$AddC_{ft}$	$AddC_{ft}$					
	Probit	FE	Probit	FE					
	(1)	(2)	(3)	(4)					
$FC_{ft-1}$	-0.018***	-0.022**	-0.021***	-0.015**					
-	(0.005)	(0.007)	(0.006)	(0.007)					
$\ln Empl_{ft-1}$	0.015***	-0.003	0.017***	-0.006*					
v	(0.002)	(0.004)	(0.002)	(0.003)					
$\ln Age_{f,t}$	-0.024***	-0.019***	-0.013***	-0.023***					
• /	0.002)	(0.003)	(0.002)	(0.003)					
$\ln ASSETS_{ft-1}$	0.033***	0.028***	0.061***	0.024***					
v	(0.002)	(0.004)	(0.002)	(0.005)					
$\ln GOM_{ft-1}$	0.004***	0.002	0.004***	-0.001					
·	(0.001)	(0.001)	(0.001)	(0.001)					
Year FE	Yes	Yes	Yes	Yes					
Product-Mix*Year FE	No	Yes							
Country-Mix*Year FE			No	Yes					
R-squared	0.035	0.091	0.062	0.182					
N.Observations	110425	110425	110425	110425					
N.Product-mix		6135							
N.Country-mix				22022					
N.Firms	45722	45722	45722	45722					

Table 5: Adding new Products-Country and firm's financial constraints

Note: Table reports regression using data on 2001-2003. Table reports regression of a dummy variable indicating a firm adding at least a new product or a new destination country between t - 1 and t.  $FC_{t-1}$  is a dummy for constrained firms. Robust standard errors clustered at product-mix or country-mix level are reported in parenthesis below the coefficients: asterisks denote significance levels (\*\*\*:p<1%; \*: p<5%; \*: p<10%).

#### **Product-Country adding**

We next turn to explore if limited access to external finance influences firms' product and country adding decisions. Following Bernard et al. (2010) we examine the probability that a current exporter adds at least a new product or a new destination to its export portfolio between two consecutive years. We define an indicator of product adding,  $AddP_{ft}$ , that takes value 1 if at least one product which was not exported by firm f at time t - 1 is exported at time t, and 0 otherwise. Symmetrically, we construct an indicator of country adding,  $AddC_{ft}$ , which equals 1 if at least one new country is served by firm f at time t, as compared to the set of countries served at time t - 1, and 0 otherwise.<sup>21</sup> To get rid of possible confounding factors associated with the decision to enter into exporting activities in the first place, the analysis is performed on incumbent firms, i.e. on those firms who already export at least one product or are active in at least one country in t - 1. The estimated equations are

$$Pr(AddP_{ft} = 1) = \alpha + \gamma FC_{ft-1} + \beta \mathbf{Z}_{ft-1} + \epsilon_{ft}$$
(12)

for product adding, and

$$Pr(AddC_{ft} = 1) = \alpha + \gamma FC_{ft-1} + \beta \mathbf{Z}_{ft-1} + \epsilon_{ft}$$
(13)

for country adding, where  $Z_f$  includes the usual set of firm characteristics. The two equations are estimated both via Probit and via a linear probability model. In the second case, we also include product-mix or country-mix fixed effects, which control for common characteristics of those firms

<sup>&</sup>lt;sup>21</sup>Note that while the dropping regressions are at the firm-product or firm-country level, the adding analysis aggregates the information at the firm level. Firm-product and firm-country regression are unfeasible here, as indeed one would need to create an observation for each firm for all the products or countries existing in the dataset at time t - 1 (even for those not actually included in a firm's portfolio), and then see which of these products or countries are added at time t. This cannot be managed given the high number of firms, products and destinations.

that export the same bundle of products or serve the same geographical areas in the initial year t - 1.<sup>22</sup> We then interact the set of product or country mix fixed effects with time fixed effects.

Columns 1 and 2 of Table 5 show the results concerning product adding. The two specifications provide a consistent picture. Constrained firms are significantly less likely to add new products. Taking FE estimates, the probability of observing a constrained firm that adds at least one product is 2.6% lower than for an unconstrained firm (2.2 percentage points less compared to an average add rate of 84% among unconstrained firms). We find a negative and strongly significant coefficient on age, possibly in line with the idea that older firms can be thought of as relatively more stable entities, characterized by a more persistent product scope, and thus less likely to export new products. Availability of collateral has the expected positive sign. Size and the amount of internal resources have a positive association with product adding, even though the coefficients are not statistically significant in the FE linear probability model.

The results for country adding are then presented in Columns 3 and 4. The findings fit well with the picture emerged with product adding. We still observe a negative and significant coefficient on the FC dummy: problems to access external finance do reduce the ability to widen geographical diversification. According to FE estimates, constrained firms have a 1.9% lower probability to add at least one destination (1.5 percentage points lower compared to an average add rate of 78% among unconstrained firms). The other controls display coefficients quite close to those observed for product adding: age has negative and significant impact, while the availability of collateral increases the likelihood to serve new countries. Size and internal resources are both positive in the probit specification, but the estimates are not statistically significant in the linear model. In unreported regressions (available upon request), we have confirmed that the results are robust to an explicit control for either the number of products exported or the number of countries served in the initial year.

Interpreting the evidence of this section, the results emphasize the importance of financial constraints in explaining selection mechanisms within firms across products and destinations. In accordance with the predictions sketched in the theoretical framework, financing problems hamper the possibility to pursue an effective reallocation of resources from (product or destination) markets that over time become less profitable to markets that becomes more profitable. Everything else equal, constrained firms benefit from positive shocks less than unconstrained firms, and thus have a reduced probability to add markets, but are also more sensitive to adverse shocks, and thus drop more frequently.

#### **9** Financing constraints and quantity-price effects

In this section we exploit the firm-product-destination level of the data and explore the association of financing constraints with physical quantity and prices (unit values) at transaction level. We first investigate if financing constraints influence variation of quantity or prices across firms performing the same product-country transactions. Then, we ask whether financing constraints interact with destination country characteristics in explaining quantity-price decisions of the firms exporting the same product across different destination markets.

#### Price-quantity decisions across firms

We first focus on whether constrained firms display any specific behavior in terms of quantity and price per transaction. Labeling with  $Q_{fpc}$  and  $UV_{fpc}$ , respectively, the quantity and the unit value of

<sup>&</sup>lt;sup>22</sup>Product-mixes are defined according to the main sections of HS classification. Country-mixes are based on aggregation of countries into geographical areas following the geo-economic classification provided by the European Commission (see http://www.coeweb.istat.it/english/default.htm). The US, Canada, Japan, Brazil, India, China and major European countries are each treated as independent geographical destinations, given their obvious importance.

	onstraints t	ing quantity	y price sett	ing at trans	
	$\ln Q_{fpct}$	$\ln Q_{fpct}$	$\ln UV_{fpct}$	$\ln UV_{fpct}$	$\ln UVImp_{fpct}$
	FE	Selection	FE	Selection	FE
	(1)	(2)	(3)	(4)	(5)
$FC_{ft-1}$	-0.132***	-0.135***	0.094***	0.094***	0.022
	(0.040)	(0.041)	(0.033)	(0.033)	(0.020)
$\ln Empl_{ft-1}$	-0.006	0.055***	0.060***	0.060***	0.039***
·	(0.015)	(0.017)	(0.009)	(0.009)	(0.006)
$\ln Age_{ft}$	-0.006	0.048***	-0.005	-0.005	0.010
-	(0.015)	(0.015)	(0.009)	(0.009)	(0.006)
$\ln ASSETS_{ft-1}$	0.161***	0.564***	-0.048***	-0.049***	0.009
U U	(0.013)	(0.018)	(0.009)	(0.009)	(0.006)
$\ln GOM_{ft-1}$	0.034***	0.063***	-0.004	-0.005	-0.006**
0	(0.005)	(0.006)	(0.003)	(0.003)	(0.003)
$\hat{\epsilon}_{2fpct}$		0.293***		-0.002**	
0 X		(0.005)		(0.001)	
$avg\ln UV_f$					0.182***
					(0.006)
Year FE	Yes	Yes	Yes	Yes	Yes
Country-Product FE	Yes	Yes	Yes	Yes	Yes
R-squared	0.432	0.536	0.684	0.677	0.740
N.Observations	4374164	4272390	4374164	4272390	806363
N.Firms	53103	52681	53103	52681	29891
N.Product-country groups	271193	233697	271193	233697	56222

Table 6: Financial constraints and quantity-price setting at transaction level

Note: Table reports regression using data on 2001-2003. The dependent variable used is reported at the top of each column.  $FC_{f,t-1}$  is a dummy for constrained firms. Robust standard errors clustered at firm level are reported in parenthesis below the coefficients: asterisks denote significance levels (\*\*\*:p<1%; \*\*:p<5%; \*:p<10%).

the export by firm f in product p to country c, we estimate

$$\ln Q_{fpct} = \alpha + \gamma F C_{ft-1} + \beta \mathbf{Z}_{ft-1} + c_{pc} + \epsilon_{fpct}$$
(14)

and

$$\ln UV_{fpct} = \alpha + \gamma FC_{ft-1} + \beta \mathbf{Z}_{ft-1} + c_{pc} + \epsilon_{fpct} \quad , \tag{15}$$

where  $FC_f$  is our usual dummy for constrained firms and  $Z_f$  the usual set of firm level controls. Inclusion of product-country fixed effects,  $c_{pc}$ , implies that we are comparing quantity-price decisions across across firms, within the same product-destination market. We report FE estimates, and control for selection bias via the two step procedure described in Section 5, entailing a Tobit selection equation on the transaction level export value, estimated product by product in each year of the sample period.<sup>23</sup>

Table 6 reports the results. Columns 1-2 present the estimates of the quantity equation. The positive and significant coefficient on  $\hat{\epsilon}_{2fpct}$ , the residual from the first stage Tobit, suggests again that correcting for selection is important. Accounting for that, we find a negative and significant coefficient on the FC dummy: transactions of constrained firms involve a 13.5% reduction in the quantity exported. The other controls have the expected positive sign, and are all significant once we address selection: bigger, older, more collateralized and more profitable firms all export more.

Results on transaction prices are reported in Columns 3-4. The strength of selection is much less relevant here than in the quantity equation: the coefficient on first-step residual is quite small even if significant. Accordingly, the estimates of the other coefficients do not substantially change across the two estimation methods. Conditional on other factors, we find that constrained firms charge higher

<sup>&</sup>lt;sup>23</sup>To be sufficiently confident in first step results, we only consider products for which 50 or more transactions occur in each year, meaning that the product by product estimates in the first step involves at least 50 observations. Modification of this threshold does not substantially change our results.

prices (an increase of 9.4%) compared to unconstrained firms exporting the same product in the same country. The elasticity of size is positive and significant, while age does not seem to play a role. Availability of collateral associates with lower prices, while operational profits does not play any statistically significant role

Combining the findings on quantity and price, the observed behavior of constrained firms is open to different interpretations. Lower quantities per transaction are consistent with the idea, already emerged in the firm level analysis, that financing problems induce firms to ship less than their first best. However, lower quantities-higher prices are consistent with both a pure efficiency interpretation, where FC firms set higher prices because they operate at lower efficiency (i.e. at higher marginal cost), and also in line with "strategic" pricing explanations, where constrained firms attempt to offset the negative impact on revenues associated with reduced quantities. The findings are instead more difficult to reconcile with explanations based on quality, which would predict that constrained firms reduce both quantities and prices as compared to unconstrained firms. Export prices are only an indirect signal of quality, however. A more direct test to exclude the role of quality considerations is to look at input prices, and see if firms that set higher export prices also purchase more costly inputs. We perform an exercise in this direction by exploiting information on the price of imports in intermediate goods. We run the following regression

$$\ln UVImp_{fpct} = \alpha + \gamma FC_{ft-1} + \delta Avg \ln UV_{ft} + \beta \mathbf{Z}_{ft-1} + c_{pc} + \epsilon_{fpct}$$
(16)

where we consider the unit value of import, UVImp, only for those transactions in products that fall into the intermediate input category identified by CEPII-BACI classification system.<sup>24</sup> Since one cannot know which particular input is used to produce a specific exported product, the correlation with export prices is explored by the average unit value of exports across products and destinations,  $Avg \ln UV$ . We also control for firm characteristics and product-destination fixed effects.<sup>25</sup> The results (see column 5 in Table 6) show that controlling for the correlation with export prices and other firm characteristics, the price of imported inputs do not have any significant association with financing constraints. This tends to confirm that pricing decisions of constrained firms do not reflect quality issues.

#### **Price-quantity decisions across destinations**

We then explore whether financing problems interact with destination country characteristics in influencing quantity or price discrimination across destination markets. We focus on a set of key gravity factors which theory predicts to influence the decision to serve different destination countries. These are market size, consumer income, and iceberg trade costs, which we measure in a standard way by GDP, GDP per capita (GDPPC) and bilateral geographical distance (DIST). We also include a measure of remoteness (REMOTE).<sup>26</sup>

One way to include country variables is to directly add them into equations 14 and 15, and then only control for product fixed effects. However, for more consistent estimation of the impact of coun-

<sup>&</sup>lt;sup>24</sup>BACI is the World trade database developed by the CEPII at a high level of product disaggregation. Original data are provided by the United Nations Statistical Division (COMTRADE database). The classification of products by transformation level follows the Broad Economic Categories of the UN (Gaulier and Zignago, 2010).

<sup>&</sup>lt;sup>25</sup>Following Manova and Zhang (2011) average unit value of export is computed as the average of the unit values of all the export (product-destination) transactions of a firm (in logs), de-meaned by their product specific averages (i.e. across firms and destinations) and weighted by the share of each transaction in the overall export revenues of a firm.

<sup>&</sup>lt;sup>26</sup>Data on GDP and GDP per capita are taken from the World Bank Development Indicators (nominal figures). Distance of destination countries from Italy is computed via the great circle method (Mayer and Zignago, 2005) on the CEPII database. Remoteness is defined as in Manova and Zhang (2011):  $REMOTE_c = \sum_o GDP_o \cdot DIST_{oc}$ . The subscript *o* stands for the origin country, and therefore, REMOTE is a weighted sum of all the distances between country *c* and the other countries of the world, weighted by the GDP of the latter. See Baldwin and Harrigan (2011) for a discussion of alternative proxies.

$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		$\ln Q_{fpc}$	$\ln Q_{fpc}$	$\ln U V_{fpc}$	$\ln UV_{fpc}$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		FE	Selection	FE	Selection
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(1)	(2)	(3)	(4)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\ln DIST_c$	-0.365***	-1.159***	0.077***	0.066**
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(0.081)	(0.122)	(0.027)	(0.027)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\ln DIST_c * FC_{ft-1}$	0.052***	0.435***	0.010**	0.016***
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	-	(0.019)	(0.040)	(0.004)	(0.005)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\ln GDP_c$	0.340***	0.882***	-0.005	-0.003
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(0.039)	(0.068)	(0.006)	(0.007)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\ln GDP_c * FC_{ft-1}$	0.000	-0.352***	-0.011***	-0.016
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	-	(0.011)	(0.030)	(0.004)	(0.005)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\ln GDPPC_c$	-0.111**	0.083**	0.008	0.011
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(0.044)	(0.036)	(0.011)	(0.011)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\ln GDPPC_c * FC_{ft-1}$	-0.026	-0.152***	0.015**	-0.014*
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	-	(0.017)	(0.013)	(0.007)	(0.007)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\ln REMOTE_c$	0.694***	1.418***	0.011	0.021
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(0.260)	(0.275)	(0.087)	(0.087)
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\ln REMOTE_c * FC_{ft-1}$	-0.005	0.129	0.002	0.004**
$ \hat{\epsilon}_{2fpct} & \begin{array}{c} 0.125^{***} & 0.002 \\ (0.010) & (0.001) \end{array} \\ \hline \\ Year FE & Yes & Yes & Yes & Yes \\ Product-Firm FE & Yes & Yes & Yes & Yes \\ R-squared & 0.656 & 0.689 & 0.861 \\ Observations & 4313491 & 4214586 & 4313491 & 4313491 \\ Firms & 52917 & 52575 & 52917 & 52575 \\ Products & 5296 & 3113 & 5296 & 3113 \\ Destinations & 185 & 185 & 185 & 185 \\ Product-firm groups & 833104 & 798983 & 833104 & 798983 \\ \hline $	-	(0.004)	(0.144)	(0.002)	(0.002)
(0.010)       (0.001)         Year FE       Yes       Yes       Yes       Yes         Product-Firm FE       Yes       Yes       Yes       Yes         R-squared       0.656       0.689       0.861       0         Observations       4313491       4214586       4313491       4313491         Firms       52917       52575       52917       52575         Products       5296       3113       5296       3113         Destinations       185       185       185       185         Product-firm groups       833104       798983       833104       798983	$\hat{\epsilon}_{2fpct}$		0.125***		0.002
Year FEYesYesYesYesYesProduct-Firm FEYesYesYesYesR-squared0.6560.6890.861Observations4313491421458643134914313491Firms52917525755291752575Products5296311352963113Destinations185185185185Product-firm groups833104798983833104798983	• •		(0.010)		(0.001)
Product-Firm FEYesYesYesYesR-squared0.6560.6890.861Observations4313491421458643134914313491Firms52917525755291752575Products5296311352963113Destinations185185185185Product-firm groups833104798983833104798983	Year FE	Yes	Yes	Yes	Yes
R-squared0.6560.6890.861Observations4313491421458643134914313491Firms52917525755291752575Products5296311352963113Destinations185185185185Product-firm groups833104798983833104798983	Product-Firm FE	Yes	Yes	Yes	Yes
Observations4313491421458643134914313491Firms52917525755291752575Products5296311352963113Destinations185185185185Product-firm groups833104798983833104798983	R-squared	0.656	0.689	0.861	
Firms52917525755291752575Products5296311352963113Destinations185185185185Product-firm groups833104798983833104798983	Observations	4313491	4214586	4313491	4313491
Products5296311352963113Destinations185185185185Product-firm groups833104798983833104798983	Firms	52917	52575	52917	52575
Destinations         185         185         185         185           Product-firm groups         833104         798983         833104         798983	Products	5296	3113	5296	3113
Product-firm groups 833104 798983 833104 798983	Destinations	185	185	185	185
	Product-firm groups	833104	798983	833104	798983

Table 7: Financial constraints and firm's export: quantity and unit value across destinations

try characteristics on firm behavior, it is more appropriate to control for within firm-product variation. This identifies price-quantity discrimination of the same firm in exporting the same product across different destinations. Accordingly, we capture the role of financing constraints via their interactions with country characteristics. The main equations are

$$\ln Q_{fpct} = \alpha + \beta \mathbf{V}_{ct} + \gamma \mathbf{V}_{ct} \cdot FC_{ft-1} + c_{fp} + \epsilon_{fpct}$$
(17)

and

$$\ln UV_{fpct} = \alpha + \beta \mathbf{V}_{ct} + \gamma \mathbf{V}_{ct} \cdot FC_{ft-1} + c_{fp} + \epsilon_{fpct}$$
(18)

where  $V_c$  is the set of country-level variables (all in logs), FC the indicator for constrained firms, and  $c_{fp}$  is a firm-product fixed effect. To address selection we again follow the two-stage procedure described in Section 5.<sup>27</sup>

$$\ln \operatorname{Exp}_{fpct} = Max \left[ 0, c_{2p} + \beta_{2p} \mathbf{V}_{ct} + \gamma_{2p} \mathbf{V}_{ct} \cdot FC_{ft-1} + \epsilon_{2fpct} \right]$$

Note: Table reports regression using data on 2001-2003. The dependent variable used is reported at the top of each column.  $FC_{ft-1}$  is a dummy for constrained firms. Columns 1 and 3 report OLS estimates, while in columns 2 and 4 we correct for selection through the 2-Stage procedure by Wooldridge (1995). Robust standard errors clustered at country level are reported in parenthesis below the coefficients. Asterisks denote significance levels (\*\*\*:p<1%; \*\*:p<5%; \*:p<10%).

<sup>&</sup>lt;sup>27</sup>The first stage regression is again a product by product Tobit on transaction level export values

appropriately modified to include country variables and interactions. Estimates by year gives the residuals to plug in the main equations in the second stage. As before, in order to get reasonably credible estimates in the first step, we only include observations for product level data that cover at least 50 or more transactions.

Table 7 reports FE and selection-corrected estimates. For the quantity equation (see Columns 1-2), selection bias is significant. Concerning country characteristics, we find that the quantity involved in each transaction decreases with distance, but increases with market size, income per capita and remoteness. Financing constraints, however, give raise to interesting inter-plays. First, FC firms are more sensitive than non financially constrained firms to distance. Given the negative sign on distance, this means that FC firms reduce the quantity less than unconstrained firms when exporting in a more distance country, and increase the exported quantity less than unconstrained firms when distance decreases. Further, constrained firms are less sensitive to market size and consumer income: as gdp or gdp per capita increase, they increase the shipped quantity less than unconstrained firms do. Finally, constrained firms do not display any significantly different behavior in relation to remoteness.

Results for the price equation (in Columns 3-4) are radically different. First, selection does not play a role in price discrimination across countries. Second, differentiation of prices across destinations only depends on distance: firms set higher prices to more distant countries, while the other country characteristics do not exhibit any statistically significant role. Third, financing problems associate with an higher sensitivity of firm-product price to distance, meaning that constrained firms increase the mark-ups even more than unconstrained firms in more distant markets. The interactions with other destination characteristics are only barely significant.

These findings on the behavior of firms across destination markets add to our key result that constrained firms ship second best quantity and sell at higher prices, highlighting the peculiar sensitivity of firms with financing problems to variation in country characteristics.

## **10** Conclusions

The present paper provides a comprehensive analysis of the role that financial constraints play in shaping firms' export activities. Using detailed information on international activities of a large and representative sample of Italian manufacturing firms, we investigate the link between financial frictions and different margins of export, extending the existing literature in a number of directions.

First, financially constrained firms export less, serve fewer countries and ship a narrower range of products. This evidence indicates that limited credit availability provides a barrier in the financing of both fixed and variables costs of exporting. In particular, we confirm the existence of relevant country specific and product specific fixed costs, which indeed limit the scope of geographical and product diversification of financially constrained firms.

Second, by taking a dynamic perspective, we find that financing constraints increases the probability to drop products or destinations, and decrease the probability to add new products or new destinations. These results highlight the role of credit frictions as an important attribute that determines firms' strategies of switching among products or destinations.

Third, exploiting information at transaction level we explore the association of financing constraints with quantity exported and prices. The key findings are that constrained firms export lower quantities and sell at higher price per transaction. Destination country characteristics interplay with financing constraints in determining the quantity shipped, while only geographical distance matters for pricing strategies. This evidence suggests that credit conditions do not only restrict firms' ability to sell in international markets, but also interact with pricing strategies across products and destinations.

All the results are robust to specific control for self-selection into export, which we tackle with an appropriate econometric procedure that allows for unobserved heterogeneity in both the main and selection equations.

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# 11 Appendix A

#### 11.1 COE

In compliance with the common framework defined at the EU level, there are different requirements in order for a transaction to be recorded, depending on whether the importing country is an EU or NON-EU country, and on the value of the transactions. As far as outside EU transactions are concerned there is a good deal of homogeneity among member countries as well as over time. Since the adoption of the euro as a common currency, Italy set the threshold at 620 euro (or 1000 Kg), so that all transactions bigger than 620 euro (or 1000 Kg) are recorded.<sup>28</sup> For all of these recorded extra-EU transactions, the COE data report complete information, that is, also information about the product quantity and value. Transactions within EU are collected according to a different systems (Intrastat), where the threshold on annual value of transactions qualifying for complete record are less homogeneous across EU member states, with direct consequences on the type of information reported in the data. In 2003 (the last here covered by our final sample, see below), there are two cut-offs. If a firm has more than 200,000 euro of exports (based on previous year report), then she must fill the Intrastat document monthly. This implies that complete information about product is also available. Instead, if previous year export value falls in between 40,000 and 200,000 euro, the quarterly Intrastat file has to be filled, implying that only the amount of export is recorded, while information on the product is not. Firms with previous year exports below 40,000 euro are not required to report any information on trade flows. Thus, firms which do not appear in COE are either of this type (i.e. marginal exporters) or do not export at all.

#### 11.2 Representativeness

As shown in Table 8, the representativeness of the dataset is however quite high: although we can include about 20% of all manufacturing in terms of number of firms, the data cover about 60% of exporting firms, and about 84% of the total value of exports.<sup>29</sup> This picture is explained by the well known abundance of micro and small firms in Italian manufacturing, together with the observation that the legal status of limited firm tend to be more spread across medium-bigger firms. Yet, despite relatively few in terms of number of active firms, one expects that, in line with well established results across different countries, medium-big firms account for the great bulk of overall export activities in the country. In agreement with this, Table 9 shows that the firms in our sample are comparatively bigger and more productive, on average, than the population of manufacturing firms. At the same time, however, we do not observe big differences when we focus on exporting firms: the average size, productivity, export values, number of exported products and number of destinations served do not differ significantly across our sample and the population.

 $<sup>^{28}</sup>$ From 2007 onward the threshold is 1000 euro (or 1000 KG). On some kind of goods Italy applies even a lower threshold.

<sup>&</sup>lt;sup>29</sup>We report 2003 data, but figures are comparable in the other years.

		OVERALL		]	EXPORTERS		EX	EXPORT VALUE			
Sector	ASIA-COE (Number)	Our dataset (Number)	Coverage %	ASIA-COE (Number)	Our dataset (Number)	Coverage %	ASIA-COE (billion)	Our dataset (billion)	Coverage %		
15	71345	8882	12.45	4926	2875	58.36	12.1	9.4	77.77		
17	27762	6408	23.08	5680	3447	60.69	12.5	10.8	86.70		
18	41615	6134	14.74	5035	2655	52.73	9.7	8.1	83.56		
19	21985	4495	20.45	5688	2644	46.48	10.8	8.8	81.62		
20	46584	3550	7.62	2458	978	39.79	1.5	1.3	83.88		
21	4566	1951	42.73	1328	884	66.57	4.0	3.8	95.28		
22	27344	7801	28.53	2164	1239	57.26	1.7	1.6	91.25		
23	443	333	75.17	84	73	86.90	3.8	3.7	99.25		
24	6127	3529	57.60	2595	1988	76.61	22.6	16.3	71.80		
25	13084	5575	42.61	4421	2970	67.18	10.4	8.9	85.72		
26	27230	6218	22.84	4522	2176	48.12	7.2	6.2	86.18		
27	3814	1893	49.63	1335	1016	76.10	9.9	8.7	88.21		
28	99519	19551	19.65	10280	5774	56.17	12.6	11.2	89.26		
29	42391	14710	34.70	12128	8193	67.55	43.3	38.0	87.61		
30	1976	822	41.60	262	185	70.61	1.5	1.3	91.19		
31	18316	5315	29.02	3214	2131	66.30	8.1	6.6	82.12		
32	8671	1665	19.20	911	609	66.85	5.2	3.7	71.02		
33	22399	3073	13.72	1920	1357	70.68	4.6	3.9	85.18		
34	1962	1122	57.19	918	687	74.84	17.8	15.3	85.86		
35	4684	1541	32.90	819	498	60.81	6.7	4.9	73.84		
36	50018	7873	15.74	8663	4195	48.42	12.1	10.4	85.96		
Total	541835	112441	20.75	79351	46574	58.69	218.1	183.0	83.93		

Table 8: Coverage of the dataset, Manufacturing: Number of firms, number of exporters and export value (2003)

Table 9: Descriptive Statistics: A	ASIA-COE vs Our dataset (2003)
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		ASIA-	COE	Our Dataset				
	Mean	Sd	Observations	Mean	Sd	Observations		
Manufacturing firms								
$\ln Empl.$	1.12	1.14	541836	2.13	1.38	112441		
$\ln TS/Empl.$	3.78	1.12	518839	4.65	1.09	110160		
	Manufacturing Exporters							
$\ln Empl.$	2.43	1.35	79352	2.85	1.32	46574		
$\ln TS/Empl.$	11.74	0.94	77068	11.99	0.82	46073		
$\ln Export$	4.71	2.74	79352	5.52	2.67	46574		
#Countries	8.77	12.92	79352	11.66	14.74	46574		
#Products	8.04	14.7	79352	10.36	17.15	46574		