Firm size and export performance: Evidence from Uruguayan manufacturing SMEs

Preliminary draft

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Abstract

Small and medium-sized enterprises (SMEs) are recognized as an important driving force in economic development, both in industrialized and developing countries. Despite their increasingly active role in foreign markets, evidence drawn mainly from developed economies indicates that several obstacles still constrain SMEs' international activities, affecting these firms' ability to seize opportunities and confront threats emanating from the globalization process. This paper provides a developing country perspective on this issue, empirically evaluating the relationship between size and firms' involvement in export markets in the case of the Uruguayan manufacturing industry.

Using detailed firm-level panel data covering the period 1997-2005, this study investigates how enterprise size relates to five dimensions of firms' export performance: export propensity, export intensity, product scope, geographic scope, and export survival. Controlling for other firm characteristics that may be associated with export activities, as well as for unobserved firm heterogeneity, the results obtained suggest that the inherent resource constraints that characterize SMEs might be hampering these firms' participation in export markets. These findings provide support for the argument that policymakers should develop specific initiatives regarding internationalization of SMEs. Given the important role played by SMEs in the Uruguayan economy, the improvement of their international insertion is crucial for strengthening the country's export performance, as well as for enhancing the impact of exports on the rest of the economy.

Keywords: small and medium-sized enterprises (SMEs), export performance, heterogeneous firms

JEL classification: F14, D22, L25, C23

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1. Introduction

Small and medium-sized enterprises (SMEs) play a crucial role in most economies, accounting for a substantial share of total employment. They are recognized as a driving force for wealth creation, making important contributions to innovation, productivity and economic growth (OECD, 2005). Compared to large firms, SMEs are considered to have a number of inherent advantages –such as superior operational flexibility and greater ability to innovate–, which would allow them to be more responsive to the business environment. However, they are generally more resource-constrained than large enterprises, in terms of financial capital and technical and managerial capabilities, which might limit the scope of these firms' activities.

Although in the past internationalization was mostly related with large firms, the contemporary globalization process creates new opportunities and incentives for SMEs to internationalize, while confronting them with increased foreign competition in their home market. By engaging in international activities, firms can benefit from pursuing larger and new niche markets, exploiting scale economies, accessing advanced know-how and technologies, and lowering costs. Internationalization is also a way of diversifying risk (by spreading sales across different markets), and provides opportunities for the exchange of knowledge and the enhancement of capabilities, strengthening the long-term competitiveness of the firm (Wilson, 2007).

Declining trade barriers, lower transport costs and advances in information and communication technologies have reduced many of the traditional obstacles to internationalization. Additionally, the increasing fragmentation of production processes across countries provides opportunities for all enterprises, regardless of size, to participate in international value chains. However, SMEs still face many barriers in the process of internationalization. According to OECD (2009), the most serious impediments for SMEs to internationalize are shortage of working capital to finance overseas operations, inadequate knowledge of international market (limited information to locate/analyse markets and identify foreign business opportunities), and lack of relevant managerial skills and knowledge. These barriers are largely internal and would mainly reflect firms' limitations in regard to the key resources and capabilities they need to enter foreign markets.

Even though small size does not impede successful internationalization, evidence on SMEs' participation in international markets would suggest that the resource and capability constraints characteristic of smaller firms affect their ability to exploit the opportunities emanating from the globalization process. As a result, in spite of being worldwide the dominant form of business organization, the majority of SMEs is not actively involved in international markets and, for those that have internationalized, international activities are often limited, both in geographical scope and in comparison to domestic activities. This is clearly the case in Latin America and the Caribbean (LAC), where SMEs –which constitute more than 90 percent of enterprises– are notably underrepresented in the region's external sector (IDB, 2014).[1]

Most of the studies on firms' participation in international markets look at developed countries, and do not explicitly explore whether the determinants of firms' internationalization differ across firm sizes. As pointed out by Ottaviano and Volpe Martincus (2011) –referring particularly to the export behaviour of firms–, a priori there are good reasons to believe that firms of different sizes may be differently affected by the various factors determining their export decisions, and that the importance of these factors may also depend on the development level of firms' countries. Resource constraints and barriers to entry are critically higher for SMEs than for large companies, limiting the scale of international activities undertaken by these firms (Acs et al., 1997; Karagozoglu and Lindell, 1998; Hollenstein, 2005 (cited in Pradhan and Das, 2012); IDB, 2014). Larger firms are in a better position to absorb the cost of entry into foreign markets (related to the gathering of information on foreign business practices and consumer preferences, the identification of business opportunities abroad, the adaptation of products to foreign markets, and the establishment of distribution and marketing channels abroad); they can also afford to assume more risks and their risks from foreign operations are less than those of small firms (Volpe Martincus et al., 2010). Small firms from developing countries are generally confronted with greater difficulties than those from developed economies, as the conditions prevailing in these countries (such as a higher economic regime uncertainty, a poorer exporting infrastructure (in terms of transport, communication, and intermediation), and a more limited access to

[1] Despite their prominence in LAC economies, less than 15 percent of LAC SMEs engage in direct exporting (18 percent if indirect exporters are included), and those that do export tend to sell only a few products to a very small number of markets. Many economies in the region even lag behind comparable emerging markets in SME export participation, diversification, and export sales (IDB, 2014).

financing), tend to aggravate the problems that SMEs naturally face when trying to penetrate foreign markets (Ottaviano and Volpe Martincus, 2011).

This study attempts to contribute to the still scarce literature on the internationalization of SMEs in developing countries (particularly, in the Latin American region), by providing evidence on Uruguayan manufacturing firms. Within the context previously outlined, the focus of this paper is on examining the relationship between the size of the firm and its process of internationalization, specifically its export activity (the most frequent outward international activity carried out by SMEs). A firm-level panel covering the period 1997-2005 is used to empirically explore the link between firm size and five dimensions of firms' export behaviour: export propensity, export intensity, product scope, geographic scope, and export survival. The study also evaluates whether Uruguayan manufacturing SMEs exhibit different export behaviour patterns than large firms, and whether there are differences in the determinants of export decisions across firm sizes. In so doing, the study attempts to assess to what extent the resource and internal capability constraints that often characterize SMEs limit these firms' involvement in export markets.

The remainder of the paper is organized as follows. Section 2 presents a brief review of some of the most relevant theoretical literature on heterogeneous firms and trade (in which this study is framed), and refers to the empirical works on the relationship between firm size and exporting. Section 3 discusses the empirical strategy adopted in this study. Section 4 presents the data used and describes the export behaviour patterns of Uruguayan manufacturing firms. Section 5 discusses the econometric results. Finally, section 6 concludes.

2. Literature review

The relationship between firm characteristics and internationalization has attracted considerable research attention. Since the mid-1990s, a growing body of empirical literature has focused on the links between firm characteristics and exporting, showing that there exist substantial differences between exporting and non-exporting firms (in terms of size, productivity, capital and skill-intensity, and wages) (e.g., Bernard and Jensen, 1995, 1999, 2001; Roberts and Tybout, 1997; Bernard and Wagner, 1997). More recently, evidence has also shown that firms engaged in

other international activities, such as importing, have different characteristics than those that are not internationalized. These findings challenged both traditional and new trade theory, which emphasize the role of comparative advantage (i.e., the variation in opportunity costs of production across countries and industries), and a combination of economies of scale and consumer preferences for variety, respectively, as the basis for international trade, assuming a representative firm (at least within each industry). As a result, the focus of the international trade field shifted from countries and industries to firms and products, leading to the development of richer theoretical models that stress the importance of firm heterogeneity in generating international trade (Bernard et al., 2007a).

Heterogeneous-firm models capture the interaction between firm heterogeneity and international trade, explaining the difference in export behaviours among firms by differences in firm-specific efficiency and trade costs. Any factor that affects firms' efficiency levels or trade costs may therefore influence their export decisions. A first theoretical framework was developed by Melitz (2003), who introduced firm heterogeneity into Krugman's (1980) model of intra-industry trade under monopolistic competition and increasing returns to scale. Melitz's model is a dynamic industry model in which firms differ in productivity levels, produce horizontally differentiated varieties within the industry, and have to incur sunk fixed entry costs (both for their domestic market and for any potential export market).[2] Only firms whose productivity is above a certain threshold will find it profitable to pay the cost of entering the home market (i.e., firms with a productivity level below the zero-profit cutoff productivity would make negative profits if they produced, hence they exit immediately without producing[3]). Similarly, of the active firms in an industry, only those whose productivity exceeds the export cutoff level are able to cover the costs of exporting and, therefore, find it profitable to export; the less productive active firms will serve only the domestic market.

Melitz (2003) shows how the exposure to trade induces a domestic market selection effect (of firms out of the industry) and an export market selection effect, both of which reallocate market

[2] The coexistence of firms with different productivity levels within the same industry is the result of firms' uncertainty about their productivity before an irreversible entry decision is made. Prior to entry, firms (potential entrants) are identical. Once the sunk domestic market entry cost is paid, each firm draws its productivity from a fixed distribution that is common to all entrants. The export decision occurs after firms observe their productivity, which remains fixed after entry.

[3] All producing firms face subsequently a constant exogenous probability of exiting the market in each period, which is independent of firm's productivity and induces steady-state entry and exit of firms in the model.

shares towards more efficient firms and contribute to an aggregate productivity gain. Trade increases the expected profitability in the industry, which stimulates entry, raises the productivity threshold required to survive and forces the least productive firms to exit the market. Particularly, following a decline in trade costs, existing exporters expand their sales in the foreign market and the most productive firms among this group also experience an increase in profits, while the most productive non-exporters begin to export (as they now find it profitable to enter export markets). In contrast, low productivity firms exit the industry and the profits of surviving non-exporting firms decrease.[4] Thus, (increased) trade causes a reallocation of production and resources towards higher-productivity firms, which raises average industry productivity. The mechanism behind these within-industry reallocations is the differential impact of trade liberalization on exporters and non-exporters, a key implication of Melitz's model.

The model is consistent with the evidence suggesting the existence of sunk export market entry costs (e.g., Roberts and Tybout, 1997; Bernard and Jensen, 2001; Bernard and Wagner, 2001), associated with items such as information requirements (about consumer tastes, market structure and regulations in foreign countries), the adjustments of product designs to foreign standards and regulations, and the establishment of distribution and marketing channels abroad. These entry costs affect how the impact of trade is distributed across different types of firms. The model also addresses a number of empirical regularities concerning the behaviour and relative performance of exporting firms: relatively few firms export; exporters tend to be more productive and larger than non-exporting firms (even prior to entering export markets); and trade liberalization induces reallocations of resources across firms within industries (both in developing and developed countries).

Bernard et al. (2003) (henceforth BEJK) was another important early contribution to the literature on firm heterogeneity and exporting. They developed an alternative theoretical framework, introducing imperfect competition into the static Ricardian model of trade of Eaton and Kortum (2002). The BEJK model also addresses several of the stylized facts of international trade. Similarly to Melitz (2003), reductions in trade costs are here related to within-industry

[4] The expansion of the most productive existing exporters and the entry of new firms into the industry raise labour demand and drive up the real wage. As a result, the productivity threshold required to survive is pushed up, forcing the least productive firms to exit and reducing the revenue of intermediate-productivity firms that serve only the domestic market. Although high-productivity exporting firms also experience a contraction in revenue in the domestic market, the expansion in export revenue dominates.

reallocations and increases in aggregate industry productivity (as lower productivity, non-exporting firms exit, more productive existing non-exporters or new entrants begin to export, and high-productivity existing exporters increase their foreign sales). However, these reallocations occur through different channels in the two models. In contrast to Melitz (2003), in BEJK it is import competition that forces the least efficient (productive) domestic producers to exit, since they lose their position in the domestic market in favour of more efficient (lower cost) foreign firms producing the same variety.

The focus of much recent theoretical research in international trade has been on elaborating on the Melitz (2003) model, which has proved to be adaptable to a wide range of applications.[5] Bernard et al. (2007b) explore the interaction between comparative advantage and heterogeneous firms, adding firm heterogeneity, multiple factors of production and asymmetric industries and countries to the standard trade paradigm of Helpman and Krugman (1985). By combining factor endowment differences across countries, factor intensity differences across industries, and heterogeneous firms within industries, the model is able to simultaneously explain why some countries export more in certain industries than in others (endowment-driven comparative advantage); why two-way trade is observed within industries (firm-level horizontal product differentiation combined with increasing returns to scale); and why, within industries, some firms export and others do not (self-selection driven by trade costs).[6]

Also along the lines suggested by Melitz (2003), Helpman et al. (2008) develop a model of international trade with heterogeneous firms in which the profitability of exports varies by destination. Firms differ in productivity and face fixed and variable costs of exporting, which depend on the characteristics of the importing and exporting countries (but not on firms' productivity). Under these circumstances only a fraction of the firms, those with higher productivity, find it profitable to export to each destination. Thus, the model is consistent with some important stylized features of the data: it predicts positive –though asymmetric– trade flows as well as zero trade flows across pairs of countries, and it allows the number of exporting

[5] Reviews of the theoretical literature on heterogeneous firms and trade can be found in Helpman (2006) and Redding (2011). See also Melitz and Redding (2012).

[6] The Melitz model only considers symmetric countries, which implies that all trade is intra-industry trade and that the productivity gains from trade are symmetrically distributed across countries. In Bernard et al. (2007b) countries are identical in terms of preferences and technologies, but differ in their relative factor endowments. Also, the intensity of use of production factors (skilled and unskilled labour) varies across industries.

firms to vary across destination countries (with larger numbers of firms exporting to larger destination markets).[7] As a result, the impact of trade frictions on trade flows can be decomposed into the so-called intensive (trade volume per firm) and extensive (number of exporting firms) margins, with the latter explaining a substantial proportion of the observed trade adjustments. These adjustments along the extensive margin are found to be typically driven by the export participation decisions of smaller firms (Ottaviano and Volpe Martincus, 2011).

The growing body of theoretical literature on heterogeneous firms and trade has been accompanied by a large number of empirical studies, stimulated by the increasing availability of firm-level data.[8] Although heterogeneous-firm models emphasize the role of sunk costs and firm productivity, the empirical literature has found that a number of other firm characteristics are also important determinants of firms' export decisions (Greenaway and Kneller, 2007). Among the firm characteristics typically considered in this literature, the role of size has been extensively investigated.[9] Several studies show evidence of a positive relationship between firm size and the probability of entering export markets (see, e.g., Roberts and Tybout (1997) on Colombia, Bernard and Jensen (1999) on the US, Bernard and Wagner (1997, 2001) on Germany, Sterlacchini (2001) on Italy, and Girma et al. (2004), Greenaway and Kneller (2004), Gourlay and Seaton (2004), Kneller and Pisu (2007) and Harris and Li (2009) on the UK). Some of these studies also evaluate the link between firm size and export intensity, finding mixed results (e.g., Sterlacchini (2001) and Gourlay and Seaton (2004) show evidence of a positive relationship between the two variables, while in Kneller and Pisu (2007) the impact of firm size is not significant).

The firm size-export nexus is considered to reflect economies of scale in production and export marketing, as well as larger firms' advantages (over smaller firms) in terms of the availability of (financial and managerial) resources to overcome entry costs and absorb the risks associated with internationalization. However, the relationship between size and exporting has been frequently found to be non-linear, exhibiting an inverted U-shaped pattern. This would indicate that once a

[7] The profitability of exports is higher for exports to countries with higher demand levels, lower variable export costs, and lower fixed export costs. For any country pair (*i*, *j*), it may be the case that no firm from country *j* is productive enough to profitably export to country *i*, and/or vice versa.

[8] For a review of this empirical literature, see Bernard et al. (2007a) and Wagner (2007, 2012).

[9] The focus of most empirical studies is not on firm size *per se*; rather, firm size is often included as a control variable. Caves (1989), Berry (1992) and Wagner (2001) provide reviews of some of the evidence relating firm size and export propensity.

certain threshold size is achieved, coordination costs cause further export expansion to be non profitable (Wagner, 2001).[10] Also, it would reflect that larger firms might have an incentive to expand their foreign-market penetration through foreign direct investment (FDI) (rather than exports), which often constitutes an alternative strategy for international expansion (Harris and Lee, 2009).

The number of studies that evaluate the relationship between size and other dimensions of firms' export behaviour (besides export propensity and export intensity) is relatively small, due mainly to the limited availability of the required data. Navaretti et al. (2011) analyse the internationalization of manufacturing firms in seven European countries (Austria, France, Germany, Hungary, Italy, Spain, and the UK). Among other results, they find that firm size is positively related to firms' export performance in all countries, in terms of the probability of exporting, the share of exports in total turnover, the number of foreign markets served, and the probability of exporting to distant countries. In addition, they find evidence of a positive relationship between firm size and more complex internationalization strategies, such as FDI and international outsourcing.

Although an increasing number of empirical studies are directed at the analysis of SMEs' export behaviour, evidence from developing countries is still rather scarce. Ottaviano and Volpe Martincus (2011) analyse the factors that affect the export decisions of SMEs in Argentina, aiming at assessing whether they exhibit distinguishing patterns with respect to those observed for larger firms in developed countries. The estimation results suggest that sunk entry costs play an important role in Argentinean SMEs' export decisions, as current export market participation shows a strong positive association with previous export experience. Also, larger and more productive firms (i.e., those with higher employment levels and larger average sales per employee, respectively) are more likely to export; and sourcing intermediate inputs from abroad and investing in product improvement are as well associated with increased export probabilities. The authors also analyse whether firms' export behaviour differs across two specific destination markets (MERCOSUR –the main destination of Argentine manufacturing exports–, and the rest of the world), finding that sunk entry costs and firm size are important for exports to both

[10] Conditional on having overcome entry barriers, the effect of size on export performance could become negative. As the scale of operation increases (i.e., firms grow larger), coordination costs increase and, at some point, further export expansion is not profitable.

markets (though the effect of size is considerably larger for exports to MERCOSUR). The impact of labour productivity, sourcing from abroad and investing in product improvement is only relevant for firms exporting to MERCOSUR; while for exports to the rest of the world training activities seem to be a key factor.

Other empirical works on SMEs' export behaviour in developing countries include the studies by Yang et al. (2004) for Taiwan, Gumede (2004) for South Africa, and Pradhan and Das (2012) for India. In the three cases, SMEs' export decisions are positively affected by firm size, at least over a relevant range. Other influencing factors are research and development (R&D), technology imports, training investment, skills of the workforce, and labour productivity (Yang et al., 2004); firm age, access to information and financing, and enterprise linkages (Gumede, 2004); and firm age, technology imports, affiliation to foreign companies, credit availability, port and telecommunication facilities, competition in the domestic market, presence of foreign firms, and government fiscal incentives (Pradhan and Das, 2012).

The various empirical studies on firms' export behaviour differ, among other things, in the econometric methods applied. An important issue that has to be accounted for in any empirical analysis that relates firm characteristics and export activities is unobserved firm heterogeneity (like that associated with managerial skills or attitudes). Wagner (2003, 2008) shows the importance of controlling for these unobserved firm effects when evaluating the relationship between firm size and export behaviour. The author argues that, although not all large firms are successful exporters and not all successful exporters are large, factors that make a successful exporter seem to be found more often in larger firms (i.e., they are positively correlated with firm size). Ignoring this unobserved firm heterogeneity would lead to biased estimates; particularly in this case, the estimated coefficient on the firm size variable would be biased upwards. The same argument applies to the evaluation of other firm's international activities, such as importing or FDI. As is shown in section 3, problems of unobserved heterogeneity can be addressed by the use of appropriate econometric methods.

3. Empirical methodology

3.1 Estimation strategy

This paper adds to the empirical literature on the internationalization of SMEs in developing countries, providing evidence on Uruguayan manufacturing firms. Particularly, it investigates the relationship between firm size and five dimensions of firms' export behaviour (assessed by seven indicators, described below): export propensity, export intensity, product scope, geographic scope, and export survival. Export propensity is included in the analysis to evaluate the association of firm size with the probability of exporting. The next three dimensions considered are aimed at capturing the relationship between size and the degree of each firm's involvement in exporting activities. Finally, the analysis of export survival is intended to evaluate how the size of the firm relates with its success upon entry into export markets (i.e., with keeping the firm exporting once it has started to export).

The baseline equation, estimated separately for each of the measures of export performance considered as dependent variable (called generically Y_{it}), is:

$$Y_{it} = \gamma_0 + \gamma_{size} SIZE_{it-1} + \gamma_z \mathbf{z}_{it-1} + \gamma_I I_j + \gamma_T T_t + \varepsilon_{it} \quad (1)$$

where the subindices i, j and t denote firm, industry and time, respectively. *SIZE* is the variable representing firm size, for which two alternative measures are considered (see below); **z** is a vector of firm-level control variables; I are industry dummies to control for unobserved time-invariant industry characteristics that may affect firms belonging to a particular sector[11]; T are time dummies to control for time-varying macroeconomic factors (such as business cycles and real exchange rate); and e is the error term. Both the size measures and the control variables are lagged one year to reduce possible simultaneity problems (Bernard and Jensen, 1999; Ottaviano and Volpe Martincus, 2011).

Table 1 presents the description of all the dependent and independent variables considered in the analysis. Export propensity is defined as a binary variable that equals 1 if the firm exports in period t (0 otherwise), and export intensity is measured by the share of exports in firm's total

[11] Industry dummies are defined at the three-digit level of the International Standard Industrial Classification (ISIC) revision 3.

sales. Product scope is assessed by the number of products exported by the firm (given by the number of export lines at the eight-digit Harmonized System (HS) level), and the proportion of exported products to total number of products produced by the firm[12]; while geographic scope is measured by the number of countries to which the firm exports. In addition, the relationship between size and the degree of firm's exports concentration, in terms of both products and destination markets, is assessed by the share of the main product-destination in firm's total exports. Finally, export survival is evaluated by a dummy variable that identifies firms that exit export market and do not re-enter it at a later date during the period studied.

The focus of this paper is on small and medium-sized firms. On the one hand, it aims at evaluating how being a SME relates to firm's export performance. In addition, the paper assesses whether the factors that affect firms' export behaviour differ across firm sizes, by running separate regressions for SMEs and large firms.

There is no universal definition of SMEs, as variations exist across countries, sectors and even different governmental agencies within the same country. The most standard classification is based on the number of employees, while other definitions consider either a turnover ceiling or a balance sheet ceiling (generally combined with staff headcount thresholds). A classification criterion based both on the number of employees and sales would give a better insight into the relationship between firms' export behaviour and size (Calof, 1994).

According to the official definition of SMEs used in Uruguay by government agencies, a firm qualifies as SME if it employs up to 99 employees and has an annual sales turnover not exceeding 75 millions of indexed units (UI, for its Spanish acronym), currently equivalent to around 9 million US dollars.[13] Based on these criteria, this study considers two alternative measures of firm size. The first measure is a size coefficient, computed as:

[12] For this last indicator, the number of products is measured by the number of product codes as given by the Uruguayan Classification of Economic Activities (CLAEU, for its Spanish acronym), which is based on the ISIC revision 3 and the Central Product Classification (CPC) version 1.0.

[13] The UI is a money analogue unit of account indexed to the consumer price index. The official definition of SMEs, laid down in the government decree 504/07, makes a distinction between micro (1-4 employees and annual sales not exceeding 2 million UI), small (5-19 employees and annual sales not exceeding 10 million UI), and medium-sized firms (20-99 employees and annual sales not exceeding 75 million UI). The panel used in this study does not include firms with less than 5 employees, since they are not encompassed by the activity survey from which data were obtained (see section 4).

$$SC_{it} = 10\sqrt{\frac{EMP_{it}}{EMP_m}\frac{SALES_{it}}{SALES_m}} \quad (2)$$

where EMP_{it} is the firm's number of employees at time *t*, EMP_m is the reference number of employees (99 in this case), $SALES_{it}$ is the value of firm's annual sales at time *t*, and $SALES_m$ is the reference annual sales value (75 millions of UI).[14] The second measure, more standard in the literature, is based only on the number of employees.

In evaluating the relationship between firm size and export behavior, the variable *SIZE* in equation (1) is given by: 1) an indicator variable $SME1_{it}$ that takes the value 1 if the firm's size coefficient at time *t* is lower or equal to 10 (0 otherwise),[15] or, alternatively, 2) an indicator variable $SME2_{it}$ that takes the value 1 if the firm's number of employees at time *t* is lower than 100 (0 otherwise).[16]

As for other independent variables, a set of firm-level variables is included in all regressions to take account of factors, other than size, that may influence firms' export behaviour (and that, if ignored, would bias the results on firm size): age, productivity, prior exporting experience, import status, foreign ownership, R&D intensity, skill (or human capital) intensity, (physical) capital intensity. In addition, an index of market concentration is included (see table 1).

Firm age is commonly controlled for, based on the premise that older firms are more experienced (i.e., they have accumulated learning and information over the past) and therefore are more likely to export and to have higher export-sales ratios.[17] Age may also be considered as reflecting cost differences across firms: if market forces induce inefficient producers to exit, then older firms tend to be more competitive in world markets, either because of cost advantages or because they have had time to move down a learning curve (Ottaviano and Volpe Martincus, 2011). Although some empirical studies confirm the positive relationship between firm age and export

[14] The size coefficient was adapted from that established in the Southern Common Market (MERCOSUR) Resolution 59/98.
[15] 10 is the value of the size coefficient for firms with 99 employees and annual sales of 75 million UI.
[16] Here, firms' classification based on the number of employees follows the size ranges officially considered in Uruguay (i.e., small firms are those with 5-19 employees, medium-sized firms are those with 20-99 employees, and large firms are those with 100 employees or more). This classification is the same as the one adopted in IDB (2014) for the analysis of LAC SMEs.
[17] It is argued that older firms have learnt how to successfully conduct business and how to adjust business strategies to foreign environments (Kaiser and Kongsted, 2004).

behaviour[18], the so-called "born global" firms –which enter the international market immediately or soon after inception and, in some cases, rapidly generate a high percentage of their total sales abroad–, would show that youth is not necessarily an obstacle to internationalization (Fryges, 2006).

The relationship between firms' productivity and export activities has been extensively investigated. Two alternative –but not mutually exclusive– hypotheses have been proposed to explain why exporters can be expected to be more productive than non-exporting firms: 1) self-selection of the more productive firms into export markets (productivity causes exporting, because only the most productive firms are able to overcome the costs of entering export markets), and 2) learning-by-exporting (exporting makes firms more productive, through knowledge and technology transfers from foreign buyers and competitors, exposure to more intense competition, and exploitation of scale economies). While the self-selection hypothesis is confirmed in many empirical studies (suggesting the existence of sunk costs of entry into export markets), evidence for the learning-by-exporting hypothesis is mixed.[19]

In the presence of sunk entry costs, prior exporting experience is found to positively affect firms' current export decisions (by lowering the re-entry costs);[20] however, the effect would depreciate rapidly over time (i.e., recent participation in foreign markets would matter significantly more than the participation further in the past) (Roberts and Tybout, 1997). Similarly, firms' importing activities might impact positively on their later exporting activities, due to the existence of common sunk costs (Kasahara and Lapham, 2008). In addition, importing may increase firm efficiency or product scope and quality (through access to higher quality or richer variety of inputs and to new technologies embodied in foreign inputs), thus allowing firms to become more competitive in the international markets and start exporting (Aristei et al., 2013).

Foreign ownership has also been found to be positively related to firm's export activities (Kneller and Pisu, 2004; Clarke, 2005; Sjöholm and Takii, 2008; Cerrato and Piva, 2012). Wholly or partly foreign-owned enterprises are expected to export more, *ceteris paribus*, than

[18] For references see Fryges (2006).
[19] For a survey on this literature see Greenaway and Kneller (2007), Wagner (2007), and Girma et al. (2004).
[20] The theoretical models developed by Baldwin (1988), Baldwin and Krugman (1989), and Dixit (1989) predict that, due to sunk export costs, current foreign market participation is affected by previous export experience. Empirical findings are consistent with this theoretical prediction (e.g., Roberts and Tybout, 1997; Bernard and Jensen, 1999, 2001, 2004; Bernard and Wagner, 2001).

wholly domestic-owned firms because they may have access to superior production technology and management know-how (which would allow them to produce more efficiently), as well as to international marketing and distribution networks that facilitate exporting (Ramstetter, 1999; as cited in Van Dijk, 2002).

Other likely determinants of firms' export activities are innovation, human capital, and physical capital (i.e., fixed assets). Regarding innovation, several studies support the hypothesis that firms that start to sell into foreign markets are ex-ante more innovative (i.e., innovative firms would self-select into exporting, as innovation activities translate into competitive advantages that allow the firm to compete in international markets), although findings are not conclusive. Evidence that exporting activity spurs (product or process) innovation (i.e., there is a learning-by-exporting effect) is more limited (see Harris and Li, 2009; Aristei et al., 2013).[21] A drawback of these studies is that they are generally based on partial measures of innovation, like R&D expenditure, which do not take into account incremental improvements of products and processes. This would be especially relevant for SMEs or other firms in developing countries who do not have a formal R&D department or where R&D spending is low because overall technical change is of an adaptive nature (Van Dijk, 2002; Pradhan and Das, 2012).

The impact of human capital on firms' export behaviour is related to that of technological capabilities. Accordingly, the argument proposed is that the greater the skill level of the workforce, the higher the propensity to export. Empirical findings tend to support this proposition (see, e.g., Wagner, 2001; Bernard and Jensen, 2004; Alvarez, 2007; Cerrato and Piva, 2012). Similarly, physical capital intensity would enhance export activity since it embodies past innovations or reflects economies of scale (Van Dijk, 2002).[22]

Finally, the domestic market structure may also be related to firms' export behaviour, although there are two conflicting viewpoints regarding the sign of this relationship (Clougherty and Zhang, 2008). On the one hand, the supporters of the so-called national-champion rationale argue

[21] The learning effect induced by participation in international markets is often considered indirectly through the link between innovation and productivity growth (Harris and Li, 2009). Self-selection is consistent with theoretical models such as the one proposed by Atkeson and Burstein (2010), while the learning-by-exporting effect is in accordance with models of endogenous innovation and growth, such as Romer (1990) and Grossman and Helpman (1991).

[22] A potential explanation for findings that exporters are more capital- and skill-intensive than non-exporters, both in developed and developing countries, is technology-skill complementarity (for references see Bernard et al. (2012)).

that greater industry concentration (low domestic competition) allows firms to gain scale economies, which can enable them to compete in export markets (therefore, high levels of market concentration would be positively correlated with exports). On the other hand, those supporting the rivalry rationale point out that domestic rivalry (high domestic competition) pressures firms to improve their performance and innovate, which would allow them to earn large shares and profits in export markets. Empirical studies would mainly support the rivalry rationale; therefore, domestic competition would enhance firms' export activity.

In order to assess whether there are differences in the determinants of export behaviour across firm sizes, equation (1) is run separately for SMEs and large firms. Firms are classified in size categories based on the two size measures considered, which are averaged over the sample period.[23] Now, the variable ***SIZE*** in equation (1) is (the natural logarithm of) the size coefficient or the number of employees. Also, with the aim of evaluating to what extent factors affecting firms' export behaviour differ between small and medium-sized enterprises, the analysis is performed separately for these two firm categories (see table 2).[24]

3.2 Econometric implementation

The starting point for explaining why some firms export and others do not is the existence of sunk costs (Girma et al., 2004), introduced in the theoretical literature by Baldwin (1988, 1989), Baldwin and Krugman (1989), Dixit (1989a, b), and Krugman (1989).[25] Many empirical analyses on firms' export behaviour are based on the dynamic discrete-choice model developed by Roberts and Tybout (1997), which separates the roles of profit heterogeneity and sunk costs in

[23] According to the first size measure, a firm is classified as SME if its overall size coefficient –computed considering the firm's sample average of employment and sales– is lower or equal to 10. Based on the second size measure, a firm is classified as SME if it has, on average, up to 99 employees. Given that average measures may be affected by extreme values, it was controlled that firms classified in each size category belong to that category –according to their yearly size coefficients or number of employees– at least 75 percent of the panel years. In the few cases where this condition did not hold, the classification was based on the firm's most frequent size category (i.e., the size class in which the firm is classified at least 50 percent of the panel years).

[24] According to the size coefficient, a firm is classified as small if its average coefficient is lower or equal to 1.6, and it is considered a medium-sized firm if its average coefficient is higher than 1.6 and lower or equal to 10. When considering the second size measure, small enterprises are those with an average number of employees lower or equal to 19, while medium-sized firms are those with 20-99 employees on average.

[25] These theoretical models suggest that the existence of sunk costs leads to persistence in firm exporting behaviour. This export hysteresis implies that transitory policy changes or macro shocks (such as real exchange rate movements) can produce effects in trade flows that persist after the stimulus that caused them has disappeared.

explaining firms' exporting decisions. The reduced-form model expresses each firm's current exporting status as a function of its previous export-market experience (from which the importance of sunk costs can be inferred), observable firm's characteristics that affect its future profits from exporting, and time-specific effects (reflecting macro-level factors exogenous to the firm, such as exchange rates, trade-policy conditions, and credit-market conditions).

In Roberts and Tybout (1997), a profit-maximizing firm will enter export markets only if the present value of its profits exceeds the entry costs (in other words, if the expected profits net of entry costs are positive). In a multi-period setting and in the presence of entry costs, the expected profits of the firm *i* in period *t* can be expressed as[26]:

$$\Pi_{it} = \mathrm{E}_t\{\sum_{s=t}^{\infty} \delta^{s-t}[\tilde{\pi}_{is}(Q_{is}^*, \mathbf{z}_{is}, \mathbf{g}_s)|X_{is}]\}$$

$$= \mathrm{E}_t\{\sum_{s=t}^{\infty} \delta^{s-t}[P_{is}Q_{is}^* - C_{is}(Q_{is}^*, \mathbf{z}_{is}, \mathbf{g}_s) - N(1 - X_{is-1})|X_{is}]\} \quad (3)$$

where $\tilde{\pi}$ are the period-by-period profits, P_{is} is the export price of goods sold abroad by firm i in period s, Q_{is}^* is firm i's profit-maximizing level of exports in period s,[27] C_{is} is the variable cost of producing quantity Q_{is}^*, $\mathbf{z}_{is}$ is a vector of firm-specific characteristics that influence the probability of exporting (e.g., size, age, productivity, ownership structure), $\mathbf{g}_s$ is a vector of exogenous factors affecting profitability (e.g., business cycles, exchange rates, industry demand shocks), X_{is} is a binary variable indicating the export status of firm i in period s, N is the entry cost that the firm must pay if it did not export last period (i.e., if $X_{is-1} = 0$), and δ is the discount rate.

The firm chooses a sequence of output levels in order to maximize current and discounted future profits. The existence of sunk entry costs makes the decision rule dynamic, because exporting today implies an additional option value of being able to export tomorrow without facing again those costs. The value function for the dynamic programming problem is given by:

$$V_{it} = \max_{X_{it}\in[0,1]}\{\tilde{\pi}_{it}[X_{it} = 1] + \delta\,\mathrm{E}_t[V_{it+1}(.)|X_{it}]\} \quad (4)$$

or, equivalently:

[26] Based on Bernard and Jensen (1999, 2001), and Ottaviano and Volpe Martincus (2011).

[27] It is assumed that, if the firm enters the foreign market, it always produces the profit-maximizing level of exports (as it freely adjusts export levels in response to current market conditions).

$$V_{it} = \max_{Q_{it}^*}\{\tilde{\pi}_{it}[Q_{it}^* > 0] + \delta \, \mathrm{E}_t[V_{it+1}(.)|Q_{it}^*]\} \quad (5)$$

The firm will choose to export in period t (i.e., $X_{it} = 1$, or equivalently, $Q_{it}^* > 0$) if expected profits are greater than zero in present value (i.e., if current and expected future revenues are larger than the current period costs (C_{it}) plus any costs of entry):

$$P_{it}Q_{it}^* + \delta\{E_t[V_{it+1}(.)|X_{it} = 1] - E_t[V_{it+1}(.)|X_{it} = 0]\} > [C_{it} + N_{it}(1 - X_{it-1})] \quad (6)$$

Thus, the solution to the dynamic programming problem can be expressed as the following decision rule:

$$X_{it} = \begin{cases} 1 \text{ if } \hat{R}_{it} > C_{it} + N(1 - X_{it-1}) \\ 0 \text{ otherwise} \end{cases} \quad (7)$$

where $\hat{R}_{it}$ are the revenues of export sales today and any discounted increase in the value of the firm in the future from exporting today (i.e., $\hat{R}_{it} = P_{it}Q_{it}^* + \delta\{E_t[V_{it+1}(.)|X_{it} = 1] - E_t[V_{it+1}(.)|X_{it} = 0]\}$).

The actual decision to export in a particular period depends on whether the firm has exported in the previous period (i.e., its lagged exporting status), firm-specific characteristics ($\mathbf{z}_{it}$), and factors exogenous to the firm ($\mathbf{g}_t$). The theoretical decision rule can then be expressed as an empirical binary choice model of the form:

$$X_{it} = \begin{cases} 1 \text{ if } \beta\mathbf{z}_{it} + \gamma\mathbf{g}_t - N(1 - X_{it-1}) + \varepsilon_{it} > 0 \\ 0 \text{ otherwise} \end{cases} \quad (8)$$

As noted previously, an important issue in the estimation of equations like (8) is that there likely exist unobserved firm characteristics affecting the decision to export. Since these characteristics are potentially permanent, or at least highly serially correlated, they will lead to persistence in export behaviour, either in or out of the market. Thus, failing to account for these unobserved effects can result in the overestimation of the sunk entry costs, as the model will incorrectly attribute the persistence it induces in exporting status to these costs (Roberts and Tybout, 1997; Bernard and Jensen, 2001). It will also lead to biased estimates of the coefficients on the firm characteristics included as regressors (such as firm size, the main variable of interest in this study), which are very likely correlated with the unobserved firm heterogeneity. Following Roberts and Tybout (1997), this unobserved heterogeneity can be formally modelled assuming

that the error term (e_{it}) is the sum of two components: a permanent component that represents unobservable firm-specific factors that induce persistent differences in the returns from exporting (h_i), and a component that represents transitory exogenous shocks to exporting profits (w_{it}).

In addition to export propensity, the existence of sunk entry costs may affect the scope of firms' involvement in export markets, in terms of the number of products exported and the number of export destinations. Each successive product and market entry may imply a new fixed cost and require very specific firm assets and capabilities that the largest firms possess more readily than SMEs (IDB, 2014). Also, smaller firms may face greater obstacles to sustained export participation. Thus, firm size might not only be related to firms' decisions of whether or not to export, but also to firms' choices regarding their expansion in export markets and products, as well as to firms' export success.

As it was mentioned before, this paper investigates the relationship between firm size and five dimensions of firms' export behaviour: export propensity, export intensity, product scope, geographic scope, and export survival. In evaluating the association of size with firms' export propensity, equation (1) is estimated as a conditional fixed-effects logit model, in order to control for unobserved firm heterogeneity. This model has the disadvantage that only the sub-sample of firms that have variation over time in the dependent variable (i.e., firms where the dependent variable switches at least once from 0 to l or vice versa) can be considered in the estimation, which in this case leads to the exclusion of around 70 percent of the observations. For comparison purposes, a standard logit model and a 'fixed-effects' probit model are also estimated. In the probit model specifications, unobserved firm heterogeneity is addressed by including the firm-level time averages of the explanatory variables as additional controls.

The relationship between firm size and export intensity is estimated using a fractional fixed-effects probit model, based on the approach developed by Papke and Wooldridge (1996) and introduced by Wagner (2001) into the empirical literature on the determinants of firms' export activities. This model is particularly appropriate for dealing with fractional (or percentage) dependent variables like the share of exports in total sales, which is by definition bounded between 0 and 1 (or between 0 and 100 percent) and has usually many observations at the lower limit (as many firms do not export at all). Following Wagner (2008), the estimation is performed using the new method introduced by Papke and Wooldridge (2008), which can be applied to

panel data with a large cross-sectional dimension and relatively few time periods, explicitly allowing for time-invariant unobserved effects that can be correlated with the explanatory variables.[28] For robustness check, estimates are performed using two versions of a generalized linear model with a probit link function: 1) one in which unobserved heterogeneity is controlled for by including the firm-level time averages of the explanatory variables, and 2) an unconditional fixed-effects model which includes a dummy variable for each firm. The same method is used to assess the relationship between size and the other fractional dependent variables considered as measures of firms' export performance (the proportion of exported products, and the "two-dimensional" indicator of export concentration).

The association of firm size with the number of products exported and the number of destination countries is evaluated using a conditional fixed-effects Poisson model, which accounts for unobserved heterogeneity.[29] In this case, both the number of products exported and the number of destination countries exhibit zero-inflation (the proportion of zero counts is almost 60 percent), since most firms do not export. In order to account for these excess zeros and to check for robustness of the results, a zero-inflated Poisson (ZIP) model is also estimated.

Finally, the way in which enterprise size relates with firms' export survival is evaluated using duration or survival methods, in order to deal with the problem of right-censoring of survival times –which, if ignored, may lead to inconsistent estimates of the covariates–.[30] These methods model survival times indirectly, via the so-called hazard rate, a concept related to chances of making a transition out of the current state at each time period, conditional on survival up to that point (Jenkins, 2005). Also, unobserved individual heterogeneity (such as firms' managerial or organizational capabilities, and access to specific assets) is controlled for. For the sake of robustness, two alternative (discrete-time) models are considered: a proportional hazard

[28] I thank Prof. Jeffrey Wooldridge for providing a code example for performing fractional probit models with unbalanced panels.

[29] Count data can be analyzed using both Poisson and negative binomial regression models. Although the Poisson model may not be totally adequate in the presence of overdispersion in the data (as it assumes that the conditional mean and variance of the dependent variable are equal), the way in which the negative binomial model addresses the overdispersion problem makes the Poisson approach preferable.

[30] The presence of right-censored observations is generated because most firms are not observed from entry to exit; rather, the sample period generally ends before the relevant event (firm exit) has occurred. Consequently, the total length of time between entry to and exit from the export market is unknown.

(complementary log-log) model with Gamma-distributed unobserved heterogeneity, and a logistic hazard model with log-normal unobserved heterogeneity.[31]

The following hazard function is estimated:

$$h(t, \mathbf{z}_{it-1}|v_i) = h_0(t) + \gamma_{size} SIZE_{it-1} + \gamma_z \mathbf{z}_{it-1} + u_i \qquad (9)$$

where v_i is a time-invariant unobservable firm effect, $u_i \equiv \log(v_i)$, $h_0(t)$ is the baseline hazard function[32], *SIZE* is the measure of firm size, and $\mathbf{z}_{it-1}$ is a set of control variables.

As in equation (1), the set of control variables considered in equation (9) are aimed at taking account of other factors that may be associated with firms' export survival (besides firm size). Here, the variables included are: age, productivity, foreign ownership, R&D intensity, human capital intensity, physical capital intensity, and the index of market concentration. Also in this case, both the size measures and the control variables are lagged one period to avoid simultaneity problems. Additionally, some firm-level export performance indicators are included as controls (average export propensity, average number of product exported, and average number of destination countries). Also, in order to control for the fact that a firm's exit from export market may be driven by the firm's shutdown, a dummy variable that takes the value one if the firm fails at time *t+1* (and zero otherwise) is added to the regressions.

4. Data and descriptive evidence

The empirical analysis carried out in this paper is based on an unbalanced panel of Uruguayan manufacturing firms, which covers the period 1997-2005.[33] The panel contains annual firm-level

[31] The use of discrete-time duration models is determined by the fact that the panel used in this study contains grouped duration data (i.e., survival times are grouped into number of years). Although the underlying transition process (firm exit from export market) occurs in continuous time, the data are observed annually.

[32] The baseline hazard function summarizes the pattern of duration dependence (i.e., how the hazard varies with survival times), which is assumed to be common to all firms.

[33] The panel dataset was constructed using survey data from the Uruguayan national statistics office. The data sources were the IV Economic Census (1997) and the annual Economic Activity Surveys (EAE, for its Spanish acronym) (1998-2005). The EAE includes all formal firms with 50 or more employees and a random sample of those with 5 to 49 employees. From the Economic Census, which encompassed all formal manufacturing enterprises that were active in 1997, only those firms surveyed in the 1998 EAE were considered.

data (in 1997 constant prices) on sales, value added, capital,[34] intermediate inputs (disaggregated in domestically-purchased and imported), energy, and other expenditures.[35] It also includes data on employment and foreign capital participation, as well as information on the products produced by the firm (broken down according to their international or domestic destination).[36] The firm-specific product and geographic export scope measures considered in the analysis (see table 1) were computed using, in addition, information from the Uruguayan customs office, which comprises firm-level data on annual export flows (including export values, quantities and countries of destination by product, at the eight-digit HS level).

According to the National Institute of Statistics of Uruguay (INE), firms with fewer than 100 employees make up almost 99 percent of enterprises in the Uruguayan manufacturing industry, accounting for around 60 percent of sectoral employment (see figure 1). The vast majority of these firms are micro enterprises (1-4 employees), not encompassed in the manufacturing surveys from which the data used in this study were drawn. On average, over the period 1997-2005, small (5-19 employees) and medium-sized (20-99 employees) firms constituted around 30 percent of total manufacturing enterprises, and accounted for around 50 percent of total manufacturing employment. If micro firms are excluded, SMEs represented, on average, around 95 percent of enterprises and 58 percent of employment in the manufacturing industry.

As for this paper's dataset, the two classification criteria considered yield similar results in terms of the distribution of firms by size category. Firms classified as SMEs according to their average number of employees (i.e., those with an average employment lower or equal to 99) represent 83 percent of total firms, with 30 percent of small firms and 53 percent of medium-sized enterprises (see table 5). When firms are classified on the basis of their average size coefficient, the

[34] The capital stock (tangible assets excluding land and buildings) was calculated using the perpetual inventory method, taking as initial stock the asset's book value of the first year available for each firm.

[35] The current price data were deflated using detailed price indices for each variable. For sales and intermediate inputs, firm-specific deflators were computed as the weighted average of the price indices (at the four-digit level of the ISIC revision 3) corresponding to all items produced and used as inputs, respectively, each year by the firm (where weights were given by the yearly share of each item in the firm's product/input basket).

[36] Survey data contain the value of each firm's sales, disaggregated by product into domestic sales and exports. Product codes are those of the Uruguayan Classification of Economic Activities (CLAEU, for its Spanish acronym), which is based on the ISIC revision 3 and the Central Product Classification (CPC) version 1.0.

proportion of SMEs in the total number of enterprises is 84 percent, with 33 percent of small firms and 51 percent of medium-sized enterprises (see table 4).[37]

The analysis of the yearly classification of firms shows that most enterprises in the dataset remain in the same size group over the sample period, particularly in the case of SMEs (see table 3). Around 94 percent of firms classified as SMEs belong to that size category during the whole observation period, while for large enterprises the fraction of firms that do not change their size group is around 70 percent when considering the size coefficient as classification criterion and 61 percent when classification is based on the number of employees. For firms classified as large according to their average size coefficient, the fraction that changes their size class at least once over the sample period includes: around 9 percent of firms that were in the SME group in their first year in the dataset and ended as large enterprises, 8 percent that started and ended as large firms, around 12 percent that started as large and ended as SMEs, and less than 2 percent that started and ended as SMEs. When the classification criterion is the average number of employees, these percentages are 10, 11, 17 and less than 1, respectively.

Tables 4 and 5 report descriptive statistics for the firms in the dataset, averaged over the sample period. They show significant differences between size groups, mainly in terms of sales, value-added, capital and labour (the more direct size-related variables). Also, large enterprises exhibit a considerably higher labour productivity (value-added per employee) than SMEs, in particular when firms are classified on the basis of their size coefficient. Large firms are also more capital and skill intensive, and the presence of foreign capital is more frequent among them. Within SMEs, there are as well significant differences between small and medium-sized firms. A common feature of all size groups is their low R&D intensities.

Differences in size are also associated with firms' participation in international markets, both as exporters and importers. The proportion of firms that export is around two-fold higher for large enterprises than for SMEs; however, for those firms that export, the average share of foreign sales in total sales is similar between both size groups (around 42 percent and 36 percent,

[37] Of those firms classified as SMEs according to their average number of employees, 98 percent are also classified as SMEs on the basis of their average size coefficient. As for the classification of SMEs into small and medium-sized enterprises, 93 percent of firms classified as small according to their average number of employees are also classified as small when considering their average size coefficient, and 86 percent of firms classified as medium-sized enterprises on the basis of their average number of employees are classified in the same category according to their average size coefficient.

respectively, with both classification criteria). Remarkably, exporting small enterprises show almost the same average export share than large firms (in fact, this share is even slightly higher for small firms), although the fraction of small enterprises that export is only around 15 percent (compared to more than 80 percent for large firms and around 60 percent for medium-sized enterprises). Similarly, the proportion of firms that import intermediate inputs is considerably higher for large enterprises (in particular, compared to small firms), while for input-importing firms the share of imports in total intermediates is quite similar for all size groups.

5. Estimation results

Tables 6A and 6B present the results on the estimation of the relationship of firm size with export propensity, for size indicators based on firms' size coefficient and employment level, respectively. These estimates show that, even when controlling for unobserved firm heterogeneity, SMEs' likelihood to export is lower than that of large firms (i.e., there is a significant positive association between size and the firm's probability of exporting). Consistently, the (absolute) value of the coefficient on the size indicator is larger in the case of small enterprises, relative to medium-sized firms.

Tables 7A and 7B report the results for the estimates carried out to evaluate the association between firm size and export intensity. They show a significant negative relationship between the size indicator variables and the share of exports in firms' total sales, indicating that this dimension of Uruguayan manufacturing firms' participation in export markets is positively associated with the size of the firm. However, some differences are observed depending on the size measure considered. These differences will be explored in the full version of the paper.

The results regarding the control variables, when significant, are mainly consistent with findings of prior studies and expectations. Particularly, they show robust evidence of a positive relationship between productivity and firms' involvement in export markets, indicating that exporting firms are more productive and they self-select (which would suggest the existence of sunk costs of entry into foreign markets that only the most productive firms find it profitable to incur). Also, prior export-market experience significantly affects current exporting activities; particularly, by increasing the likelihood to export. On the other hand, the significant positive

relationship between the firm's import status and the probability of exporting would point to the presence of common sunk entry costs.

The results on the estimation of the relationship of firm size with the other export performance indicators considered show that firms' involvement in exporting activities –in terms of the number of products exported, the number of destination countries and the overall diversification of export sales– is negatively associated with firm size. Also, the results obtained indicate that large firms have better survival prospects in export markets than SMEs.[38]

6. Concluding remarks

SMEs worldwide are more and more faced with opportunities and challenges presented by economic globalization. Despite their increasingly active role in foreign markets, evidence drawn mainly from developed economies suggests that several obstacles still constrain SMEs' international activities. This paper provides a developing country perspective on this issue, empirically evaluating the relationship between size and firms' involvement in export markets in the case of the Uruguayan manufacturing industry.

Using detailed firm-level panel data covering the period 1997-2005, this study investigates how enterprise size relates to five dimensions of firms' export performance: export propensity, export intensity, product scope, geographic scope, and export survival. Controlling for other firm characteristics that may be associated with export activities, as well as for unobserved firm heterogeneity, the results obtained robustly suggest that the resource constraints that characterize SMEs might be hampering these firms' participation in export markets. These findings provide support for the argument that policymakers should develop specific initiatives regarding internationalization of SMEs. Given the important role played by SMEs in the Uruguayan economy, the improvement of their international insertion is crucial for strengthening the country's export performance, as well as for enhancing the impact of exports on the rest of the economy.

[38] These results could not be included in this preliminary version of the paper due to time constraints; however, they are available upon request.

The paper will be completed with a deeper analysis of the results presented in section 5 (as well as of those not included in this preliminary version). Also, the richness of the firm-level export database used in this study will be exploited in order to characterize firms' export profiles, in terms of products and destination countries. In addition, the full version of the paper will include an analysis of the determinants of firms' export performance by size groups.

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Table 1
Description of dependent and independent variables

	Variable	Description
Dependent variables	Export propensity	1 if the firm exports at time *t*, 0 otherwise
	Export intensity	Share of exports in firm's total sales at time *t*
	Product scope	
	Number of products exported	Number of export lines at the 8-digit HS level at time *t*
	Proportion of exported products	Ratio of number of exported products to total number of products produced by the firm at time *t* (CLAEU codes)
	Geographic scope	Number of countries to which the firm exports to at time *t*
	Exports concentration	Share of main product-destination in firm's total exports at time *t*
	Exit	1 if the firm exports at time *t* and does not export at time *t+1* and beyond, 0 otherwise
Independent variables	Size	
	SC_{it-1}	Firm's size coefficient at time *t-1*
	$SME1_{it-1}$	1 if the firm's size coefficient is lower or equal to 10 at time *t-1* (i.e., $SC_{it-1} \leq 10$), 0 otherwise
	$SE1_{it-1}$	1 if the firm's size coefficient is lower or equal to 1.6 at time *t-1* (i.e., $SC_{it-1} \leq 1.6$), 0 otherwise
	$ME1_{it-1}$	1 if the firm's size coefficient is higher than 1.6 and lower or equal to 10 at time *t-1* (i.e., $1.6 < SC_{it-1} \leq 10$), 0 otherwise
	EMP_{it-1}	Firm's number of employees at time *t-1*
	$SME2_{it-1}$	1 if the firm's number of employees is lower or equal to 99 at time *t-1* (i.e., $EMP_{it-1} \leq 99$), 0 otherwise
	$SE2_{it-1}$	1 if the firm's number of employees is lower or equal to 19 at time *t-1* (i.e., $EMP_{it-1} \leq 19$), 0 otherwise
	$ME2_{it-1}$	1 if the firm's number of employees is higher than 19 and lower or equal to 99 at time *t-1* (i.e., $19 < EMP_{it-1} \leq 99$), 0 otherwise
	Age	Lagged log of number of years that the firm has been in operation
	Productivity	Lagged log of labour productivity
	Exporting experience	1 if the firm has any prior exporting experience (i.e., it exported in any previous year in the data), 0 otherwise
	Import status	1 if the firm imported intermediate inputs at *t-1*, 0 otherwise
	Foreign ownership	1 if there is any presence of foreign capital in firm's total capital at time *t-1*, 0 otherwise
	R&D intensity	R&D expenditure over sales at time *t-1*
	Physical capital intensity	Log of capital-labour ratio at time *t-1*
	Human capital intensity	Proportion of skilled workers (professionals and technicians) in firm's total employment at time *t-1*
	Industry concentration	Herfindahl index of industry concentration at time *t-1* (3-digit ISIC revision 3 level)

Table 2
Firm classification criteria

Firm category	Employees	Annual sales (in UI)	Size coefficient
SMEs	5-99	<= 75 millions	<= 10
Small	5-19	<= 10 millions	<= 1.6
Medium	20-99	> 10 & <= 75 millions	> 1.6 & <= 10
Large	>= 100	> 75 millions	> 10

Source: Author's elaboration.

Table 3
Changes in firms' classification over the sample period

Firms classified as SMEs

		No change Last year		At least one change Last year		
		SME	Large	SME	Large	Total
Classification criterion: size coefficient						
First year	SME	93.5		1.3	2.7	97.4
	Large			2.6	0.0	2.6
Classification criterion: number of employees						
First year	SME	93.6		0.8	2.0	96.3
	Large			3.5	0.1	3.7

Firms classified as large

		No change Last year		At least one change Last year		
		SME	Large	SME	Large	Total
Classification criterion: size coefficient						
First year	SME			1.4	8.9	10.3
	Large		69.9	11.6	8.2	89.7
Classification criterion: number of employees						
First year	SME			0.6	10.1	10.7
	Large		61.0	17.0	11.3	89.3

Source: Author's elaboration.

Table 4
Descriptive statistics, averages 1997-2005[a]
Firms classified according to their average size coefficient

	All	SMEs	Small enterprises	Medium-sized enterprises	Large enterprises
Firms					
Number	926	780	305	475	146
Percentage		84.2	32.9	51.3	15.8
Observations					
Number	5,900	4,795	1,582	3,213	1,105
Percentage		81.3	26.8	54.5	18.7
Output[b]	67.5	17.7	2.8	25.0	283.9
	(209.6)	(22.1)	(3.1)	(23.8)	(418.2)
Value added[b]	26.7	7.4	1.1	10.5	110.6
	(103.4)	(11.3)	(1.2)	(12.6)	(218.8)
Capital[b]	13.4	3.8	0.7	5.4	54.8
	(45.3)	(8.0)	(1.6)	(9.3)	(92.6)
Labour[c]	79.1	38.8	12.6	51.7	253.8
	(145.1)	(31.7)	(8.1)	(31.0)	(265.5)
Value added per employee[d]	276.0	194.6	99.7	241.3	629.1
	(1,103.7)	(572.0)	(198.7)	(679.9)	(2,221.4)
Age	28.1	25.9	19.8	29.0	37.4
	(16.4)	(14.8)	(12.5)	(14.9)	(19.4)
R&D intensity[e]	0.08	0.08	0.04	0.10	0.08
	(0.43)	(0.46)	(0.42)	(0.48)	(0.29)
Human capital intensity[e]	2.5	1.8	0.6	2.5	5.1
	(5.9)	(4.9)	(2.9)	(5.5)	(8.6)
Physical capital intensity[d]	125.9	101.3	71.9	115.8	232.4
	(229.1)	(201.1)	(211.0)	(194.5)	(301.4)
Foreign capital[f]	9.4	5.6	1.0	8.6	29.5
Exporters[g]	49.2	42.2	14.4	60.0	87.0
Export share[e]					
Exporting firms	38.0	35.9	42.5	35.2	41.7
	(34.5)	(34.8)	(34.6)	(34.8)	(33.8)
All firms	15.2	11.2	3.5	15.1	33.0
	(28.7)	(25.6)	(15.4)	(28.6)	(34.5)
Importers[h]	54.1	49.1	19.0	68.4	80.8
Import share[e]					
Importing firms	55.2	53.4	51.7	53.5	60.0
	(31.7)	(30.9)	(30.5)	(31.0)	(33.0)
All firms	26.9	22.8	6.7	30.7	44.4
	(35.4)	(33.3)	(20.5)	(35.4)	(38.7)

Notes: [a] Standard deviations in parentheses; [b] Millions of constant Uruguayan pesos (base year 1997); [c] Total employment (number of employees); [e] Thousands of constant Uruguayan pesos (base year 1997); [e] In percentages; [f] Percentage of firms with foreign capital participation at least one year over the sample period; [g] Percentage of firms that export at least once over the sample period; [h] Percentage of firms that import intermediates at least once over the sample period.

Source: Author's elaboration.

Table 5
Descriptive statistics, averages 1997-2005[a]
Firms classified according to their average number of employees

	All	SMEs	Small enterprises	Medium-sized enterprises	Large enterprises
Firms					
Number	926	767	274	493	159
Percentage		82.8	29.6	53.2	17.2
Observations					
Number	5,900	4,703	1,437	3,266	1,197
Percentage		79.7	24.4	55.4	20.3
Output[b]	67.5	24.0	5.0	32.3	238.8
	(209.6)	(97.9)	(17.5)	(116.0)	(376.9)
Value added[b]	26.7	10.6	1.9	14.4	90.1
	(103.4)	(61.3)	(11.0)	(72.8)	(181.4)
Capital[b]	13.4	3.9	1.0	5.2	50.6
	(45.3)	(8.2)	(2.5)	(9.5)	(90.1)
Labour[c]	79.1	36.0	10.7	47.1	248.3
	(145.1)	(26.4)	(5.5)	(24.2)	(255.2)
Value added per employee[d]	276.0	254.5	169.9	291.7	360.3
	(1,103.7)	(1,209.0)	(989.7)	(1,292.2)	(502.7)
Age	28.1	25.9	19.9	28.6	36.4
	(16.4)	(15.0)	(13.1)	(14.9)	(19.0)
R&D intensity[e]	0.08	0.07	0.04	0.09	0.08
	(0.43)	(0.46)	(0.44)	(0.46)	(0.32)
Human capital intensity[e]	2.5	2.0	0.8	2.6	4.1
	(5.9)	(5.2)	(3.5)	(5.8)	(7.7)
Physical capital intensity[d]	125.9	105.9	91.3	112.3	204.3
	(229.1)	(208.8)	(250.0)	(187.5)	(282.5)
Foreign capital[f]	9.4	6.4	2.2	8.7	23.9
Exporters[g]	49.2	41.9	15.3	56.6	84.9
Export share[e]					
Exporting firms	38.0	35.7	43.0	34.9	41.7
	(34.5)	(34.9)	(33.1)	(35.0)	(33.6)
All firms	15.2	11.0	4.0	14.2	31.8
	(28.7)	(25.5)	(16.1)	(28.2)	(34.3)
Importers[h]	54.1	48.8	19.3	65.1	79.9
Import share[e]					
Importing firms	55.2	55.6	48.9	56.4	54.4
	(31.7)	(31.1)	(33.7)	(30.7)	(32.9)
All firms	26.9	23.6	7.0	30.9	39.6
	(35.4)	(34.2)	(21.3)	(36.1)	(37.1)

Notes: [a] Standard deviations in parentheses; [b] Millions of constant Uruguayan pesos (base year 1997); [c] Total employment (number of employees); [e] Thousands of constant Uruguayan pesos (base year 1997); [e] In percentages; [f] Percentage of firms with foreign capital participation at least one year over the sample period; [g] Percentage of firms that export at least once over the sample period; [h] Percentage of firms that import intermediates at least once over the sample period.

Source: Author's elaboration.

Table 6A
Determinants of export propensity of Uruguayan manufacturing firms, 1997-2005
Size indicators based on firms' size coefficient

	Standard logit model		Fixed-effects logit model		'Fixed-effects' probit model	
	(1)	(2)	(3)	(4)	(5)	(6)
Small or medium-sized enterprise (SME1)	-1.382***		-1.132***		-0.525***	
	(0.244)		(0.385)		(0.196)	
Small enterprise (SE1)		-2.166***		-1.110**		-0.414
		(0.340)		(0.514)		(0.293)
Medium enterprise (ME1)		-1.334***		-1.131***		-0.521***
		(0.242)		(0.385)		(0.196)
Age	-0.431***	-0.451***	0.248	0.253	-0.249	-0.259
	(0.120)	(0.120)	(0.950)	(0.968)	(0.432)	(0.432)
Productivity	0.216**	0.126	0.422***	0.423***	0.101*	0.106*
	(0.0958)	(0.103)	(0.148)	(0.149)	(0.0569)	(0.0578)
Exporting experience	4.010***	3.897***	0.883***	0.884***	0.662***	0.663***
	(0.219)	(0.219)	(0.310)	(0.312)	(0.224)	(0.224)
Importing activity	0.733***	0.626***	0.814***	0.814***	0.331***	0.330***
	(0.179)	(0.179)	(0.235)	(0.235)	(0.125)	(0.125)
Foreign ownership	0.222	0.219	5.095	5.077	-0.509	-0.512
	(0.290)	(0.287)	(123.8)	(121.5)	(0.396)	(0.398)
R&D intensity	21.78*	19.47	-11.32	-11.28	-4.976	-4.924
	(12.28)	(12.38)	(51.11)	(51.11)	(7.544)	(7.583)
Physical capital intensity	0.213***	0.232***	-0.281*	-0.282*	-0.0152	-0.0238
	(0.0793)	(0.0809)	(0.164)	(0.168)	(0.0898)	(0.0925)
Human capital intensity	4.206**	4.072**	-3.833	-3.827	0.0196	0.0395
	(1.888)	(1.875)	(2.555)	(2.564)	(1.438)	(1.433)
Industry concentration	-0.508	-0.197	-0.597	-0.606	-0.309	-0.349
	(1.217)	(1.252)	(1.383)	(1.388)	(0.775)	(0.782)
Time dummies	yes	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes	yes
Observations	4,337	4,337	1,159	1,159	3,220	3,220

Notes: i) All independent variables are lagged one period; ii) Robust standard errors adjusted for clustering at the firm level in parentheses; iii) *** significant at 1%, ** significant at 5%, * significant at 10%; iv) The results on the averages of the explanatory variables, included in the probit model specifications, are not reported in the table due to space considerations.
Source: Author's estimations.

Table 6B
Determinants of export propensity of Uruguayan manufacturing firms, 1997-2005
Size indicators based on firms' employment level

	Standard logit model		Fixed-effects logit model		'Fixed-effects' probit model	
	(1)	(2)	(3)	(4)	(5)	(6)
Small or medium-sized enterprise (SME2)	-1.344***		-1.142***		-0.623***	
	(0.221)		(0.335)		(0.173)	
Small enterprise (SE2)		-2.076***		-1.308***		-0.717***
		(0.302)		(0.487)		(0.272)
Medium enterprise (ME2)		-1.261***		-1.149***		-0.626***
		(0.221)		(0.335)		(0.174)
Age	-0.436***	-0.460***	0.0165	0.0554	-0.251	-0.230
	(0.120)	(0.123)	(0.948)	(1.002)	(0.437)	(0.430)
Productivity	0.309***	0.281***	0.473***	0.473***	0.125**	0.125**
	(0.0951)	(0.0975)	(0.146)	(0.146)	(0.0568)	(0.0569)
Exporting experience	4.052***	3.961***	0.920***	0.910***	0.668***	0.664***
	(0.224)	(0.227)	(0.309)	(0.311)	(0.225)	(0.225)
Importing activity	0.679***	0.592***	0.794***	0.787***	0.328***	0.327***
	(0.187)	(0.187)	(0.236)	(0.236)	(0.124)	(0.124)
Foreign ownership	0.216	0.204	5.006	5.098	-0.478	-0.473
	(0.280)	(0.279)	(107.5)	(118.6)	(0.409)	(0.407)
R&D intensity	19.82	18.87	-11.54	-11.45	-4.816	-4.875
	(12.55)	(12.20)	(48.31)	(48.28)	(8.232)	(8.234)
Physical capital intensity	0.223***	0.250***	-0.268	-0.249	-0.000481	0.00838
	(0.0795)	(0.0815)	(0.168)	(0.170)	(0.0889)	(0.0927)
Human capital intensity	4.206**	4.073**	-3.961	-4.019	-0.0667	-0.0739
	(1.875)	(1.884)	(2.584)	(2.595)	(1.432)	(1.433)
Industry concentration	-0.603	-0.525	-0.801	-0.785	-0.343	-0.331
	(1.296)	(1.303)	(1.369)	(1.370)	(0.792)	(0.791)
Time dummies	yes	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes	yes
Observations	4,337	4,337	1,159	1,159	3,220	3,220

Notes: i) All independent variables are lagged one period; ii) Robust standard errors adjusted for clustering at the firm level in parentheses; iii) *** significant at 1%, ** significant at 5%, * significant at 10%; iv) The results on the averages of the explanatory variables, included in the probit model specifications, are not reported in the table due to space considerations.
Source: Author's estimations.

Table 7A
Determinants of export intensity of Uruguayan manufacturing firms, 1997-2005
Size indicators based on firms' size coefficient

	Fixed-effects generalized linear model 1		Fixed-effects generalized linear model 2	
	(1)	(2)	(3)	(4)
Small or medium-sized enterprise (SME1)	-0.267**		-0.180*	
	(0.127)		(0.104)	
Small enterprise (SE1)		-0.0440		-0.256
		(0.200)		(0.188)
Medium enterprise (ME1)		-0.261**		-0.183*
		(0.127)		(0.103)
Age	0.0698	0.0645	0.150	0.152
	(0.301)	(0.306)	(0.273)	(0.271)
Productivity	0.0184	0.0251	0.0806**	0.0782**
	(0.0350)	(0.0355)	(0.0383)	(0.0385)
Exporting experience	0.401*	0.406*	0.114	0.115
	(0.213)	(0.215)	(0.197)	(0.197)
Importing activity	0.104	0.101	0.0863	0.0851
	(0.0951)	(0.0953)	(0.0949)	(0.0949)
Foreign ownership	-0.672*	-0.681*	0.0272	0.0280
	(0.367)	(0.368)	(0.141)	(0.141)
R&D intensity	-0.677	-0.523	-2.390	-2.419
	(5.361)	(5.400)	(2.974)	(2.968)
Physical capital intensity	-0.115**	-0.132**	-0.0900*	-0.0855
	(0.0535)	(0.0562)	(0.0526)	(0.0526)
Human capital intensity	0.291	0.327	-0.165	-0.170
	(0.479)	(0.484)	(0.757)	(0.753)
Industry concentration	0.0878	0.0251	0.121	0.131
	(0.289)	(0.288)	(0.316)	(0.321)
Time dummies	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes
Observations	3,294	3,294	4,373	4,373

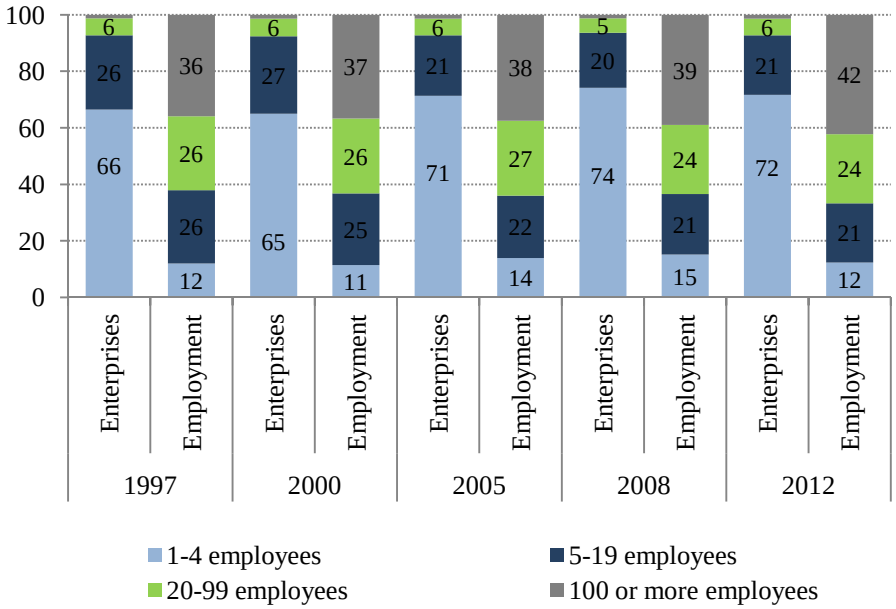
Notes: i) All independent variables are lagged one period; ii) Firm-clustered bootstrap standard errors in parentheses (500 replications); iii) *** significant at 1%, ** significant at 5%, * significant at 10%.
Source: Author's estimations.

Table 7B
Determinants of export intensity of Uruguayan manufacturing firms, 1997-2005
Size indicators based on firms' employment level

	Fixed-effects generalized linear model 1		Fixed-effects generalized linear model 2	
	(1)	(2)	(3)	(4)
Small or medium-sized enterprise (SME2)	-0.284**		-0.250**	
	(0.113)		(0.101)	
Small enterprise (SE2)		-0.415*		-0.485***
		(0.215)		(0.166)
Medium enterprise (ME2)		-0.288**		-0.262***
		(0.113)		(0.101)
Age	0.0850	0.102	0.150	0.154
	(0.288)	(0.285)	(0.268)	(0.264)
Productivity	0.0275	0.0293	0.0874**	0.0890**
	(0.0348)	(0.0350)	(0.0386)	(0.0388)
Exporting experience	0.398*	0.397*	0.116	0.106
	(0.214)	(0.215)	(0.199)	(0.197)
Importing activity	0.104	0.103	0.0834	0.0765
	(0.0947)	(0.0944)	(0.0944)	(0.0946)
Foreign ownership	-0.667*	-0.656*	0.0231	0.0341
	(0.363)	(0.363)	(0.139)	(0.141)
R&D intensity	-0.439	-0.451	-2.338	-2.134
	(5.323)	(5.253)	(2.942)	(2.910)
Physical capital intensity	-0.108**	-0.0947*	-0.0801	-0.0565
	(0.0530)	(0.0538)	(0.0535)	(0.0531)
Human capital intensity	0.222	0.222	-0.207	-0.161
	(0.465)	(0.462)	(0.750)	(0.745)
Industry concentration	0.127	0.137	0.156	0.156
	(0.289)	(0.291)	(0.312)	(0.313)
Time dummies	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes
Observations	3,294	3,294	4,373	4,373

Notes: i) All independent variables are lagged one period; ii) Firm-clustered bootstrap standard errors in parentheses (500 replications); iii) *** significant at 1%, ** significant at 5%, * significant at 10%.
Source: Author's estimations.

Figure 1
Uruguayan manufacturing industry: Distribution of number of enterprises and employment by firms' size range, selected years



Source: Author's elaboration, on the basis of data from INE.