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Do the Most Productive Firms Become Exporters? Application of a test for the case of Portugal

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Abstract

Using a longitudinal database (1996-2003) at the plant level, this article aims to shed light on the proposition that most productive domestic firms self-select to export markets. Self-selection and learning by exporting are two non-mutually-exclusive theses that attempt to explain the high correlation between firms' international trade involvement and their superior performance relative to domestic firms. In general, we find evidence of a self-selection to exports. However, there is significant heterogeneity of sales destinations, firm import status before exporting, and the specificities of the sectors firms belong to.

Key words: exports, imports, self-selection.
JEL Classification: F14, D24.

Introduction

Since the mid-1990s, there has been an on-going debate on the relationship between firms' international trade involvement and their performance, namely productivity. Pioneered by the works of Bernard and Jensen (1995) and Aw and Hang (1995), several works in recent years aim to shed light on this issue.

Two non-mutually-exclusive theses attempt to explain the observed high correlation between trade and productivity at the firm level: the *self-selection* thesis argues that only the most productive domestic firms become exporters, while the *learning-by-exporting* thesis claims that firms become more efficient as they begin exporting and experience acceleration in productivity growth compared to non-exporters.

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Although not an aim of this article, we note that in the learning-by-exporting thesis, knowledge flows from international clients or competitors and may be able to improve the post-entry performance of export starters. Moreover, firms participating in international markets are exposed to more intense competition and may have the need to improve their efficiency more rapidly than firms who sell their products only domestically.[1]

Self-selection is based on two assumptions: the first is that some firms choose to buy and sell in foreign markets because they are more interesting or have more potential than domestic ones; the second is that foreign-market entry involves strong fixed costs (*e.g.*, Jovanovic, 1982; Roberts and Tybout, 1997). In this same line of thinking, only the most productive domestic firms could overcome these costs and would self-select into foreign markets. Along these same lines, we could argue that many firms make a conscious decision to begin exporting (Yeaple, 2005), since they deliberately "invest" some years before becoming exporters and taking advantage of the opportunities in foreign markets; in these cases, higher productivity growth previous to the decision to export would result from such deliberate policies and preparation for future foreign market participation.

To study whether this analysis applies to Portuguese industrial firms, we use a large sample of Portuguese manufacturing companies for the period 1996-2003 for which data is available on economic, financial, and international trade variables. Empirically, to evaluate self-selection, we apply both a random effect probit model and a parametric test.

Using the probit methodology, we evaluate the probability of a firm becoming an exporter due to certain lagged variables, such as, among others, their size, foreign ownership status, or productivity levels before entry; in the second methodology, we regress some performance variables in the period t on dummies indicating if a firm is an export starter at time $t + \delta$ and on a set of control variables (*e.g.*, sectoral dummies).

Applying both probit models and Ordinary Least Squares (OLS) regressions, we test self-selection and, in general, we found clear evidence of it. Moreover, to reveal the heterogeneity of its effects, we also analyzed the connections between self-selection and imports, on the one hand, and between self-selection and export market destinations, on the other.

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[1] See Clerides, Lach y Tybout (1998) for a general introduction to this issue.

Nevertheless, given that new exporters' decisions are also influenced by firm managers' and owners' visions and dreams, we also refer in our conclusion to certain previous studies, which include interviews with new Portuguese exporters in order to observe and confirm the reasons why domestic firms begin exporting or are prevented from doing so.

The remainder of the article is organized as follows: after the introduction, section 2 presents a review of the main literature on self-selection and on the determinants of firms' export entry. Section 3 describes the data. Section 4 econometrically tests whether *ex-ante* firms' features influence the decision to enter into export markets. Section 5 presents some concluding remarks.

Self-selection reviewed

A large majority of empirical studies found strong evidence of self-selection (Wagner, 2007).[2] Nevertheless, little research based on micro-level data has investigated how future exporters' characteristics vary according to country destinations. In a rare study concerning all these factors, De Loecker (2007) finds significantly higher productivity premiums for Slovenian firms starting to export to higher-income markets. Using a sample of Mexican manufacturing firms, Verhoogen (2008) shows, for a developing country, that an increase in the incentive to export forces exporting firms to upgrade their production process and technologies and, in consequence, to maintain a higher quality workforce.

Conceptually, self-selection may be explained by two main hypotheses: 1) forward-looking firms increase their productivity with the explicit purpose of becoming exporters in the future and then to benefit from larger markets (conscious self-selection); 2) firms become more productive for reasons unrelated to exporting and later decide to export. This is important for policy design; if firms become more productive in order to export, then policies to encourage exports should improve productivity.

The idea that forward-looking firms may increase their productivity when targeting export markets is partly based on the observation that goods produced for foreign markets are, at least in developing countries, of a higher quality than analogous products made for the domestic market (*e.g.*, Keesing, 1983; and Keesing and Lall, 1992). Thus, a firm attempting to become an exporter may need

[2] McCann (2009) in a study of Irish firms is one of the few known exceptions.

to produce higher-quality goods, often by using more advanced technologies and more efficient organizational schemes. The argument that potentially higher returns available in international markets constitute an incentive to increase productivity is supported by anecdotal evidence and case studies (Haussmann and Rodrik, 2003, present several examples). Moreover, the core of this problem is relative competitiveness of firms across boundaries in different sectors (in Porter's sense of the term) given that, if a firm does not "feel" that competitiveness, there is no potential to export.

Complementarily, the idea that distinct firm features are required to export to different foreign markets has been considered recently in the theoretical model proposed by Chaney (2008). Expanding on Melitz (2003), Channey's model assumes that the combination of market-specific fixed entry costs and productivity differences among firms may explain why the number of firms –the extensive margin– able to overcome trade barriers change from market to market. This self-selection model differentiates one market from another, implying that each foreign market is associated with a distinct productivity threshold. Along these same lines, it should be observed that exporting firms with lower productivity serve a limited number of markets with low productivity thresholds. By contrast, exporting firms with higher productivity should export to a large number of markets with high productivity thresholds.

Reviewing the literature, we can distinguish three groups of factors influencing the propensity of a firm to export, in general, and to begin exporting, in particular: 1) firms' features and performance before beginning export; 2) sunk-entry costs of entering markets where firms want to sell, and 3) macroeconomic variables influencing all firms' ability to export.

The theoretical modeling literature contains explicit and implicit references to the decision to export. It is worth mentioning two different models of international trade that assumed, for the first time, firms' heterogeneity regarding productivity. Bernard *et al.* (2003) developed a multi-country Ricardian-based model, and Melitz (2003) introduced the referred novelty in an intra-industry trade model *à la* Krugman (1980).

Melitz's model assumes conditions of monopolistic competition in which firms produce a variety of goods and draw their productivity from a fixed distribution. There are fixed production costs and fixed and variable entry costs in export markets; thus, the productivity of the firm and the expected probability of entering the foreign market are positively related. In fact, entering export

market entails several expenditures such as market research costs, market development, and distribution channel development costs. A forward-looking manager would weigh these sunk-entry costs incurred during market entry against the future expected stream of income. Thus, entering export markets becomes a matter of which firms have the capacity to undertake this investment.

However, none of these models explained eventual learning-by-exporting effects, as both assumed that participation decisions in export markets are determined completely by a combination of foreign market sunk-entry costs and firms' exogenous differences in productivity. Along these same lines, Falvey, Greenaway and Yu (2004), extending Melitz's basic model, assume self-selection of new exporting firms to be stronger when the degree of substitution across products was high.

However, the fact that the entry costs depend on the firm's previous export status confers an intertemporal character to the decision to export. Roberts and Tybout (1997) present a review of the sunk-entry cost theoretical literature that had begun with Baldwin and Krugman (1989). In that literature, it is assumed that firms face sunk-entry costs for (re)entering foreign markets and that those costs depend on the time they were absent from foreign markets. Additionally, two more assumptions are made since exports increment expected profits by a certain amount, and there is also an exit cost. Hence, in each period, managers are assumed to choose the infinite sequence of decisions to export or not that maximizes the expected present value of payouts.[3] In line with this, other models (*e.g.*, Sjöholm and Takii, 2008) also present dynamic models of the export decision made by profit-maximizing firms.

At the financial level, Chaney (2008) builds an international trade model with liquidity constraints. Following his argument, if firms must pay some entry cost to access foreign markets, and if they face liquidity constraints to finance these costs, only firms with sufficient liquidity are able to export. In fact, literature exists that links financial development and international trade: for example, Fanelli and Keifman (2002) had already underlined that, for countries with a weak financial system, one could expect the concentration of exports in big, well-established firms. They point out that in addition to firms' size and age, access to financial markets is a relevant factor determining firms' export ability; and, thus, having a well-developed financial system can be considered a key ele-

[3] Using a Bellman's equation.

ment in determining countries' non-price competitiveness. Indeed, as exporters must incur vital costs to enter foreign markets, countries with a well-developed financial system will enjoy a certain advantage for export activities.[4]

In empirical studies, the export-market participation with a sunk-costs model has been tested for firms belonging to developed and developing countries (*e.g.*, Clerides, Lach and Tybout, 1998; Bernard and Wagner, 2001; Bernard and Jensen, 2004; Girma, Greenaway and Kneller,2004). Roughly speaking, these authors aim to quantify the impact of entry-exit costs on the probability of exporting (and some of them also test for the presence of learning-by-exporting). The empirical findings emphasize the significance of past export experience to explain firms' ability to export, confirming the relevance of the sunk-cost model to explain firms' export status. Espanol (2007) mentions that there is a wide consensus concerning firms' features that explain their export status: size, age, structure of capital ownership, and productivity are the most significant. In addition, Bernard and Jensen (2004: 569) conclude that the doubt does not refer to the variables explaining the decision to export, but that the "key unanswered question is how firms obtain the characteristics that allow them to easily enter the export market".

There is also a literature that studies macroeconomic factors affecting a firm's propensity to export. Das, Roberts and Tybout (2007) show that these changes are most relevant for firms who export little, the fringe players in export markets (Tybout, 2003). Variables whose changes produce waves of entry and exit in exports are exchange rates, policy innovation, and agglomeration effects. Sjöholm and Takii (2008) assume that the binary variable behind the dynamic binary choice model of exporting relies on parameters that reflect distinct sunk costs related to past export skills and firms' networks of foreign contacts, and on time-specific factors common to all firms (exchange rates and trade policies) and plant-specific factors (*e.g.*, value added per worker, percentage of white collar workers, and plant size). The first two variables affect plant earnings and high quality, thus influencing the probability of exporting. Learning-by-exporting is often taken as a "black-box function" with an unclear learning mechanism behind productivity growth, but several mechanisms identified in the literature could fill that gap: 1) exporting positively affects product and process innovation

[4] Given the proven negative relationship between firm size and access to the financial system, we proxy the first variable by using a dummy for smaller firms.

(*e.g.*, Salomon and Shaver, 2005; Cassiman and Martínez-Ros, 2007); 2) large and more competitive markets provide the conditions for exporters to become more efficient (competition effect); 3) a wider network of contacts with distinct sources, such as clients, suppliers, competitors, and professional and scientific institutions may enhance efficiency improvements and innovations, and 4) the larger size of international markets may offer better conditions for economies of scale. Nevertheless, the absence of a coherent theory to support and explain the learning-by-exporting thesis may be due to difficulties in controlling the learning mechanisms in empirical research, and this difficulty blocks further theoretical advances. However, a growing body of literature has claimed that exports produce learning effects, which would result from adjustments in the process governing firms' productivity growth. The basic theoretical argument behind the learning-by-exporting thesis is that firms operating in international markets can better obtain knowledge and technological spillovers from international contacts.

The empirical literature (*e.g.*, Wagner, 2007, reports studies for 34 countries) seems to confirm only the self-selection. On the other hand, learning-by-exporting tests have been produced for several countries, but overall, post-entry effects seem weak or at most are mainly observed in less developed countries or in restricted groups of exporters. In order to contribute to this discussion, in this article, we test the self-selection thesis for Portuguese firms for the first time. The learning-by-exporting test for the same sample of firms is beyond the scope of this article.[5]

Data

The empirical analysis relies on a dataset that combines two different data sources developed by the Instituto Nacional de Estatística of Portugal (INE): balance sheet information and external trade information. The two datasets are linked by firms' unrevealed fiscal number. Balance sheet information provides information about firms' balance sheets,[6] and uses a survey sample of the entire universe of Portuguese manufacturing firms from 1996 to 2003. In this article,

[5] It is performed in Silva, Afonso y Africano (2010b).

[6] Since 2004, the INE has changed its methodology and works with the universe of Portuguese manufacturing firms, but before 2004 the only data available are those that we use. INE ensures the representativeness of the sample used.

we used number of employees, turnover, value added, investment, labor costs, stock of capital assets, liabilities, and earnings.[7] Firms are classified according to their main activity, as identified by INE standard codes for sectoral classification of business activities (CBA), which has a high correlation with Eurostat NACE 1.1 taxonomy.

We define an "active firm criteria" that involves firms experiencing three conditions: firms with at least two employees, with a global turnover of at least €1 000, and a positive net fixed asset register. We also define *exporter* as a firm that exports at least 10% of its output (although, our sample of manufacturing Portuguese firms exports 36% of their output, on average). Given these restrictions and the natural entry and exit of firms or the lack of information about some variables, the dataset is unbalanced. Nevertheless, it contains information for an average of 4 500 firms per year. Capital is proxied by tangible fixed assets at book value (net of depreciation).

In turn, external trade information provides information about all Portuguese firms that exported and imported over the 1996-2003 period. For each firm, external trade information supplies data on trade volume (exports and imports) aggregated by year and by country (destination of exports and origin of imports), and also information on the types of products/sectors traded for each transaction,[8] and on the volumes (kilograms) involved. All nominal variables are measured in 1996 euros and are deflated using 2-digit industry-level price indices provided by INE; for capital stock, we use the same deflator as for all sectors. Firm-level productivity is measured using two concepts: value-added per employee (or labor productivity, LP) and total factor productivity (TFP). Since it is highly probable for profit-maximizing firms to immediately adjust their input levels (especially capital) each time they notice productivity shocks, productivity and input choices are likely to be correlated and TFP estimation encounters problems.

In line with several authors (*e.g.*, Sharma and Mishra, 2009; Maggioni, 2009), TFP is estimated using the semi-parametric method of Levinsohn and Petrin (2003). This method recognizes the simultaneity bias in computing TFP as firms observe the productivity shocks but econometricians do not. Thus, Levinsohn

[7] Unfortunately, we do not have other types of data that would have been useful, such as innovation performance, workforce composition, workforce educational level, or information about affiliates of Portuguese multinationals.

[8] Our data includes 14 different sectoral types of traded products.

and Petrin (2003) compute TFP as the residual of a Cobb-Douglas production function in which each firm's value added is the independent variable; capital, labor, and unobservable productivity levels are the dependent variables. This method assumes that intermediate inputs present a monotonic positive relationship with productivity and thus could be used as proxies. Given our data availability, we use intermediate inputs as the values of "supplies and services from third parties" at book value. We estimate the production function for every 2-digit sector separately.[9]

Self-selection to export in Portuguese firms

Silva, Afonso y Africano (2010a) have verified the positive correlation between trade and performance, namely TFP. Another simple test of this hypothesis would be a Granger-causality test. Appendix A suggests the existence of bi-directional causality: productivity Granger-causes exports and exports Granger-cause productivity.

Nevertheless, as we are interested in shedding more light on one of these causal relationship directions, we propose to evaluate self-selection more carefully. Thus, we studied firms beginning to export in the sample period and, as a "control group," the firms that never export throughout the period (our database includes 996 control firms). We defined as "export starters" firms that export in t and $t+1$ years, and that had never exported in the two previous years, $t-1$ and $t-2$. We ended up with five cohorts, one for each year from 1998 to 2002 totaling 220 different starters (7 firms were starters twice, and we eliminated those records.). Table 1 shows the number of starters across cohorts.

Table 1
Export starters

Year	*1998*	*1999*	*2000*	*2001*	*2002*
Starters	54	43	47	34	42

Source: calculations by authors.

Empirically, to evaluate self-selection, we could apply two distinct approaches: 1) a random effect probit, testing the probability of a firm becoming an exporter

[9] Details of the Levinshon and Petrin methodology can be found in Maggioni (2009).

due to certain lagged variables, such as size, foreign ownership status, sector fixed effects, and, mainly, productivity levels before entry (McCann, 2009), and 2) an analysis of *ex-ante* differences between export starters and never-exporters, using a parametric exercise (Bernard and Jensen, 1999).

Using the first approach, we tested a model in which the dependent variable is a dummy indicating whether a firm became a new exporter in that year. The explanatory variables, lagged one year, include productivity, capital, investment, number of employees, a dummy for small firms, sector dummies, time dummies, a dummy for firms that import, a dummy for firms with employees devoted exclusively to research and development (R&D) activities, and, lastly, a dummy for foreign capital participation. The selection approach is confirmed as a positive significant coefficient on lagged TFP and can be observed in table 2. Moreover, lagged imports and investment are also significant, suggesting that firms had to invest and import to become exporters.

Table **2**
Self-selection to export (probit model)

TFP_{t-1}	$Capital_{t-1}$	$Investment_{t-1}$	$Employees_{t-1}$	$Imports_{t-1}$	$R\&D_{t-1}$	*Capital formation*$_{t-1}$	*Observations*
0.392	–0.004^{+}	0.219	0.001^{+}	0.032	0.086^{+}	0.111^{+}	3 413
(0.227)	(0.011)	(0.101)	(0.006)	(0.01)	(0.16)	(0.161)	

Notes: robust standard errors in parentheses. If nothing mentioned coefficients are significant at least at 10%. (+) means not significant. Estimations obtained with *Stata* 10 software.
Source: calculations by authors.

Nevertheless, if we split the starters into two groups: 1) those that are already importers even before exporting (only importers), and 2) starters that did not import before exporting (purely domestic firms), we find that self-selection is observed only for firms that were importers before starting to export; for non-traders the self-selection thesis is not confirmed (see table 3).

Given the fact that firms that import may have already paid out part of the sunk costs of entry in external markets when they initiated their imports, we can argue that they are more likely to be prepared to face the challenge of exporting. Moreover, combining the fact that lagged imports and investment are also significant in table 2 with the findings of table 3, we could also argue that the self-selection of the most productive firms into the export markets requires imports. On the other hand, if new exporters are not the most efficient firms, then previous imports are not needed and thus not shown.

Table 3
Self-selection to export using import status (probit model)

	Only importers become also exporters	*Non-traders become exporters*
TFP_{t-1}	1.57	0.005+
	(0.004)	(0.333)

Notes: (+) no statistically significant. See table 2.
Source: calculations by authors.

Bearing in mind that we are interested in evaluating self-selection not only regarding productivity indicators (TFP and labor productivity), but also with regard to other characteristics (size, capital intensity, or wages) and also in order to test for conscious self-selection, we developed a second approach to test for self-selection. In fact, in line with Bernard and Jensen (1999) and Serti and Tomasi (2008a), we regressed our performance variables (all in logarithms) in period t on dummies indicating whether a firm is an export starter at time $t + \delta$ and on a set of controls (sectoral dummies, time dummies, and size).[10]

$$y_{i,t-\delta} = \alpha + \beta_1 starter_{i,t} + \beta_2 controls_{i,t-\delta} + \varepsilon_{i,t} \qquad [1]$$

where $starter_{i,t}$ is a dummy variable equal to 1 if the firm begins exporting in t; $y_{i,t-\delta}$ is our performance variable, in logarithms, at the pre-export time, and $0 < \delta < 5$. Table 4 shows the transformed estimated coefficients of [1] for relevant dependent variables; *i.e.*, the conditional percentage differential between starters and never-exporters in absolute levels (as opposed to growth rates).

By investigating variables in levels (see table 4), we found support for self-selection: more productive firms become exporters. This is confirmed by using either LP, or TFP. In fact, before entry into export markets, the starters are more productive, larger, present higher capital intensity and higher sales than never-exporters. On the five-year average, the *ex-ante* TFP of starters is around 33% higher than that observed for never-exporters. In addition, future exporters' labor cost per unit of sales is on average half the value observed for the control group, thus indicating starters' higher efficiency before exporting. Regarding firms' sales, we observed that, as the time of internationalization approaches, future exporters also appear to be increasingly more successful in

[10] We only consider static specifications, given that by running dynamic panel data models, we are not able to find adequate instruments in the sense that all the test statistics reject the validity of the instruments.

domestic markets. They also display superior firm size (number of employees), which relates to the issue of scale and its importance in productivity and interest in exporting.[11]

Table **4**
Self-selection: levels

	t – 5	*t – 4*	*t – 3*	*t – 2*	*t – 1*
Total factor productivity	36.3+ (0.001)	28.4 (0.001)	25.9 (0.001)	35.9 (0.002)	41.5 (0.002)
Labor productivity	32.1+ (0.01)	37.2 (0.02)	43.2 (0.003)	49.1 (0.01)	52.1 (0.001)
Employees	68.1 (0.05)	58.1 (0.084)	55.2 (0.01)	72.3 (0.007)	83.5 (0.003)
Sales	192 (0.000)	177 (0.03)	166 (0.02)	211 (0.001)	203 (0.000)
Capital	139 (0.04)	169 (0.006)	228 (0.01)	225+ (0.012)	205 (0.000)
Capital intensity	43 (0.33)	79 (0.012)	163 (0.013)	112 (0.005)	100 (0.01)
Investment	32.5 (0.025)	32.6 (0.031)	66.3 (0.004)	27.2+ (0.28)	75.1 (0.04)
Unit labor cost	–39 (0.02)	–75 (0.000)	–85 (0.000)	–56 (0.01)	–41 (0.01)
Observations*	1 237	2 312	3 918	5 152	5 320

Notes: (+) no statistically significant. (*) Maximum number of observations available for each time lag. In computing the coefficients, we use the exact percentage differential given by $(e^{\beta 1} - 1) \times 100$; *p*-value of robust *t*-test are in brackets below estimates. Also see table 2.
Source: calculations by authors.

We also found that starters invest more than never-exporters, mainly three years before entry, thus giving some support to the thesis of firms' "conscious self-selection" to export; this investment performance also explains their strong advantage in capital and size terms. López (2009) has proposed the idea that, in developing countries, self-selection to export may be a conscious process whereby some firms increase their productivity with the aim of becoming exporters. This can be due to the need to produce top-quality goods for exports to more developed countries. Thus, firms that aim to export would be com-

[11] Given the small number of observations for export starters, we were not able to perform a sectoral disaggregated analysis that would have allowed us to understand in more detail how different optimal scale dimensions of firms influence their propensity to become exporters.

pelled to buy new technologies and invest in new capital in order to produce top-quality goods. Moreover, the use of a new technology increases the value added by future exporters, thereby increasing measured productivity relative to non-exporting firms, which continue to produce low-quality goods for domestic markets.[12]

Hence, some Portuguese firms may have made a conscious effort to increase their productivity once they began to focus on export markets. Thus, increased productivity in some firms does not seem to be entirely exogenous: it may be motivated by the expectation of future access to export markets. However, alternative explanations cannot be totally ruled out. It is quite possible that firms invest simply to succeed in the domestic market without any intention of becoming exporters, but then, after experiencing domestic success, decide to enter export markets, eventually also motivated by government support.

Looking for further insights, we tested if firms modify their behavior in the pre-entry period according to their future export status. Indeed, it seemed wiser to study the dynamics of future exporters' premiums rather than studying only level differences.

$$\ln y_{i,t-s} - \ln y_{i,t-\delta} = \alpha + \beta_1 starter_{i,t} + \beta_2 controls_{i,t-\delta} + \varepsilon_{i,t} \qquad [2]$$
$$0 \leq \delta \leq 5 \text{ and } 0 \leq s \leq 4$$

For relevant dependent variables, table 5 reports the transformed estimates of the conditional percentage differential between growth rates of starters and never-exporters.

Looking at the growth rate differentials between different time spans, we found a significant increase in starters' pre-entry export premiums, in terms of firms' size (number of employees), sales, and capital; this superior dynamic of future exporters extends just to the entry year only in the case of the number of employees and seems to be larger three years before the internationalization begins.[13] The coefficients, employing the two productivity proxies as dependent variables, are almost never significant: in the pre-entry period, starters and never-exporters' efficiency dynamics are, on average, similar.

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[12] Important theoretical support for the idea that entry into export markets is not an exogenous process but a conscious decision is provided by Yeaple (2005).

[13] Apart from the existence of non-linearities with respect to the moment of foreign-market entry.

Table 5
Self-selection: growth rates

	(t – 4)/(t – 5)	*(t – 3)/(t – 4)*	*(t – 2)/(t – 3)*	*(t – 1) / (t – 2)*	*t/(t – 1)*
Total factor productivity	–0.018+ (0.66)	–0.017+ (0.60)	0.053+ (0.18)	0.001+ (0.26)	–0.041+ (0.87)
Labor productivity	0.005+ (0.953)	–0.016+ (0.63)	0.052+ (0.22)	0.001+ (0.01)	–0.132+ (0.90)
Employees	–0.061+ (0.56)	0.057** (0.02)	0.076** (0.03)	0.087+ (0.49)	0.050** (0.01)
Sales	0.045+ (0.76)	0.058* (0.40)	0.147** (0.01)	0.045+ (0.67)	0.034+ (0.56)
Capital	0.084+ (0.100)	0.076* (0.06)	0.101** (0.01)	–0.028+ (0.62)	0.052+ (0.10)
Capital intensity	0.144* (0.09)	0.019** (0.07)	0.028+ (0.58)	–0.087+ (0.59)	0.003+ (0.95)
Investment	–0.431+ (0.491)	0.272** (0.01)	–0.007+ (0.96)	–0.022+ (0.92)	0.131+ (0.43)
Unit labor cost	–0.040+ (0.980)	0.812** (0.16)	–0.461+ (0.46)	–0.029+ (0.70)	0.025+ (0.73)
Observations	871	1 567	1 354	1 533	1 335

Notes: all regressions include, as controls, foreign-ownership dummy, sectoral dummy, number of employees dummy –except when the number of employees is the dependent variable– and year dummy. Robust standard errors appear below the coefficients' estimates in parenthesis. (*) and (**) mean statistical significance at 10 and 5 percent, respectively. (+) means not statistically significant; if nothing is mentioned, estimates are significant at 1% level. Estimations obtained with *Stata* 10 software.
Source: calculations by authors.

Starters' superior capital growth is not constant and is only reflected by increasing capital intensity in years $t-3$ and $t-2$. Thus, any eventual change in starters' productive structure (which could be materialized with several years of higher capital growth) seems to occur "long" before exports begin, suggesting both the need for a long time period to make such a decision and also that firms' conscious self-selection to export is not confirmed in this period of time. Moreover, as labor cost per unit of sales coefficients are non-significant, during the pre-entrance period, future exporters may not undertake substantial structural changes in terms of production organization and technology (compared to never-exporters), but they do grow (in size) comparatively more. Overall, these facts suggest that, in the five years preceding export market entry, new exporters are not more dynamic in improving their efficiency than never-exporters but, in general, are more dynamic in terms of capital, employees, and sales growth.

As Serti and Tomasi (2008a: 673) said: "In the spirit of self-selection, this means that prior to exporting, a firm must have certain characteristics in terms of productivity, size, human capital, and capital intensity in order to sell its goods abroad". Yet, as we stressed, there is little evidence indicating that firms prepare themselves before entering foreign markets. In fact, any preparation would consciously involve higher investment growth, which is only partially detected, or subjection to some common shock; but both facts would represent a change in their production structure and in efficiency, which is almost undetected. It seems, instead, that future exporters have superior features from the beginning of our database, *vis-à-vis* never-exporters. This suggests that self-selection is not "built up" in that short period previous to export market entry.

On another level, in the pre-entry period, we also found some important evidence about import activity (see table 6). There is a consistent difference in the import share, measured by the ratio between imports and output, between never-exporters and starters, mainly until entry time. Moreover, in the years before entry, we can observe a constant import share for never-exporters, while starters increase their higher import share.

Table **6**
Import share trend of starters and of never-exporters before and after exports begin

Time	$t-5$	$t-4$	$t-3$	$t-2$	$t-1$	t	$t+1$	$t+2$	$t+3$
Never-exporters	5	5	5	5	5	6	6	5	4
All starters	17	21	22	23	23	22	20	19	18

Source: calculations by authors.

One possible explanation for these numbers is that, in order to enter the export market, some firms also start importing materials and machines or increase their import levels. After export entry ($t + 1$ to $t + 3$), the import share declines a little, but is still much higher for starters. Firms that want to export may need to improve the quality of goods and/or adapt them to foreign customers' requirements and tastes. To fulfill these needs, foreign materials could be more suitable; moreover, as firms begin being involved in the international market by importing, they create networks with foreign contacts that bolster exports.

To sum up, it is important to bear in mind that an important share of export starters is also involved in importing, which may begin in conjunction with

export entry. Table 7 confirms the idea that starters accelerate import growth some years before exporting begins.

Cuadro 7
Growth of imports (%) for export starters

Time	*(t – 2)/(t – 3)*	*(t – 1)/(t – 2)*	*t/(t – 1)*	*(t +1)/t*	*(t + 2)/(t + 1)*	*(t + 3)/(t + 2)*
Starters 1999	21	6	–4	10	0	–11
Starters 2000	20	0	–8	–15	30	–11
Starters 2001	8	10	–2	–25	11	–
Starters 2002	15	12	2	3	–	–

Source: calculations by authors.

Another important issue is the possibility of a "secondary" form of self-selection, in line with Chaney (2008). In fact, it is likely that more productive firms choose to become exporters, but also that the most efficient among them may also elect to serve more demanding markets. Along these same lines, if self-selection of more efficient firms to export is indeed a consequence of the existence of market-entry costs, and given that entry costs are very heterogeneous across markets, it is possible that self-selection differs across markets.

In fact, there are several reasons why self-selection may vary across markets since different sunk costs are related to different markets' features, such as distance, income, familiarity, cultural affinity, language, or legal and institutional structures. In addition, in line with some models such as Bernard *et al.* (2003) or the technology-gap trade models of Cimoli and Soete (1992), one can argue that more advanced markets are characterized by a higher competitive level, which could be associated with stronger efficiency requirements for future exporters.

Hence, if the nature of entry costs or product quality requirements vary across markets, this may translate into *ex-ante* disparities in terms of performance among firms exporting to different countries. Thus, it is to be expected, for instance, that exporting to distant, unfamiliar countries may entail higher entry sunk costs or exporting to highly productive, rich countries could require higher productivity, top-quality goods, and marketing. In this sense, the ideal empirical test would be a mix analysis using both the development level of export destinations and also other characteristics of those markets' geographical location (*e.g.*, population, distance, or exchange rates between countries). For the moment and in

order to test all these claims, we estimated the regression (in line with Serti and Tomasi, 2008b) as follows:

$$\ln y_{i,t-s} = \alpha + \alpha_1 E_{i,t}^{EU} + \alpha_2 E_{i,t}^{PL} + \alpha_3 E_{i,t}^{EU+PL} + \alpha_4 E_{i,t}^{Dev} + \alpha_5 E_{i,t}^{NDev} + \alpha_6 E_{i,t}^{EU+Dev} + \alpha_7 E_{i,t}^{Multiple} + \beta Controls_{i,t} + \varepsilon_{i,t} \quad [3]$$

We regressed as dependent variables the logarithm of the two productivity measures, LP and TFP, at pre-entry time.[14] As dependent variables, we used dummy variables indicating whether a firm is an export starter at time *t*, but distinguishing among several groups of destination markets. Controls include firm size, sectoral dummies for two digit CBA, and year dummies.

To test how each firm's performance differs according to the type of market it trades with, we separated starters exporting into five mutually exclusive groups of export destinations: i.1) only to Spain; i.2) only to other European Union countries (EU); i.3) only to Portuguese language countries (PL); i.4) only to other developed countries outside the EU (Dev);[15] i.5) only to non-developed countries (NDev). Additionally, we considered firms that export to more than one group of markets, namely to ii.1) EU and PL countries (EU+PL); ii.2) EU and developed countries (EU+Dev); ii.3) all other possible combinations of markets (Multiple).

The estimation results are consistent with our expectations (see table 8). In fact, compared with never-exporters, firms that start exporting only to developed countries (Dev) are the most productive ones in the pre-entry period, together with firms that export to multiple countries. Moreover, those that begin exporting to countries with Portuguese as the official language, to the EU, or to both destinations are the ones with a smaller productivity advantage over never-exporters in the pre-entry period. Exports to NDev had mixed results: in more distant years relative to export entry, there are negative coefficients, but in years close to the entry year, positive levels appear; this could be a reflection of contradictory forces, as most of those countries are geographically and

[14] We also estimate similar regressions for the following variables; number of employees, capital intensity, and investment. The same conclusions apply: firms that start trading with more developed countries invest the most, and firms that begin trading with countries with Portuguese as an official language (PL) and Spain invest the least.

[15] In this group, using per capita Gross National Product, we included the United States, Japan, Australia, New Zealand, South Korea, Singapore, Hong-Kong, Canada, Israel, Taiwan, Switzerland, Kuwait, Oman, Qatar, the United Arab Emirates, Bahrain, and Saudi Arabia.

culturally distant from Portuguese firms, but on the other hand are probably not highly demanding in terms of quality and productivity. Firms that begin exporting only to Spain show an intermediate level of TFP and LP, suggesting that the Spanish market is more demanding than the average EU market and PL markets. Overall, this analysis indicates that self-selection varies across markets, thus suggesting that each foreign market may be associated with a different productivity threshold.

Table 8
Self-selection by export destination country

	TFP				LP			
	t – 4	*t – 3*	*t – 2*	*t – 1*	*t – 4*	*t – 3*	*t – 2*	*t – 1*
Spain	0.394 (0.11)	0.147^{+} (0.21)	0.245** (0.11)	0.225^{+} (0.18)	0.645 (0.08)	0.559 (0.13)	0.405 (0.09)	0.331** (0.17)
EU	0.254 (0.12)	0.126^{+} (0.21)	0.160* (0.09)	0.070^{+} (0.16)	0.330* (0.20)	0.300^{+} (0.24)	0.321** (0.15)	0.227^{+} (0.20)
PL	0.067^{+} (0.15)	0.051^{+} (0.17)	–0.178* (0.10)	–0.025^{+} (0.12)	0.101^{+} (0.19)	0.051^{+} (0.17)	0.141^{+} (0.23)	0.125^{+} (0.15)
EU + PL	–	–0.021* (0.10)	–0.127 (0.01)	0.074 (0.01)	–	0.088 (0.01)	–0.017^{+} (0.01)	0.222 (0.01)
Dev	0.579 (0.01)	0.507 (0.06)	0.512 (0.19)	0.427** (0.13)	0.979 (0.02)	0.942 (0.07)	0.931 (0.19)	0.667 (0.12)
EU + Dev	–	0.551 (0.25)	0.452 (0.19)	0.428** (0.23)	–	0.781* (0.43)	0.791 (0.30)	0.828 (0.30)
NDev	–0.156 (0.01)	–0.167 (0.01)	0.442** (0.24)	0.391 (0.19)	–0.281 (0.01)	–0.107 (0.01)	0.712** (0.21)	0.651 (0.24)
Multiple	0.056^{+} (0.28)	0.426* (0.27)	0.621 (0.21)	0.975 (0.38)	0.246^{+} (0.53)	0.467* (0.29)	0.831 (0.23)	1.202 (0.41)
R squared	0.15	0.15	0.15	0.10	0.10	0.10	0.10	0.10

Notes: see table 5. All regressions include the following as control variables (not reported, but available upon request): foreign-ownership dummy, sectoral dummies, number of employees (size), and year dummies. Size always has significant positive coefficients.
Source: calculations by authors.

We could also argue that the self-selection of more productive firms to foreign markets is also conditioned by the heterogeneity among the sectors firms belong to. We thus analysed the self-selection thesis, in levels, but now splitting firms according to the technological sophistication of the sectors they belong to.

Thus, we aggregated the initial 23 two-digit sectoral codes and 201 five-digit sectoral codes (the original INE disaggregation) into five sectoral classifications

based on technological sophistication (in line with Pavitt, 1984 –adapted): group 1 (Gr1), with the lowest technical sophistication (food, beverages, and tobacco); group 2 (Gr2) (textiles, wearing apparel and leather); group 3 (Gr3) (wood, pulp, paper, printing, and furniture); group 4 (Gr4) (chemicals, rubber, plastic, non-metallic goods, basic-metallic goods, fabricated-metallic goods, and recycling sectors), and group 5 (Gr5), with the highest technical sophistication (machinery, office machines, computers, electrical machinery, medical instruments, motor vehicles, and other transport equipment).

Using these five groups we repeated regression [1] only for TFP and noticed (see table 9) that self-selection is stronger for firms of group 1, the lowest technological-level sector.

Table **9**
Self-selection in levels for different groups of sectors

TFP	$t-5$	$t-4$	$t-3$	$t-2$	$t-1$
Gr 1	5.7^{+} (0.12)	–	15.1 (0.09)	23.5 (0.09)	24.7 (0.09)
Gr 2	–	-5.1^{+} (0.11)	-5.1^{+} (0.11)	-13.1^{+} (0.11)	-9.6^{+} (0.11)
Gr 3	-4.7^{+} (0.09)	–	7.2 (0.05)	1.1 (0.03)	11.1^{+} (0.09)
Gr 4	–	-1.9^{+} (0.09)	4.9^{+} (0.08)	8.6 (0.04)	9.2 (0.03)
Gr 5	2.7^{+} (0.069)	–	6.93^{+} (0.058)	10.8 (0.056)	11.2 (0.052)

Notes: see table 4.
Source: calculations by authors.

On the contrary, self-selection is undetected for firms that belong to sectors of group 2 and only partially observed in firms of the other groups.

Moreover, in Appendix B, we observe that firms from group 2 (textiles, wearing apparel, and leather) have the lowest propensity to begin exporting, given the high weight of this sector in total exporters, in the Portuguese economy. Taken together, these facts suggest that starters from group 2 are not the most efficient firms, which may be explained by the fact that the most efficient ones probably became exporters long ago. In addition, we acknowledge that Silva and Leitão (2007) found that, between 1995 and 1997, Portuguese firms from the clothing and footwear industries worked on an outsourcing basis, adopting a low-price strategy that did not rely on product innovation. In this respect, we

confirmed that, before beginning exports, firms of Group 2, unlike those of all other sectors, did not have higher wage levels than never-exporters (see table 10).

Table **10**
Self-selection in wage levels for all firms and group 2 firms

Wages	*t* – 5	*t* – 4	*t* – 3	*t* – 2	*t* – 1
All firms	24.7 (0.00)	23.4 (0.00)	23.0 (0.00)	24.8 (0.00)	23.5 (0.00)
Group 2		11.1^{+} (0.44)	13.5^{+} (0.26)	10.1^{+} (0.34)	10.9^{+} (0.37)

Notes: see table 4.
Source: calculations by authors.

In this line of thinking, we could argue that if there is no evidence of self-selection for some firms or for groups of firms, this derives from the fact that not all firms trying to enter into export markets may need to: 1) make contacts with potential foreign customers; 2) establish distribution channels; 3) modify their products to foreign tastes or to country-specific regulations. In fact, if some firms begin to export on an outsourcing basis, it is very likely that they are "chosen" for their "moderate" wage level and not for their higher efficiency. In these cases a different and perverse selection is observed: moderate-level-wage firms are selected or select themselves into exports.

Concluding remarks

Given the importance of exports for the Portuguese economy and assuming a positive correlation between firm efficiency and international trade involvement, we studied the self-selection thesis of domestic firms to exports for the first time for Portuguese firms, for the period from 1996 to 2003.

We found that, for all the variables under analysis and particularly for efficiency indicators, future exporters display advantages with respect to firms that decided not to export later on. However, when looking at the growth rates of the relevant features, in the pre-entry period, we observed that starters and never-exporters in general do not differ in terms of their dynamic path, with the exception of the scale of production and sales. This may mean that future exporters are "better" than never-exporters even before the year we begin our analysis, suggesting that self-selection requires time to be prepared. Of course,

some firms are productive enough to begin exporting but decide not to anyway; however, we do not study such clusters of firms, given the impossibility of knowing the real firms in our database.

Recent contributions of some models (*e.g.*, Chaney, 2008) assume that self-selection is a heterogeneous phenomenon depending on starters' destination markets. Along these lines, our study also confirmed that self-selection of firms that begin exporting reveals significant heterogeneity according to export destination: the most productive starters are able to export to more demanding markets, while the least productive ones seem fit to begin exporting to less exigent destinations. Moreover, we were also able to uncover the importance of imports for self-selection of most productive firms and of some sectoral specificity: for firms from some industries, we noticed a different, perverse self-selection as moderate wage-level firms, not the most productive ones, are selected (or self-select) to future exports.

We also acknowledge that the decision to start improving productivity (in order to become a new exporter) and the very decision to start exporting are made by firm owners or managers; in this sense, asking them specifically what their aims and strategies are at such moments would be enriching and enlightening for this kind of research. However, given data anonymity, we were unable to interview some decision makers from our sample. Nevertheless, Pinho and Martins (2010) agree to recognize that, to be competitive, firms cannot remain domestic and that successful internationalization requires the will, the preparation, and the financing to move into more demanding markets. In the sequence of interviews with managers and owners, results show that non-exporters consider the following the main export barriers: lack of knowledge about potential markets, of qualified export personnel, of technical suitability, of financial assistance (from governmental and financial institutions), and of qualified human resources. Thus, even if such firms gather the required funding and productivity, they may not be able to begin exporting because they lack the vision and the will to do it properly, and that's why, in the end, it all comes down to human decisions.

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Appendix A

Granger causality tests between Ln TFP and export ratio

Vector autoregressions estimated by OLS
and Granger-causality tests based on F-tests

$$\ln TFP_{i,t} = a_i + \sum_{j=1}^{5} \rho_j \ln TFP_{i,t-j} + \sum_{j=1}^{5} \alpha_j ExpRatio_{i,t-j} + e_{i,t}$$

$$ExpRatio_{i,t} = b_i + \sum_{j=1}^{5} \omega_j \ln TFP_{i,t-j} + \sum_{j=1}^{5} \varphi_j ExpRatio_{i,t-j} + u_{i,t}$$

H_0: $\alpha_1 = \alpha_2 = \alpha_3 = 0$; F (3, 4 056) = 0.92 ; Prob > F = 0.421
H_0: $\phi_1 = \phi_2 = \phi_3 = 0$; F (3, 4 053) = 0.72 ; Prob > F = 0.542

Note: exportation ratio = exports / output. We used 5-year lags.

Appendix B

Percentage differential between the weight of each industrial sector in export-starters and in all exporters (1997-2002)

CBA	15	17	18	19	20	21	22	24	25	26
Difference	+3	–2	–3	–2	+3	0	+3	0	0	–1
CBA	27	28	29	31	32	33	34	35	36	37
Difference	+2	+1	+2	+1	0	0	0	+1	0	0

Source: calculations by the authors.