INTERNATIONAL TRADE AND FIRM PRODUCTIVITY WITHIN THE ITALIAN MANUFACTURING SECTOR: Self-Selection or Learning-by-Exporting?

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Quaderno n. 21/2008
Abstract

The ongoing process of international economic integration has induced several academic researchers and policy makers to deepen increasingly issues about the relationship between international trade and economic growth. More in particular, the attention is increasingly focusing on the link between exporting and firm performance, acknowledging the extreme relevance of ‘firm heterogeneity’.

This paper investigates empirically the exporting-productivity linkage in the Italian manufacturing sector, following a brief overview of recent literature. By using firm-level panel data for the years 2000 and 2003, we find that exporters are more productive than non-exporters and this productivity gap could be due to the self-selection mechanism – solely the high-performance firms are able to serve foreign markets – rather than post-entry effects.

Keywords: Trade, Productivity, Heterogeneous firms, Self-selection, Learning-by-exporting.

JEL Classification: D21, F14

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I am deeply grateful to Filippo Reganati (University of Sapienza – Italy) and Alasdair Smith (University of Sussex – UK) for their valuable comments and suggestions. However, I am the only responsible for the content of this paper.
1. Introduction

The ongoing process of international economic integration has induced many academic researchers and policy makers to investigate the role of international trade in economic growth, and more particularly, the relationship between exports and productivity. Empirical studies explored this important link by using data at a country or industry level until the middle of the nineties, when some papers started utilizing firm-level data, recognizing the important role of firm heterogeneity. For instance, using longitudinal data from U.S. manufacturing firms, Bernard and Jensen (1995, 1999) found relevant differences between exporters and non-exporters on several measures of firm performance, including productivity. This was followed quickly by several other studies, all of which provided clear evidence that an export productivity premium exists, i.e. firms involved in export activities turn out to be more productive compared with firms that serve exclusively the domestic market (in particular, see The International Study Group on Export and Productivity (2007) for an international comparison).

More recently, researchers have attempted to understand the direction of causality, i.e. to answer the question: ‘Is exporting a cause or a consequence of firm productivity?’ The answer to this question does not seem to be univocal. Some empirical studies support the idea that firms self-select into international markets, as only the more productive ones are able to cover the sunk costs to entry into foreign markets, and to face foreign competition. Whereas, other empirical investigations support learning-by-exporting, arguing that firms become more efficient after they start exporting basically because of knowledge flows arising from their foreign buyers. These two hypotheses are not necessarily mutually exclusive, i.e. the existence of pre-entry differences in economic performance between exporters and non-exporters, does not preclude the possibility that the former improve their efficiency following the entry into foreign markets, and vice versa. Wagner (2007a) has carried out an empirical literature review and has documented that the first hypothesis is more robustly supported by the empirical evidence, compared with the mixed support for the second hypothesis: therefore, he concludes that ‘exporters are more productive than non-exporters, and the more productive firms self-select into export markets, while exporting does not necessarily improve productivity’.
The empirical relevance of the ‘self-selection effect’ and the related differences in productivity across firms, motivated some researchers to generate theoretical trade models assuming imperfect competition and heterogeneous firms. Bernard et al. (2003) and Melitz (2003) can be regarded as the theoretical pioneers of the ‘new new trade theory’, given that they developed the first theoretical frameworks capturing the interaction between international trade and heterogeneous firms: the former based on Bertrand competition in a multi-country Ricardian framework (2002), the latter in Krugman’s monopolistic competition model of intra-industry trade (1980). In particular, the Meltiz’s model can be considered an actual turning point for international trade theory, since it gives results which are particularly tractable, and constitutes the basis for further theoretical investigations (Helpman, Meltiz and Yeaple (2004), Bernard, Redding and Schott (2007), Greenaway and Yu (2004), Melitz and Ottaviano (2008), Yeaple (2005), Helpma, Melitz and Rubinstein (2007), and Chaney (2007)).

The main purpose of this paper is to investigate empirically the exporting-productivity linkage within the Italian manufacturing sector, by using firm-level panel data for the years 2000 and 2003. This study is organized as follows. In the section 2 we introduce the theoretical background and the empirical evidence on ‘trade, productivity and heterogeneous firms’, by focusing mainly on the relationship between firm performance and exporting and the related causality question, i.e. both self-selection and learning-by-exporting hypotheses. Section 3 describes the dataset used for the analysis. Section 4 presents the econometric methodology, meant to explore, step by step, the link between firm productivity and exporter. Section 5 shows the empirical results and the related interpretation. Finally, in the section 6, we draw our conclusion on the basis of our findings.
2. Theoretical and empirical background

2.1. Trade, productivity and heterogeneous firms

International trade theories can be distinguished into traditional (or old) and new theories. The former are aimed at explaining the trade flows of different goods between countries (the so-called inter-industry trade), in terms of comparative advantages related to cross-countries differences in technology or factor endowments (such as Ricardian and Heckscher-Ohlin models). The latter are directed to motivate trade flows of similar goods between countries (the so-called intra-industry trade), by allowing for economies of scale and consumer preferences for variety (Dixit-Stiglitz, 1977; Krugman, 1979). Later, these two theories were integrated within a single model – explaining thus simultaneously intra- and inter-industry trade – by considering endowment-related comparative advantages, economies of scale and product differentiation at the same time (Helpman and Krugman, 1985).

The all above-mentioned models assume firms are homogeneous within each sector, but recent empirical studies have found that almost all of a country’s exports are typically concentrated in a handful of firms which appear to be larger and more productive than other firms. For this reason, recently, theoretical studies – associated with an increasingly growing volume of empirical evidence – focus on the role of firm heterogeneity to account for international trade dynamics1.

Bernard et al. (2003) and Melitz (2003) can be regarded as the theoretical pioneers of the so-known ‘new new trade theory’, given that they generated the first theoretical frameworks capturing the interaction between international trade and heterogeneous firms. In particular, the former inserts stochastic firm productivity into the multi-country Ricardian model (2002), assuming that there is a fixed number of goods producible by competing firms in all countries, consumers buy the cheapest version of each good around the world, and finally, all firms use different technologies – within and across countries – to produce the same goods, but the only most productive ones will engage in foreign markets, having cost advantages – compared with other competitors –

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1 Seeing Melitz (2007) for theoretical evolution about International trade and heterogeneous firms.
which would allow them to fix lower prices. The latter introduces firms heterogeneity into Krugman’s model of intra-industry trade (1980), and the related distinctive traits will be analysed in more detail, since it results to be particularly tractable and constitutes the basis for further theoretical implications concerning other international trade arguments².

Melitz’s model can be summarised into the following key points:

- Potential firms can enter the industry by paying sunk fixed costs, without knowing their relative productivity within the industry. Only after entry costs are paid, firms will be able to know the fixed average industry productivity and their own relative collocation.
- Firms run the risk of having to drop out of the industry, since they produce horizontally differentiated goods and their productivity may be below the minimal level necessary to make non-negative profits (the ‘zero-profit productivity cutoff’).
- Because of the further fixed and variable costs of entering international markets, only the firms whose the productivity level is above a given higher threshold (‘export productivity cutoff’) will find profitable to engage in exporting activities.
- Reductions in trade barriers imply an increase in profits from foreign markets for exporters, who will consequently tend to intensify their sales abroad, and simultaneously, a fall in export productivity cutoff, inducing further domestic firms to serve international markets. This increase in both intensive and extensive margins of trade will cause a rise in labour demand within the industry, therefore in related factor price, which in turn will reduce the profits of non-exporters – the least productive of whom will be forced to exit from the industry – and contemporaneously rise zero-profit productivity cutoff – making more difficult the entry for new firms. Thus, we will note an increase in average productivity at a sector level.
- Consumers within country can choose among several varieties of the same good, whose number changes according to country characteristics and the related trade costs with trading partners.

In few words, the whole story includes two mechanisms: *self-selection*, since the only high-performance firms can be involved in export activities, and *resources reallocation*, given that trade openness leads to a resources shift from less to more productive firms within the same industry, generating improvements in terms of aggregate productivity. Indeed, three groups of domestic firms can be distinguished: 1) the least productive firms, which are forced to exit since they start making losses in home market and are not able to access foreign market; 2) the most productive firms, which are able to maintain their domestic market share as well as to expand their market share abroad; and finally 3) the intermediate firms, which are unable to enter foreign markets but can keep some of their domestic market.

Several empirical works have highlighted a high level of firm heterogeneity within a sector in performance – such as productivity and size – which is strongly correlated with a firm decision to engage in international markets – such as through exports, imports, FDI (see Greenaway and Kneller (2005) for a survey). For instance, Bernard et al. (2006) find that exporting firms are more productive, more capital- and skill-intensive and pay higher wages compared with non-exporting firms in the U.S.

With regard to the specific link between firm productivity and export status, it is empirically studied by interrelating the firms’ labour productivity in terms of levels (or alternatively, growth rates) with a dummy variable assuming value one if the firm exports and zero otherwise – whose coefficient would represent the so-called *export productivity premium* – in order to check whether exporters are more productive (or alternatively, grow more rapidly) than non-exporters (Wagner (2007a); The International Study Group on Export and Productivity (2007)).

For instance, following a brief literature review of the exports-productivity link – commentating separately on empirical studies on developed and developing economies – Cole, Elliot and Virakul (2008) focus their attention on Thai manufacturing firms’ decision to export and the related determinants during the period 2001-2004. In particular, current export status is interrelated with – among other variables – total factor productivity and past export status, bearing in mind that the latter may represent the previous export experience or the presence of sunk entry costs (for which, whatever, a positive relationship is expected). They document that firms self-select into the international markets according to several firm traits: in particular, the probability of
exporting seems to be higher for firms with high productivity and enterprises with already international experience, which are – consistently with theoretical expectations – likely to be able to cover the sunk costs to enter or remain in foreign markets.

Wagner (2007a) reviews the findings of 54 empirical studies aimed to examine the relationship between exporting and productivity, using firm-level data from 34 countries (developed, developing, the least developed and transition countries): apart from a few cases, exporters are found to be more productive in terms of both levels and growth rates.

2.2. Exporting and firm performance: Self-Selection or Learning-by-Exporting? Or both?

The above-examined theories about the link between exporting and firm performance assume the self-selection hypothesis, i.e. exporters turn out to be more productive than non-exporters before their entry into international market because of several reasons: sunk fixed costs to enter into foreign markets, since entrepreneurs who want to extend their market share beyond the national borders have to face further costs – such as costs related to transport, distribution, marketing, production to adapt domestic goods for foreign consumers’ tastes or country-specific regulations, workers with skills oriented to manage foreign networks (Meltiz, 2003); low pricing strategy, by reducing marginal cost or mark-up, if they really want to compete with other firms at an international level (Bernard et al., 2003).

Alternatively or simultaneously, the existing performance gap in favour of exporters rather than domestically-oriented firms could be due to post-entry effects, in the sense that export activity may affect positively firm productivity. Several channels can be identified: learning-by-exporting mechanism, i.e. exporters appear to be recipients of knowledge transfer – about, for example, new product designs or more advanced

3 The presence of sunk costs can also explain the persistence in the export status: negative shocks could not induce firms to exit from export market, in order not to pay entry costs again. Similarly, positive shocks could not motivate firms to enter in international market, if higher profits cannot cover the entry costs. Indeed, Bernard and Jensen (2004) find that the probability of exporting increases if there is a previous experience in export activity.
production systems – from their foreign buyers; exploitation of scale economies, connected to the extension of firm’s relevant market size, due to the engagement in exporting; a higher propensity to reduce X-inefficiency and invest in innovation, given that firms will be pushed to become more productive by more intense international competition.

Similar to the previous section, these two hypotheses can be empirically tested by putting the export status dummy in interaction with the past and future firm labour productivity (LP) – which can be alternatively expressed in either level or growth rate terms – respectively. Researchers are used to analyse the self-selection hypothesis by allowing for LP levels – to control simply whether exporters were already more productive than non-exporters before their entry into international market – and learning-by-exporting hypothesis by referring to LP growth rates – in order to see whether exporters have grown more rapidly than non-exporters after their entry into foreign markets – (Wagner (2007a); The International Study Group on Export and Productivity (2007)).

A lot of empirical studies have tried to explore the trajectory of causality in the positive correlation between the export status of firms and their productivity. Apart from a few cases revealing the existence of post entry effects, linked especially to ‘learning by exporting’ (exporting → productivity) and developing countries cases⁴, most of evidences support the ‘selection into export status’ (productivity → export): firms with a better performance have a stronger propensity to export than other firms (Tybout, 2003). In other words, ex-ante productivity determines the firm’s decision to compete in foreign markets, given that if firms want to export, they have to be productive enough to earn profits as to cover the sunk cost to enter into international markets. Conversely, the case where the productivity raises after the access to export market has not yet been sufficiently supported by empirical evidence⁵.

Bernard and Jensen (1999) look for any evidence that export activities lead firms to a faster productivity growth – considering also the inverse possibility – by using plant-

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⁴ For instance, Van Biesebroeck (2005) reports that exporting raises productivity for sub-Saharan African manufacturing firms.

⁵ Empirical studies find mixed results: some of them argue that learning – thus post-entry performance change – is specific to some firms (young or highly exposed to export markets) or industries (the higher exposure to foreign firms is, the lower productivity changes are).
level data as well as industry aggregates in the U.S manufacturing sector. In particular, they test whether the increasing international trade – due to the further trade liberalization process – determines productivity growth within plant (through learning-by-exporting mechanism), or at a more aggregate level (because of the resources reallocation between plants or industries). Their results show a weak evidence for positive link between exporting and faster productivity growth rates within the firm, which, in any case, is more related to a self-selection mechanism, rather than learning-by-exporting hypothesis, since the rise in the productivity level has been found before entry. However, they also document an aggregate productivity growth due to resources reallocation across firms ‘within’ and ‘between’ industries, given that exporters appear to be correlated to higher employment growth rates, even after their entry. Hence, their study has been able to provide empirical evidence on the explanatory role for exports in increasing economic growth. In addition, they observe some differences in performance in advantage of new exporters around the point of entry. Hence, if policymakers want to exploit the beneficial link between exporting and productivity, they should support potential rather than already existing exporters.

After having confirmed the existence of export productivity premium in all empirical studies under review, Wagner (2007a) notes that the results for pre-entry differences in performance between exporters and non-exporters turn out to be in line with the self-selection hypothesis; whereas those for post-entry differences between new export starters and non-exporters are mixed, in the sense that only some of them seem consistent with the learning-by-exporting hypothesis. Finally, most of the findings for post-exit differences in productivity growth between export stoppers and non-exporters point out that stopping to export is correlated with a decrease in firm performance. Hence, he concludes that ‘exporters are more productive than non-exporters, and the more productive firms self-select into export markets, while exporting does not necessarily improve productivity’. Moreover, several empirical works have shown that export firms are also larger, more skill- and capital-intensive and pay higher wages than non-trading firms.

This distinction based on the timing of export market entry has been overshadowed by the latest empirical studies reporting that technology/innovation decisions of a firm are based on its current or future participation in international
markets. Lopez (2004) and Alvarez and Lopez (2005) argue that productivity changes occur after the decision to start exporting, and therefore, prior to the actual entry into foreign market: they basically support the idea of ‘learning to exporting’ (pre-entry effect) rather than ‘learning by exporting’ (post-entry effect). Hence, some academic scholars reach the conclusion that productivity and exporting decisions are interdependent (export ↔ productivity), and the ‘timing’ cannot be anymore used to identify the causality. Nevertheless, it is true that irrespective of decisions timing (whether exporting choice is made before the R&D investment choice, or vice versa), firms effectively starting to engage in export activities are expected to be, on average, more productive than those carrying on to serve solely domestic market.

The two above-described alternative hypotheses are not necessarily mutually exclusive, i.e. exporters turn out to have higher performance because firms self-select into international market and, at the same time, benefit from further productivity gains related to post-entry effects.

Using panel data related to the Taiwanese electronics industry for the years 1986, 1991 and 1996, Aw, Roberts and Winston (2007) empirically study the link between export market participation, investments in R&D (and worker training) and firm productivity. Their findings indicate that the decision to export is affected by both firm’s economic performance and prior international experience, sustaining the relevance of sunk costs to enter into foreign markets, which in turn determines the persistence in exporting patterns: higher-productivity firms, and firms with prior export market experience are more likely to sell abroad. They also prove the existence of a positive relation between firm’s export status and its future productivity, which would intensify if the firm is engaged in R&D activities: in substance, exporters gain benefits by international knowledge transfer from their foreign customers, which are enhanced through investments aimed to improve their absorptive capacity for new technologies. Hence, they document the coexistence of both hypothesis connected to productivity-exports link: self-selection and learning-by-exporting.

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6 Indeed, already in 2003, Lopez, by using plant-level data from Chilean manufacturing sector, finds that export plants increase their productivity and investment levels before they enter into foreign markets, without changing their shares in domestic market: in other words, new investments in machinery and technologies are explicitly oriented to sell abroad.

7 The argument is similar if we consider the exit from export market, rather than the entry: by analyzing several empirical studies, self-selection seems to be more important, although many results about the effect of exit on productivity are controversial.
By making use of a panel for Italian manufacturing firms over the period 1989-1997, Serti and Tomasi (2007) explore whether export premium exists and at the same time, whether it is due to pre-entry (self-selection) or/and post-entry (learning-by-exporting) effects, by comparing export starters with continuing non-exporters over the period prior and subsequently to the entry, respectively, in terms of productivity and other firm characteristics (size, capital endowment, workforce composition and labour cost competitiveness). Evidence for both hypotheses is detected. Firstly, they confirm that firms self-select into export market, since enterprises starting to export during the considered time display positive gaps for all the analysed variables, with respect to those serving exclusively the domestic market (although no dynamic divergence is found). Secondly, they also identify that firms improve further their performance – under almost all the variables under analysis – after becoming exporters, stressing heterogeneity across geographical locations, sectors and size categories.

3. Data description

The empirical study is based mainly on a balanced panel of Italian manufacturing firms used and provided by Morone, Petraglia and Testa (2007), which is the result of a combination of two data sources: Capitalia\textsuperscript{8} surveys and AIDA\textsuperscript{9} database. In particular, the 8\textsuperscript{th} and 9\textsuperscript{th} Capitalia surveys concern the periods 1998-2000 and 2001-2003 respectively and deal with all firms with more than 500 employees and a sample of firms with 11-500 employees – which has been determined using a random selection procedure by allowing for firm size\textsuperscript{10}, location\textsuperscript{11} and sectors\textsuperscript{12} – within the Italian manufacturing

\textsuperscript{8} Capitalia was an Italian banking group which agreed to be taken over by the Unicredit group, in may 2007.

\textsuperscript{9} AIDA is a Bureau Van Dijk’s databank which provides economic and financial data of about 500.000 firms operating in Italian territory.

\textsuperscript{10} Five dimensional categories were distinguished: a) 11-20 employees, b) 21-50 employees, c) 51-250 employees, d) 251-500 employees and finally e) more than 500 employees.

\textsuperscript{11} Four geo-economic locations were discerned: a) North West (Valle d’Aosta, Piemonte, Lombardia and Liguria); b) North East (Trentino Alto-Adige, Veneto, Friuli Venezia Giulia and Emilia Romagna); c) Center (Toscana, Umbria, Marche and Lazio); and d) South (Abruzzo, Molise, Puglia, Campania, Basilicata, Calabria, Sicilia and Sardegna).

\textsuperscript{12} Four sector categories were identified by considering the Pavitt (1984) taxonomy: a) Traditional sector (textiles, footwear, food and beverages, wood, paper and printing); b) Specialized suppliers sector (machinery and equipment; office, accounting and computing machinery; medical, precision and optical instruments); c) Scale-intensive sector (basic metals; motor-vehicles, trailers and semi-trailers); and d) High-tech sector (chemicals, pharmaceuticals and electronics). The first two industry categories are
sector: therefore, not all firms appear in both surveys. Despite the loss of some observations, the matching procedure has been executed, in order to have the continuity of observations over time. Next, AIDA data on further economic and financial characteristics have been added\(^\text{13}\).

Nevertheless, the composition of the resultant balanced panel – made up of 1070 firms – fairly reflects that of samples observed by both Capitalia surveys, which in turn, reasonably reproduce the characteristics of the Italian economy on the whole. As we can see from the Table 1, almost half of firms (about 47.85\%) are concentrated in traditional sectors, while about 30 percent are included in specialized suppliers sectors. The remaining 25 percent are firms operating in scale-intensive sectors (about 17.57\%) and high-tech sectors (about 4.67\%). On the firm size side: about 70 percent of our sample is composed of small firms (no more than 50 employees) and about one-fourth is represented by medium enterprises (no more than 250 employees); finally, the large firms (more than 250 employees) are just around 8.32 percent. Furthermore, they are especially located in Northern Italy (around 67\%), the residual one-third is predominantly situated in the Center of Italy (about 21\%): indeed, just 12.06 percent are Southern firms. Hence, our sample is exactly in line with the Italian economic reality, where the manufacturing sector is mainly made up of small-medium firms operating in Traditional and Specialized suppliers industries and located in North of the Country.

The dataset described above provides information about several firms’ characteristics and balance sheet data, but for the purpose of our study we utilize specifically: sales, number of employees, exporter status, engagement in R&D activities, net fixed assets, total labour cost, industry and geographical location. Finally, trade and production data at a 3-digit sector-level collected by Istat\(^\text{14}\) (total exports and total imports) and Eurostat\(^\text{15}\) (total sold production) have also been used.

basically composed of small-medium enterprises and are connected to one another, since the first one acquires innovative tools essential to carry out its activities from other sectors, whereas the second one is involved in producing innovative tools aimed to satisfy the needs in other sectors. Whereas, the last two industries include mainly medium-large firms characterized by highly-standardized productive processes with relevant economies of scale and high intensity of R&D activities, respectively.

\(^{13}\) For more details about the dataset construction, see Morone, Petraglia and Testa (2007).

\(^{14}\) Italian National Institute of Statistics.

\(^{15}\) Statistical Office of the European Communities.
Table 1 – Sector, geographical and dimensional composition of the sample

<table>
<thead>
<tr>
<th>SECTORS</th>
<th>N=1070</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional (or supplier dominated)</td>
<td>47.85%</td>
</tr>
<tr>
<td>Scale intensive</td>
<td>17.57%</td>
</tr>
<tr>
<td>Specialized suppliers</td>
<td>29.91%</td>
</tr>
<tr>
<td>High-tech (or science based)</td>
<td>4.67%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.00%</strong></td>
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</tbody>
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<table>
<thead>
<tr>
<th>LOCATION</th>
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<tbody>
<tr>
<td>North-West</td>
<td>35.79%</td>
</tr>
<tr>
<td>North-East</td>
<td>31.40%</td>
</tr>
<tr>
<td>Center</td>
<td>20.75%</td>
</tr>
<tr>
<td>South</td>
<td>12.06%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.00%</strong></td>
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</tbody>
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<table>
<thead>
<tr>
<th>SIZE</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>11--20</td>
<td>32.34%</td>
</tr>
<tr>
<td>21--50</td>
<td>37.48%</td>
</tr>
<tr>
<td>51--250</td>
<td>21.87%</td>
</tr>
<tr>
<td>251--500</td>
<td>4.21%</td>
</tr>
<tr>
<td>more than 500</td>
<td>4.11%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

Different data sources have different systems of industry classification: in particular, the firm-level panel data of Capitalia merged with AIDA data are classified by 5-digit Ateco 1991, whereas Istat data are classified by 3-digit Ateco 2002 and Eurostat data by 8-digit PRODCOM. In order to make them compatible: Ateco 1991 codes have been converted in Ateco 2002 ones using a conversion table (source: Istat), since the first four numbers of both Ateco 2002 and PRODCOM codes exactly correspond to NACE rev.3 code. However, we use the 3-digit level aggregation and at this level, the two Ateco classifications are very similar (the only changes are listed in the Appendix 1).

In addition, where necessary, the data have been converted from Lira to Euros and from Euro-thousands to Euro-units in order to have a homogenous unit of measurement. Finally, all variables expressed in current prices have been transformed.
into constant prices by using value added industry output deflators of Southern and Northern Italy (source: SVIMEZ\textsuperscript{16}): thus, we handle real data.

However, since the knowledge of whether the firm exports or not – relevant information for our analysis – is known just for the last year of each Capitalia survey, we were compelled to focus our attention only on the years 2000 and 2003. From Table 2, we can see that in both years the percentage of exporters is around 72 percent, and consequently that of non-exporters is around 28 percent. More specifically, 67.12 percent of sample firms are always involved in export activities, whereas 23.16 percent are always domestic-market-oriented, in both years. The remaining share (9.72%) appear to have changed exporter status: one-half were exporters in 2000 and no longer in 2003, conversely the other half result to be exporters in 2003 but were not in 2000.

Table 2 – Export status of the sample

<table>
<thead>
<tr>
<th>TRADE ORIENTATION</th>
<th>N=1070</th>
</tr>
</thead>
<tbody>
<tr>
<td>exporters in 2000</td>
<td>72,18%</td>
</tr>
<tr>
<td>non-exporters in 2000</td>
<td>27,82%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100,00%</strong></td>
</tr>
<tr>
<td>exporters in 2003</td>
<td>72,00%</td>
</tr>
<tr>
<td>non-exporters in 2003</td>
<td>28,00%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100,00%</strong></td>
</tr>
<tr>
<td>always exporters</td>
<td>67,12%</td>
</tr>
<tr>
<td>always non-exporters</td>
<td>23,16%</td>
</tr>
<tr>
<td>entrants in export market</td>
<td>4,86%</td>
</tr>
<tr>
<td>firms exiting from export market</td>
<td>4,86%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100,00%</strong></td>
</tr>
</tbody>
</table>

4. Econometric methodology\textsuperscript{17}

The following empirical methodology basically derives from methods proposed by the International Study Group on Exports and Productivity (2007) and Machin (1996). It can be divided in two sections: the first one analyses the correlation between firm productivity and sector trade intensity, underlining the gap between exporters and non-

\textsuperscript{16} SVIMEZ is an Italian association for the industry development in South of Italy.

\textsuperscript{17} All econometric definitions have been drawn by Gujarati (2004) and Greene (2003) textbooks.
exporters; the second one studies the direction of causality between firm performance and exporter status, allowing for the not mutually exclusive hypotheses: self-selection (pre-entry premium) and learning-by-exporting (post-entry premium).

4.1 Firm performance, sector trade intensity and exporter status

We start by analysing the connection between firm-level labour productivity and sector-level trade intensity – discriminating between exports and imports – assuming a log-lin functional form\(^{18}\), and investigating whether there are some differences between exporters and non-exporters through the estimation of the exporter productivity premium (\(\hat{\beta}_1\)).

Firstly, we focus separately on the first year (2000, denoted \(t=0\)) and the second one (2003, denoted \(t=1\)), whereas during a second stage, we consider them together. Thus, we will have two cross-sections and one balanced panel of just two years distant over time, respectively:

\[
\begin{align*}
\ln LP_{it} = & \hat{\beta}_0 + \hat{\beta}_1\text{EXPORTER}_{it} + \hat{\beta}_2\text{EXPind}_{it} + \hat{\beta}_3\text{IMPind}_{it} + \hat{\beta}_4\text{CONTROLS}_{it} + \varepsilon_{it} \\
(1.a) & \text{for } t = 0; \ i = 1,\ldots,n; \ j = 1,\ldots,m \ (\text{cross-section}) \\
(1.b) & \text{for } t = 1; \ i = 1,\ldots,n; \ j = 1,\ldots,m \ (\text{cross-section}) \\
\ln LP_{it} = & \hat{\gamma}_0 + \hat{\gamma}_1T_i + \hat{\gamma}_2\text{EXPORTER}_{it} + \hat{\gamma}_3\text{EXPind}_{it} + \hat{\gamma}_4\text{IMPind}_{it} + \hat{\gamma}_5\text{CONTROLS}_{it} + \varepsilon_{it} \\
(2) & \text{for } t = 0, 1; \ i = 1,\ldots,n; \ j = 1,\ldots,m \ (\text{panel})
\end{align*}
\]

\(^{18}\)This is the semilog model where the regressand \(Y\) appears in the logarithmic form and the regressors \(X\) are expressed in linear form: \(\ln Y = a + b X\). It is considered the natural form for models with dummy variables and the most appropriate model, when we want to know the rate of growth of a certain economic variable (as productivity) respect to the other variables. The related slope coefficient \(b\) measures the relative change in \(Y\) for a given absolute change in \(X\): indeed, by using differential calculus, we can show that \(b = \frac{d(\ln Y)/dX}{(1/Y)/(dY/dX)} = (dY/Y)/dX\). By multiplying \(b\) by 100, we will obtain the percentage change in \(Y\) for an absolute change in \(X\), namely the instantaneous rate of growth (known also as the semielasticity of \(Y\) with respect to \(X\)). Finally, if we want to know the compound rate of growth, we should use the following formula: \((e^b-1)*100\).
where

\( i \) is the index of firm, \( j \) is the index of sector (or industry) and \( t \) is the index of year.

\( T \) is a time dummy to allow for changes in \( \ln \text{LP} \) over time (1 if the year is 2003, 0 else).

\( \text{LP} \) is the firm’s labour productivity, measured as sales per employee.

\( \text{EXPORTER} \) is a dummy variable which assumes the value 1 if the firm exports and 0 otherwise.

\( \text{EXPind} \) measures the sector export intensity and has been computed as the share of exports in total domestic sold production in each sector:

\[
\text{Sector export intensity index} \quad \text{EXPind}_{jt} = \frac{\text{Exports}_{jt}}{\text{Sold Production}_{jt}}
\] (3)

\( \text{IMPind} \) measures the sector import intensity and has been calculated as the share of imports in total domestic consumption in each sector:

\[
\text{Sector import intensity index} \quad \text{IMPind}_{jt} = \frac{\text{Imports}_{jt}}{\text{Sold Production}_{jt} - \text{Exports}_{jt} + \text{Imports}_{jt}}
\] (4)

\( \text{CONTROLS} \) are control variables at a firm level:

- R&D is a dummy variable which assumes the value 1 if the firm is involved in R&D activities and 0 otherwise;
- \( (K/L) \) is the capital-to-labour ratio of firm (measured as net fixed assets per employee);
- \( (w/L) \) is the pro-capita labour cost (quantified as total labour cost per employee) to proxy for the human capital.

Finally, \( \varepsilon_{ijt} \) is the error term, which is assumed to follow the classical assumptions: basically, \( \varepsilon_{ijt} \sim \mathcal{N}(0, \sigma^2) \)

We can observe that the panel equation (2) is equivalent to the cross-section one (1) extended with the time dummy \( T \), which measures the firm labour productivity.
changes over time. When we use OLS estimators, we assume that we do not have problems of omitted variables and that the error term is not correlated with our explanatory variables, in order to have consistent estimators. This is of particular concern when we include data from both years in a Pooled model, where basically, intercept and slopes are assumed time-invariant and constant across individual units, while the error term simultaneously captures both individual and time differences.

The unobservable component $\varepsilon_{ijt}$ could contain some time-constant factors affecting the dependent variable: the so-called ‘individual effects’ (such as the firm location/industry which do not change over time). Thus, we can write the unobservable component of the equation (2) as:

$$\varepsilon_{ijt} = \lambda_i + \xi_{ijt} \tag{5}$$

where

$\lambda_i$ is an unobservable component affecting the firm labour productivity which does not change over time (individual effects), and

$\xi_{ijt}$ is an unobservable component affecting the firm labour productivity which does change over time (idiosyncratic component).

Then, we can rewrite the equation (2) as:

$$\ln LP_{ijt} = \hat{\gamma}_0 + \hat{\gamma}_1 T + \hat{\gamma}_2 \text{EXPORTER}_{ijt} + \hat{\gamma}_3 \text{EXPInd}_{ijt} + \hat{\gamma}_4 \text{IMPInd}_{ijt} + \hat{\gamma}_5 \text{CONTROLS}_{ijt} + \lambda_i + \xi_{ijt} \tag{6}$$

These individual effects $\lambda_i$ could be correlated with the explanatory variables (other than the dependent variable): thus, they could make our coefficients biased, since they are included within our error term. For instance, the managerial abilities included within the error term can be considered firm-specific and time-invariant and can affect not only the firm productivity, but also the capability to serve international markets, the propensity to invest in R&D activities, etc.. A remedy to this problem could be the first-differentiation of the equation (6), i.e. we can difference the data over two years and consequently have a cross-section equation without individual effect component, since it is constant over time:
\[ \Delta \ln LP_{ij} = \gamma_1 + \gamma_2 \Delta \text{EXPORTER}_{ij} + \gamma_3 \Delta \text{EXPind}_{ij} + \gamma_4 \Delta \text{IMPind}_{ij} + \gamma_5 \Delta \text{CONTROLS}_{ij} + \Delta \xi_{ij} \quad (7) \]

In our particular case – when we have just two years – the first-differentiated model (7) is exactly equivalent to the Fixed Effect version of equation (2), where basically the individual effects are captured by the intercept term. Thus, the latter tends to vary across firms, although the each firm’s intercept remains fixed over time (whereas the slopes continue to be assumed constant across firms and over time): this is the reason why the following equation is called Fixed Effect (FE) model

\[ \ln LP_{it} = \gamma_0 + \gamma_1 T_{it} + \gamma_2 \text{EXPORTER}_{it} + \gamma_3 \text{EXPind}_{it} + \gamma_4 \text{IMPind}_{it} + \gamma_5 \text{CONTROLS}_{it} + \xi_{it} \quad (8) \]

In practice, these fixed effects can be ‘observed’ by the dummy variable technique, bearing in mind that n-1 differential intercept dummys are needed if we have an initial intercept representing already one firm – or alternatively, n intercept dummies if we do not have an initial intercept – to avoid falling into the problem of perfect collinearity (indeed, in the literature, this model is also known as Least-Squares Dummy Variables – LSDV – model). In order to choose between the Pooled and Fixed Effect models, we can resort to an F-test, considering that the former is the restricted version of the latter (indeed, a single intercept is imposed to all individual units in the Pooled model respect to FE model): thus, if the F-value is statistically significant, the restricted version – i.e. Pooled model – seems to be invalid. However, as Gujarati briefly summarizes, the FE model cannot always be used, since the introduction of too many dummies can lead to the drastic loss in degrees of freedom and the possibility of multicollinearity (making precise estimation of some parameters difficult); also, some effects of time-invariant characteristics cannot be identified (such as, the impact of sex, religion, ethnicity); finally, the related estimations are based on the classical assumptions (namely, \( \varepsilon_{it} \sim N(0, \sigma^2) \), but it is sometimes necessary to assume that error variance is different for all cross-sectional units (thus, heteroskedastic), error terms are correlated over time for each individual unit (autocorrelation) or across individual units for a given time. Some of these problems can be solved by assuming the intercept in the previous equation (8) as a random variable with a mean value of \( \gamma_0 \), rather than fixed (i.e. as \( \gamma_{0i} = \gamma_0 + \lambda_i \), where \( \lambda_i \) is a random error term with zero mean and constant variance): substantially, this new
model, the so-called Random Effect (RE) model, can be expressed in the form of equation (6) – by assuming \( \lambda_i \sim N(0, \sigma^2_\lambda) \), \( \xi_{ijt} \sim N(0, \sigma^2_\xi) \), no correlation between the two types of errors and no autocorrelation over time and across individual units for each kind of error – and the related more appropriate method is Generalized Least Squares (GLS). To check if random effects are present, we can resort to the Breusch-Pagan test under the null hypothesis of ‘no random effects’. It is not sufficient to state if the RE model is more suitable than FE model in the case where the null hypothesis is rejected, since the former also requires zero correlation between individual error component \( \lambda_i \) and regressors. The existence of the last condition is checked by the Hausman test, whose null hypothesis is exactly associated to the higher suitability of the RE compared with FE one.

In the estimations section, we will report the results of equations 1.a, 1.b, and 2 in all model versions (Pooled, Fixed and Random).

### 4.2 Self-selection versus Learning-by-exporting

The previous section considers whether there is some correlation between firm performance and exporter status, but it says nothing about the related direction of causality. As we have mentioned above, two hypotheses can be put forward, which are not necessarily mutually exclusive: Self-Selection and Learning-by-Exporting.

The **Self-Selection hypothesis** entails that the more productive firms are more likely to sell abroad: thus, we should test if there was already some productivity gap in the past between current exporters and non-exporters. First of all, we estimate the empirical model:

\[
\ln LP_{y0} = \hat{\beta}_0 + \hat{\beta}_1 \text{EXPORTER}_{y1} + \hat{\beta}_2 \text{EXPInd}_{y0} + \hat{\beta}_3 \text{IMPInd}_{y0} + \hat{\beta}_4 \text{CONTROLS}_{y0} + \epsilon_{y0} \quad (9)
\]

\( LP_{y0} \) is the labour productivity in the year 0, \( \text{EXPORTER}_{y1} \) is the dummy variable for exporter status in the year 1 (one if the firm exports in the year 1, zero else) and the respective coefficient \( \hat{\beta}_1 \) captures the productivity gap of both continuing
exporters and new export-entrants compared with firms exiting from export market and continuing non-exporters: i.e. how much more productive firms should be in order to enter and keep a share in foreign markets. All other variables are related to the year 0.

Next we have replicated the same regression but considering two sub-samples separately, depending on whether firms turn out to serve solely the domestic market or also the foreign market in the year 0 (i.e. whether EXPORTER$_{ij0}$ assumes value zero or one, respectively). In the first case, $\hat{\beta}_i$ represents the LP gap between new entrants in export market and continuing non-exporters, i.e. how much higher the economic performance should be so that a firm is able to enter in international market: indeed, it could be defined as the ‘pre-entry export premium’. Whereas, in the second case $\hat{\beta}_i$ stands for the LP gap between continuing exporters and firms exiting from the export market, which can be defined as ‘no-exit export premium’, since it says how much more productive an exporter should be in order to keep holding a market share abroad.

The Learning-by-Exporting hypothesis implies that firms become more competitive if they are involved in export activities, since they take an advantage from links with foreign customers. Hence, we should check if there is some productivity gap in the year 1 between exporting firms and firms serving solely the domestic market in the year 0, through the next model:

$$\ln LP_{ij1} = \hat{\beta}_0 + \hat{\beta}_1\text{EXPORTER}_{ij0} + \hat{\beta}_2\text{EXPind}_{ij1} + \hat{\beta}_3\text{IMPind}_{ij1} + \hat{\beta}_4\text{CONTROLS}_{ij1} + \epsilon_{ij1}$$ (10)

$LP_{ij1}$ is the labour productivity in the year 1, $\text{EXPORTER}_{ij0}$ is the dummy variable for exporter status in the year 0 (one if the firm exports in the year 0, zero else) and the related coefficient $\hat{\beta}_1$ captures the LP gap of both continuing exporters and firms exiting from export market compared with new export-entrants and continuing non-exporters: that is, how much more productive firms turn out to be following some international experience, irrespective of whether or not they carry on exporting. Moreover, all other variables are relative to the year 1.

Like the Self-Selection hypothesis, we repeat the same regression by considering two sub-samples separately, relying on whether firms turn out to serve exclusively the domestic market or also the international market in the year 1 (i.e. whether
EXPORTER_{ijt} assumes value zero or one, respectively). In the former case, $\hat{\beta}_1$ represents the LP gap between firms exiting from export market and continuing non-exporters: indeed, it could be defined as the ‘post-exit export premium’, since firms coming back to serve exclusively the domestic market after an international experience are assumed to be more productive compared with other domestically-oriented, because of knowledge accumulated by selling abroad. Whereas, in the second case $\hat{\beta}_1$ stands for the LP gap between continuing exporters and new exporters, also known as ‘post-entry export premium’, given that it says us how much more productive the well-established exporters are compared with the recent exporters, because of more experience abroad.

Finally, we can notice that we have nothing to do with panel models, since both equations 9 and 10, with all their variants, are cross-sections.

5. Empirical results

In this section, we will report all the results from the previous regression models taking into consideration that robust standard errors have been used where needed because of the heteroskedasticity problem\textsuperscript{19}.

5.1 Findings on ‘Firm performance, sector trade intensity and exporter status’

Firstly, we focus on the results of equations 1.a, 1.b and 2 on the link between firm performance, industry trade intensity and exporter status. As we can observe from the table of the two cross-section equations (Table 3), all the coefficients are statistically significant at a 5 percent level\textsuperscript{20} both individually and jointly – although $R^2$ is not very high, indeed it suggests that in 2000 (2003), about 20% (18%) of the variation in LP is explained by the included regressors – and the signs are consistent with our expectations:

\textsuperscript{19} The problem of serial correlation concerns data very close over time: thus, it is negligible in our case, since we handle with cross-sections (one time period) and in panel with enough distanced periods.

\textsuperscript{20} Except for the exporter dummy in 2003, which is significant at a 10 percent level.
for this reason, we will just comment on the coefficients in 2000 and report in brackets those related to 2003.

Firms relatively abundant in physical capital and high-skilled human capital are more productive: indeed, if the labour-capital ratio increases by one percentage point, the labour productivity rises by 0.32\% (0.19\%)\textsuperscript{21}, on average and \textit{ceteris paribus}; while a one percentage point rise in wage per employee – which proxies the presence of highly-qualified workers – increases the labour productivity by 2.1\% (2.3\%), on average and \textit{ceteris paribus}. Firms involved in R\&D activities turn out to be more competitive, in particular, they gain 10.6\% (7.2\%) more in labour productivity, on average and \textit{ceteris paribus}.

\begin{table}[h]
\centering
\caption{Firm performance, sector trade intensity and exporter status (cross-sections)}
\begin{tabular}{lcc}
\hline
LP (dependent variable) & year 2000\textsuperscript{\textdagger} & year 2003 \\
\hline
EXPERIDER & 0.113 & 0.067 \\
& (2.73)** & -1.61 \\
EXPind & 0.024 & 0.017 \\
& (4.55)** & (3.90)** \\
IMPind & -0.192 & -0.163 \\
& (4.63)** & (4.31)** \\
R\&D & 0.099 & 0.069 \\
& (2.70)** & -1.84 \\
K/L & 0.003 & 0.002 \\
& (6.12)** & (6.06)** \\
w/L & 0.021 & 0.023 \\
& (9.26)** & (10.62)** \\
Constant & 11.163 & 11.154 \\
& (176.71)** & (181.52)** \\
\hline
\end{tabular}
\textsuperscript{\textdagger}Robust t statistics in parentheses
\textsuperscript{\textdagger}Significant at 5\%; ** Significant at 1\%
\end{table}

Now, we concentrate on the trade-related coefficients: first of all, we can observe as the firms’ productivity increases if they operate in more export-oriented sectors – in particular, by 2.5\% (1.7\%), on average and \textit{ceteris paribus}, as a consequence of a one percentage point increase in the export intensity of their industry – and conversely

\textsuperscript{21}All coefficients have been transformed through $b = (e^\beta - 1) \times 100$ in order to derive the compound rate of productivity growth respect to each single explanatory variable
decreases if they produce within more import-competing sectors – more precisely by 17.5% (15.0%) on average and ceteris paribus, following a one percentage point rise in the import intensity of the related industry. Exporters turn out to be more productive than non-exporters and the exporter productivity premium is around 12.0% (6.9%).

Hence, the results are exactly in line with theoretical predictions. A higher level of exports within a sector, implies higher economic performance of a firm belonging to that sector: this could be due to the presence of exporters and/or firms with larger export propensity – all arguments related to both self-selection and learning-by-exporting mechanisms – as well as the so-called positive spillover effects from exporters to non-exporters (for example, by knowledge transfer). Conversely, the higher intensity of imports within a sector is automatically associated to a lower productivity level of domestic firms inside that sector.

Table 4 - Firm performance, sector trade intensity and exporter status (panel models)

<table>
<thead>
<tr>
<th></th>
<th>Pooled</th>
<th>FE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>-0.052</td>
<td>-0.045</td>
<td>-0.046</td>
</tr>
<tr>
<td></td>
<td>(2.12)*</td>
<td>(3.59)**</td>
<td>(3.63)**</td>
</tr>
<tr>
<td>EXPORTER</td>
<td>0.09</td>
<td>-0.059</td>
<td>0.039</td>
</tr>
<tr>
<td></td>
<td>(3.17)**</td>
<td></td>
<td>(1.37)</td>
</tr>
<tr>
<td>EXPind</td>
<td>0.02</td>
<td>-0.012</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>(6.37)**</td>
<td></td>
<td>(4.03)**</td>
</tr>
<tr>
<td>IMPind</td>
<td>-0.176</td>
<td>0.098</td>
<td>-0.115</td>
</tr>
<tr>
<td></td>
<td>(6.38)**</td>
<td></td>
<td>(3.48)**</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>0.085</td>
<td>0.02</td>
<td>0.057</td>
</tr>
<tr>
<td></td>
<td>(3.26)**</td>
<td></td>
<td>(2.71)**</td>
</tr>
<tr>
<td>K/L</td>
<td>0.002</td>
<td>0</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(9.08)**</td>
<td></td>
<td>(4.77)**</td>
</tr>
<tr>
<td>w/L</td>
<td>0.022</td>
<td>0.019</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>(14.83)**</td>
<td>(10.72)**</td>
<td>(15.31)**</td>
</tr>
<tr>
<td>Constant</td>
<td>11.188</td>
<td>11.428</td>
<td>11.289</td>
</tr>
<tr>
<td></td>
<td>(260.97)**</td>
<td>(194.45)**</td>
<td>(267.81)**</td>
</tr>
</tbody>
</table>

F-test for fixed effects 6.83 [0.000]
corr(u_i, Xb) 0.0036
BP test 489.63 [0.000]
Hausman test 82.05 [0.000]

Observations 2045 2045 2045
Number of id 1070 1070 1070
R-squared 0.19 0.12

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%
Now, we can move from cross-section analysis to panel one, whose results are shown in the Table 4, initially considering the choice between Pooled, Fixed and Random models.

Firstly, we should consider that the last model turns out to be theoretically the most appropriate for a case like ours, given that it treats firm’s unobserved heterogeneity as a random variable – through the assumption that the unobserved errors are uncorrelated with observed explanatory variables – and our sampled firms have been drawn from a large population. Anyhow, the results of the Breusch-Pagan test (489.63 [p-value 0.000]) and the Hausman test (82.05 [p-value 0.000]) show the existence of random errors correlated with explanatory variables: i.e. the RE model turns out to be unsuitable in our case. Hence, the choice is restricted between FE and Pooled model. As we can note the fixed effects are jointly statistically significant (6.83 [p-value 0.000]) and almost not correlated at all with explanatory variables \((\text{corr}(\lambda_i, X_{it}) = 0.0036)\), i.e. the unobserved time-invariant firm characteristics, such as technology, managerial capability, result to exert a certain influence on the firm productivity (dependent variable) without affecting almost at all the other observed firm traits. Thus, the choice would seem to be clear: the FE model should be preferred to Pooled one.

However, we should bear in mind that in the former model, all firm-specific characteristics that are time invariant will be captured in the fixed effect, regardless of the fact that they have been observed or not. For instance, if our exporter status dummy was constant over time (all the exporters continue to export and all non-exporters carry on to serve solely domestic market over time), it would be dropped from the estimation in a FE model, and the effect of being an exporter would be captured by the coefficient of the firm-specific dummy variable (the so-called ‘fixed effect’): thus, it would be been impossible to study the relationship between firm productivity and exporter status. Now, if we consider a more realistic case, where the exporter status does change from one period to the other, but only for a very small portion of firms, i.e. the exporter status dummy turns out to be quasi-time-constant, a coefficient will be estimated, but it will probably not be very informative, as most of the effect of the variable will be still captured by the fixed effect. This is reflected in the fact that in Table 4 the Pooled model gives better estimates statistically. Given that our analysis is mainly aimed to unveil the relationship between firm productivity and export status, and in our dataset only about
9% of firms change export status in the period considered (as the Table 2 shows), we have decided to focus our attention on Pooled model.

As we can see from Table 4, all coefficients continue to be statistically significant at a 5% level and the signs remain the same as before, thus perfectly in line with the theoretical expectations. The extent of each coefficient lies in a range delimited by the estimated values in the two previous cross-section equations. Shortly, the firm’s labour productivity:

- Increases by 0.23% if the capital-to-labour ratio goes up by one percentage point, on average and \textit{ceteris paribus}, and by 2.2% following a one percentage point rise in wage per employee, on average and \textit{ceteris paribus};
- Rises by 2.0% if the related sector export intensity grows by one percentage point, on average and \textit{ceteris paribus}; conversely, it falls by 16.2% as a effect of a one percentage point increase in the sector import intensity, on average and \textit{ceteris paribus};
- Is higher if the firm is exporter (around 9.4% more) and also in case that the firm invests in R&D activities (about 8.8% more).

In addition, it can be observed here the time dummy, which is statistically significant and has a negative sign: thus, firm’s labour productivity decreases by about 5.0% over the three-year period considered. This could be linked to some macroeconomic changes affecting the Italian economy altogether: for example, it could easily be connected to the introduction of the Euro currency taken place in 2000.

Hence, we can conclude that a positive relationship between labour productivity and exports exists, but we are not able to say nothing about the direction of causality, i.e. if higher productivity determines higher exports (self-selection hypothesis) or vice-versa (learning-by-exporting hypothesis) or both. Because of that, we will pay more attention to analyse these two hypotheses, by allowing for the cross-section equations (9) to (10) and the related empirical results shown in the Tables 5 and 6 respectively.
5.2 Findings on ‘Self-Selection versus Learning-by-Exporting’

The ‘Self-selection’ table illustrates the results of equations (9), by considering the whole sample, the only sub-sample of non-exporters in 2000, and the only sub-sample of exporters in 2000, alternatively. First of all, it is possible to see that all coefficients have the expected signs as before, and are statistically significant, apart from some coefficients in the second column: but anyway, in this context we are especially interested in exploring the EXPORTER coefficient, which always appears to be positive and statistically significant.

<table>
<thead>
<tr>
<th></th>
<th>the whole sample</th>
<th>EXPORTER_0 = 0</th>
<th>EXPORTER_0 = 1^</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXPORTER_1</td>
<td>0.188</td>
<td>0.296</td>
<td>0.167</td>
</tr>
<tr>
<td>(4.92)**</td>
<td>(3.31)**</td>
<td>(2.09)*</td>
<td></td>
</tr>
<tr>
<td>EXPind_0</td>
<td>0.025</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>(5.30)**</td>
<td>-1.14</td>
<td>(4.63)**</td>
<td></td>
</tr>
<tr>
<td>IMPind_0</td>
<td>-0.192</td>
<td>-0.008</td>
<td>-0.247</td>
</tr>
<tr>
<td>(4.72)**</td>
<td>-0.09</td>
<td>(6.46)**</td>
<td></td>
</tr>
<tr>
<td>R&amp;D_0</td>
<td>0.088</td>
<td>0.022</td>
<td>0.113</td>
</tr>
<tr>
<td>(2.48)*</td>
<td>-0.25</td>
<td>(2.84)**</td>
<td></td>
</tr>
<tr>
<td>(K/L)_0</td>
<td>0.003</td>
<td>0.005</td>
<td>0.003</td>
</tr>
<tr>
<td>(7.19)**</td>
<td>(5.70)**</td>
<td>(4.00)**</td>
<td></td>
</tr>
<tr>
<td>(w/L)_0</td>
<td>0.02</td>
<td>0.02</td>
<td>0.021</td>
</tr>
<tr>
<td>(9.77)**</td>
<td>(4.75)**</td>
<td>(8.23)**</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>11.138</td>
<td>11.074</td>
<td>11.152</td>
</tr>
<tr>
<td>(201.00)**</td>
<td>(108.27)**</td>
<td>(122.61)**</td>
<td></td>
</tr>
</tbody>
</table>

| Observations   | 1039            | 289            | 744             |
| R-squared      | 0.21            | 0.23           | 0.21            |

Absolute value of t statistics in parentheses
^ Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

In particular, continuing exporters and export-entrants turn out to be more productive than continuing non-exporters and firms exiting from export market by about 20.7%: therefore, the only highly-productive firms will be able to enter and/or to survive in international market. In details, the pre-entry export premium – i.e. the LP gap between export starters and continuing non-starters – is around 34.4%, whereas the no-exit export premium – i.e. LP gap between continuing exporters and firms exiting from
the international market – is around 18.2%. Thus, the export productivity premium needed to enter is almost twofold higher compared with the export productivity premium required to keep the presence in foreign markets.

Similarly, the ‘Learning-by-exporting’ table shows the results of equations (10), by taking into account firstly the whole sample and after, the only sub-samples of non-exporters and exporters in 2003, respectively.

### Table 6 - Learning-by-Exporting

<table>
<thead>
<tr>
<th>LP, (dependent variable)</th>
<th>the whole sample</th>
<th>EXPORTER, = 0</th>
<th>EXPORTER, = 1^</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXPORTER,</td>
<td>0.011</td>
<td>-0.06</td>
<td>-0.109</td>
</tr>
<tr>
<td>EXPind0</td>
<td>0.016</td>
<td>0</td>
<td>0.025</td>
</tr>
<tr>
<td>IMPind0</td>
<td>-0.162</td>
<td>-0.028</td>
<td>-0.196</td>
</tr>
<tr>
<td>R&amp;D0</td>
<td>0.089</td>
<td>0.172</td>
<td>0.066</td>
</tr>
<tr>
<td>(K/L)0</td>
<td>0.002</td>
<td>0.001</td>
<td>0.003</td>
</tr>
<tr>
<td>(w/L)0</td>
<td>0.023</td>
<td>0.026</td>
<td>0.021</td>
</tr>
<tr>
<td>Constant</td>
<td>11.186</td>
<td>11.072</td>
<td>11.341</td>
</tr>
<tr>
<td>Observations</td>
<td>1005</td>
<td>281</td>
<td>712</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.18</td>
<td>0.16</td>
<td>0.21</td>
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</tbody>
</table>

Absolute value of t statistics in parentheses
^ Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Once again, we should just focus on the EXPORTER dummy’s coefficient, rather than the other ones^22, and we can note that it is always highly non-significant. Thus, we do not find a LP gap if we compare continuing exporters and firms exiting from international market on the one hand, and export starters and non-starters on the other hand: i.e. past export experience seems to do not affect the firm productivity. Even when we just contrast non-exporters and firms coming back again to supply exclusively the

^22 Anyhow, all of them appear to be significant and right in signs, expect for some of them in the second column
domestic markets, after an export experience, we do not find out any statistically relevant divergence in terms of productivity. Finally, no significant LP gap was found between export-starters and exporters for a longer period of time, which are assumed to have ‘learnt-by-exporting’ more than the first ones.

Hence, our results are perfectly in line with most of other empirical studies, since almost all of them support the ‘Self-Selection hypothesis’, rather than the ‘Learning-by-Exporting hypothesis’, i.e. higher productivity leads firms to become exporters and thus to extend the borders of their own market beyond the national borders. However, the second hypothesis should not completely be ruled out, if we consider the role of export spillover, in the sense that exporters may be recipients of knowledge from their foreign buyers, which indirectly and shortly is transferred to non-exporters too: this could be the reason why post-entry effects turn out to be less visible.

6. Conclusion

This paper participates in the intense debate about the relationship between international trade and economic performance, taking into account the role of firm heterogeneity. In detail, we analysed the exporting-productivity linkage and the underlying hypotheses: Self-selection mechanism and Learning-by-Exporting case, through a detailed recent literature review, and new empirical evidence on Italian manufacturing sector. In general, our empirical results turn out to be in line with theoretical predictions – especially emphasized by Meltiz model (2003) – and the findings of most other empirical studies (Survey of Wagner (2007a)).

In particular, we have documented the existence of the export productivity premium and the fact that is more of a pre-entry (Self-selection mechanism) rather than post-entry (Learning-by-Exporting effect) nature: firms engaged in international activities turn out to be more competitive than firms exclusively oriented to the home market, because only the most productive firms would be able to enter and after to keep their presence into foreign markets. However, the learning-by-exporting hypothesis should not completely be ruled out, if we consider the role of export spillover, in the sense that exporters may be recipients of knowledge from their foreign buyers, which
indirectly and shortly is transferred to non-exporters too, giving rise to invisible post-entry effects.

Finally, we are aware that our analysis is not absolutely exhaustive, since the same topic could be examined through different methodologies, different productivity and trade measures – such as total factor productivity or other kinds of industry trade ratios – and larger datasets including higher number of firms, more years, many more characteristics of firms under both general and internationalization profiles.

Indeed, our analysis is based on firm-level dataset composed by only two years, devoid of information about trade intensity or trade destination for which we were forced to use industry-level data. In addition, we should bear in mind that we have solely examined the productivity differences across firms in level terms (lnLP) and not in change terms (ΔlnLP), i.e. whether exporters are more productive than non-exporters and not whether the former grow more rapidly than the latter: thus, we are not even able to say whether exporters grow before or/and after their exposure to international market. These are some sufficient reasons that motivate us to deepen further our work in the future.
References


### Appendix 1 – Table of ‘Industry codes converted from Ateco 1991 to Ateco 2002 classification’

<table>
<thead>
<tr>
<th>FROM 4 (or 5)-digit level Ateco 1991</th>
<th>TO 3-digit level Ateco 2002</th>
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<tbody>
<tr>
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