



UNIVERSITÀ DEGLI STUDI DI ANCONA  
DIPARTIMENTO DI ECONOMIA

**THE DETERMINANTS OF EXPORT  
PERFORMANCE: A FIRM-LEVEL STUDY  
IN ITALIAN MANUFACTURING**

ALESSANDRO STERLACCHINI  
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**THE DETERMINANTS OF EXPORT PERFORMANCE:  
A FIRM-LEVEL STUDY IN ITALIAN MANUFACTURING**

Alessandro Sterlacchini<sup>1</sup>

**Abstract**

This paper analyses the main determinants of a firm's probability to export and export intensity and presents the findings of an empirical study carried out for a large sample of Italian firms. Among these determinants, the study considers the firms' size and industry, the geographical location, the working as a subcontractor, and the affiliation with business groups. Moreover, along with R&D intensity, other qualitative indicators of innovation are taken into account. On the basis of Probit and Tobit estimates, it emerges that the determinants of export performance change according to the size of firms. In particular, only for small firms the relationship between size and export performance is positive. The export probability and intensity of SMEs decrease with the share of sales due to subcontracting. Larger firms, instead, benefit more from being affiliated with business groups. Finally, innovative activities are particularly effective in raising the export performance of medium-sized and large firms.

**JEL Codes:** L10, O33.

**Keywords:** Export probability and intensity; firm size; innovative activities.

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## 1. Introduction

Empirical studies on the determinants of international trade have been carried out mainly across countries and industries. Only recently, and thanks to a greater availability of firm-level data, a number of attempts have been done to address also the issue of why some firms export more than others.

The idea that, in order to be successful in foreign markets, a firm should be big can be questioned on the basis of different arguments. In any case, from an empirical point of view, the size-exports relationship cannot be evaluated without controlling for other characteristics of the firms as well as their efforts to raise foreign sales (such as innovation expenditures). By considering a comprehensive set of explanatory variables, many empirical studies (reviewed in section 2) have found that the relationship between size and export performance is not always and necessarily positive.

In this paper, along with size and industry, different characteristics that can influence a firm's export behaviour are taken into account: namely, the propensity to work as a subcontractor of other firms, the affiliation with a business group and the geographical location. As far as innovation variables are concerned, together with the intensity of R&D, other qualitative indicators of innovation have been considered with particular regard to the role played by innovative machinery and the relative importance of product versus process R&D.

The results of Probit and Tobit estimates carried out for a sample of 3,659 Italian manufacturing firms are presented in section 3. They show that, after controlling for the set of the above mentioned variables, only within the subsample of small firms there is a positive impact of size on the export probability and intensity; for large firms, instead, the relationship is U-shaped. In addition,

larger firms take advantage from being affiliated with business groups (especially those with an international scope) while the intensity of subcontracting depresses the export performance of SMEs. With regard to innovation variables, it emerges that the small firms with better export performances rely primarily on product rather than process innovations. The intensity of R&D and the importance ascribed to the introduction of innovative machinery are more effective for, respectively, medium-sized and large firms.

## 2. Export performance, firm characteristics and innovative activities

### 2.1. Firm size and intensity of exports

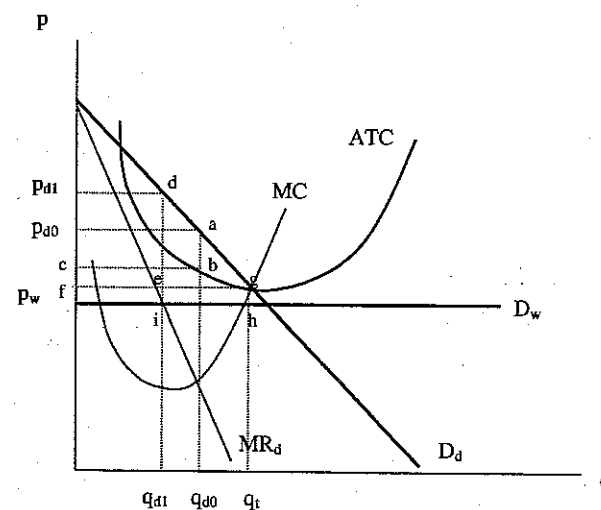
Nowadays, it is generally believed that, to compete in the global market, firms should be big. In fact, if firms must be active in different national markets by implementing a wide set of complex strategies (exports, foreign direct investments, joint ventures, and international agreements) the idea that 'big is necessary' can be hardly confuted. However, if the analysis is confined to the export activity only, the relevance of firm size can be questioned in many respects.

From a theoretical point of view, some predictions about the size-exports relationship can be drawn from the analysis of the export behaviour of a firm that enjoys, at least in the short-run, some domestic market power. For the sake of simplicity, I shall assume that such a firm is price-taker in foreign markets.

The short-run price and output choices of this firm can be described as those of a discriminating monopolist. In Figure 1,  $D_d$  and  $D_w$  identify respectively the domestic and foreign demand, the latter being infinitely elastic with respect to the world price  $p_w$ . If the firm produces in the domestic market only (the

quantity  $q_{d0}$  at price  $p_{d0}$ ) its profits amount to the area  $p_{d0}abc$ . If decides to produce in both markets, the total output is  $q_t$ ; that sold in the home market (at price  $p_{d1}$ ) is  $q_{d1}$  while the output sold abroad (at price  $p_w$ ) is  $q_t - q_{d1}$ . Thus, the export intensity of the firm (i.e. the share of exports in total sales) is  $p_w(q_t - q_{d1}) / [p_{d1}q_{d1} + p_w(q_t - q_{d1})]$ .

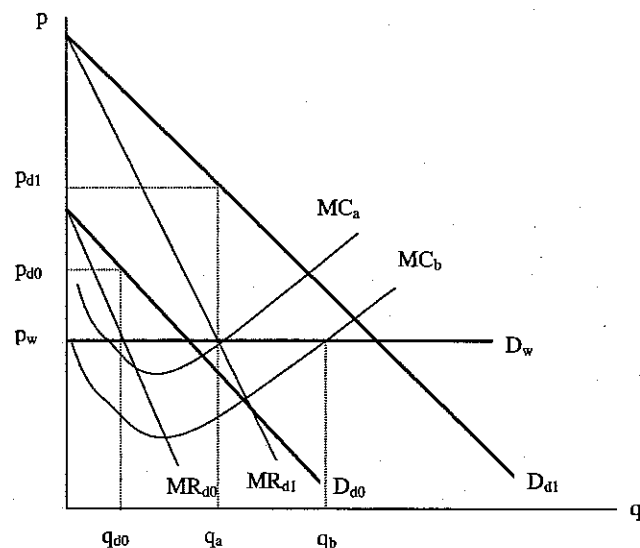
Figure 1 – Export behaviour of a price-taking firm in foreign markets



Notice that a profit-maximising firm will export only if the net profits achieved by producing for both domestic and foreign market (i.e. the difference between the profits  $p_{d1}def$  and the losses  $eghi$ ) are higher than the profits obtained by producing exclusively for the home market. This means that the losses arising in foreign markets (by selling at a price lower than the average total cost) are more than compensated by the increase of domestic profits due to the overall cost reduction (cf. Basevi, 1970).

In order to analyse the relationship between size and export intensity, consider two firms, indexed with 0 and 1, both having market power at home but not abroad. Let assume that firm 0 is characterised by a domestic demand schedule lower than that of firm 1 (with a lower intercept and the same slope) and that the two firms have identical marginal costs and face the same world price. This case is described in Figure 2.

Figure 2 – Domestic sales, production costs and export performance.



With the same marginal cost schedule, identified by  $MC_a$ , both firms produce the same quantity  $q_a$  in order to maximise profits. However, the export sales of firm 0 are substantial ( $p_w(q_a - q_{d0})$ ) while firm 1 does not export at all because the world price is precisely at the level in which  $MC_a$  cuts its domestic marginal revenues ( $MR_{d1}$ ). Since, in terms of total sales, firm 0 is smaller than firm 1 ( $p_{d0}q_{d0} + p_w(q_a - q_{d0}) < p_{d1}q_a$ ) an inverse relationship between total sales and export

intensity emerges. This occurs because firms with a large domestic output have little or no incentives to export because they can achieve the lowest level of average costs by serving almost exclusively or only the home market. On the contrary, firms with a low domestic demand are compelled to export in order to reduce costs and raise profits<sup>2</sup>.

However, the above conclusion<sup>3</sup> derives from the strong assumption that firms with different size (both in terms of total and domestic sales) face identical costs. To relax it, let assume that firm 1 (the largest one) has a marginal cost schedule  $MC_b$  lower than that of firm 0 (which remains  $MC_a$ ): this can occur, for instance, because the former is able to invest more resources to raise the capital-labour ratio or to work with a more technology-advanced capital stock. In this case, firm 1 will have an incentive to export - that is to add to its previous domestic sales ( $p_{d1}q_a$ ) some foreign sales ( $p_w(q_b - q_a)$ ) - and, depending on the distance between the two marginal cost schedules, its export intensity -  $p_w(q_b - q_a) / [p_{d1}q_a + p_w(q_b - q_a)]$  - can be lower, equal or even greater than that of firm 0. As a consequence, if large firms are more efficient than their smaller counterparts the relationship between firm size and export intensity is ambiguous rather than inverse.

Wagner (1995, p. 33) introduces various reasons supporting a positive impact of size on export performance: “[...] economies of scale in production, a more fully utilization of (specialized) executives, the opportunity to raise financing at

<sup>2</sup> The inclusion of fixed costs to enter foreign markets does not change the implications of the model because it can be shown that the absolute increase of profits due to exports is inversely related to domestic sales; this implies that, with a given fixed cost, small firms will continue to export while some of the larger firms will find convenient to produce in the domestic market only.

<sup>3</sup> In a long-run setting and according to a number of contributions (see, among others, Basevi, 1970; White, 1974), Glejser, Jaquemin and Petit (1982, p. 508) argue that ‘if exporting is essentially designed to achieve economies of scale, a negative correlation is likely to occur between domestic sales and the ratio of exports to domestic turnover’. The same ‘cost-reduction’ argument holds in the short-run model described in Figure 2 and can also be applied to justify an inverse relationship between total sales and the ratio of exports to total sales.

lower cost, benefits from bulk purchasing, own marketing department plus own sales force, and a high capacity for taking risks [...]”. However, according to the previous discussion, the ‘economies of scale’ argument can also be used to justify an inverse or not significant relationship.

Moreover, Wagner himself finds that, in the case of German firms, the positive relationship between size and export intensity holds only up to a point. Similarly, several other studies<sup>4</sup> have found that the same relationship is not ever increasing but inverted U-shaped: this means that the impact of size on export performance is positive only for a first (and generally small<sup>5</sup>) range of the size variable (total sales or employees) and the upper threshold after which the relationship becomes negative or not significant can be taken as a proxy for the minimum size required to export.

Along with those already introduced, other arguments can justify the presence of an ambiguous relationship between size and export performance.

Lefebvre and Lefebvre (2001) contend that size can be relevant during the first stages of internationalisation but not afterwards. Moreover, what matters is not the absolute but the relative size of a firm: some smaller firms may well be important players in their own niche markets whereas other SMEs find that they cannot compete with their larger rivals which occupy dominant market positions. Calof (1993, p. 67) argues that although there is a positive association between firm size and internationalisation, the size variable cannot be considered a barrier to export. “Certainly, large firms with more resources are better able to seek out internationalization opportunities, and they appear to do so with greater frequency than small and medium-sized firms. However, [...] small and medium-sized firms are capable of entering the same markets as are

<sup>4</sup> See Bonaccorsi (1992), Kumar and Siddharthan (1994), Lefebvre, Lefebvre and Bourgault (1998), Wakelin (1998), and Sterlacchini (1999).

<sup>5</sup> On the basis of a study concerned with Italian firms, Bonaccorsi (1992, p. 609) concluded that “a minimum size for export involvement probably does exist, but it is not a very large size”.

large firms. Size only limit the number of markets served”. Both lines of arguments suggest that the costs and benefits due to exports can be quite different across firms, depending not only on their size but also on their competitive strategy.

Bonaccorsi (1992), in particular, points out that the relationship between size and exports cannot be generalised since it is strongly dependent on the firms’ export strategies. The limited internal resources available to small firms do not allow them to achieve a stable presence in a large number of foreign markets. As a consequence, they usually implement weak (or narrow) export strategies – that is, requiring a low level of sunk costs - so that they can easily exit from stagnant foreign markets and enter in others with better economic prospects. In addition, small firms are particularly active in industries that are not characterised by relevant economies of scale, they found that exporting is the easiest way to grow and, often, their internationalisation is a ‘collective’ process. The last argument refers to the role played by agglomeration economies - exploitable by small firms located in industrial districts - and it will be resumed in the next section.

## *2.2. Other firm characteristics and export performance*

In a firm-level analysis of export performance, along with the size of firms, the industry to which they belong is an important control variable, simply because some industry-specific features affect the opportunity to export.

An already mentioned aspect refers to the relevance of economies of scale which shape, within industries, the number of extant firms and their size distribution (i.e. the level of concentration) and, thus, their propensity to export. Glejser, Jaquemin and Petit (1982, p. 508) pointed out that “A high domestic concentration could negative affect the share of exports in total sales. First, it



allows dominant firms to reap the possible economies of scale on the home market [...]. Second, insofar as concentration means monopoly power, dominant firms can exploit the negatively sloped domestic demand, and can avoid the possibility of exporting, as this would involve increasing the demand elasticity and becoming price-takers [...].”

Another factor is concerned with the patterns of technological change which, according to the taxonomy introduced by Pavitt (1984)<sup>6</sup>, are strongly industry-specific. To the extent that innovative activities affect a firm's export performance (see the next section), the presence of these sectoral patterns of technological change must be taken into account.

Moreover, if the different areas of a country are strongly specialised in particular industrial activities, the impact of the industry variable on the export propensity of firms is reinforced by agglomeration economies. The latter can give important competitive advantages to small firms as well as industries and countries, like Italy, characterised by a strong presence of industrial districts<sup>7</sup>.

According to Becchetti and Rossi (2000) external economies in the provision of export services and exchanges of information about foreign markets may improve the export performance of small firms located in ‘Marshallian districts’ (see also Bagella, Becchetti and Sacchi, 1998). In this way, small firms - lacking specific internal resources to implement effective export strategies -

<sup>6</sup> Pavitt identifies four sectoral patterns of technological change. In ‘supplier dominated’ industries (such as those producing traditional consumer goods) most innovations come from suppliers of equipment and materials rather than from autonomous innovative activities internal to the firms. In-house engineering and R&D capabilities are instead stronger in ‘specialised suppliers’ (which thrive on product innovations) and ‘scale intensive’ industries (which, instead, focus on process innovations in order to exploit latent economies of scale). Finally, the highest commitment to R&D is recorded in ‘science based’ industries.

<sup>7</sup> In Italy, each region (or even province) is specialised in a few industries and the structure of industrial (local) systems is based on the agglomeration, in particular areas, of a high number of small manufacturing firms working within networks characterised by increasing specialisation (of single productive units) and division of labour (among units). The situation is therefore that of the industrial districts thoroughly analysed by

can benefit from a reduction of the costs required to enter foreign markets (cf. the last part of the previous section). Obviously, the positive effect of geographical agglomeration on export performance will be higher if local firms compete in segmented foreign markets or when there are strong complementarities among them (both in production and commercial activities). In their empirical work, Becchetti and Rossi find that, in Italy, the location of small and medium-sized firms in industrial districts increases both their probability to export and export intensity.

Especially within industrial districts (although not only) many SMEs are specialised in particular phases of the production process and work as subcontractors of other larger and more mature firms. The latter can be termed ‘independent firms’ (or contractors) and produce their goods for final users, while a subcontractor is a firm to which other enterprises, belonging to the same industry, decentralise one or more production phases. This distinction is important for the analysis of export performance - and, particularly, that of SMEs - since it is reasonable to assume that contractors will realise more direct export sales than subcontractors. In fact, for a small sample of Italian SMEs, Sterlacchini (1999) has found that the percentage of sales due to subcontracting significantly depresses both the probability to export and the share of export of the firms. Consistent findings emerge from a study applied to a large sample of Canadian SMEs (cf. Lefebvre and Lefebvre, 2001)<sup>8</sup>.

Significant external economies for the firms can arise from industrial districts and networks, but can be also achieved through a formal integration with other firms. The affiliation of a firm with an industrial or business group enlarges its

Brusco (1982) and Pyke *et al.* (1990).

<sup>8</sup> A part from technological capabilities (that will be examined in the next section), Lefebvre and Lefebvre (2001) take into consideration other variables that can affect a firm's export performance. They focus, in particular, on commercial capabilities such as the extent of product diversification, the presence of trademarks or proprietary products,

financial and commercial capabilities and this should increase the opportunity for internationalisation and the propensity to export, especially when the scope of the business group is international.

### 2.3. Innovative activities and exports

The relationship between technological innovation and international trade has been mainly investigated at a macro-economic level and, in this connection, a large body of theoretical and empirical literature has stressed that innovations provide countries and industries with comparative advantages stronger and more durable than those based on unit labour costs<sup>9</sup>. A similar conclusion should also emerge from micro-economic studies, simply because technological knowledge is embodied in firms, and the firm is the subject that decides to invest in innovative activities with a view to improve its performances.

On the empirical ground, the studies carried out at firm level have generally found a positive and significant relationship between innovation and export performance. However, this relationship is not strong and always significant when innovation is measured exclusively by the intensity of R&D expenditures or employees<sup>10</sup> because this indicator neglect other types of innovative efforts which are particularly important for firms with a small size or belonging to non-R&D-intensive industries (Sterlacchini, 1999).

A firm-level study carried out in Canada by Lefebvre *et al.* (1998) has shown that a firm's R&D intensity does not affect its export performance, but the impact of other technology variables (such as the percentage of employees with

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the access to distribution channels and the types of intermediaries employed by SMEs in foreign markets.

<sup>9</sup> See, among others, Fagerberg (1988), Dosi *et al.* (1990) and Wakelin (1997).

<sup>10</sup> See Hirsch and Bijaoui (1985), Ito e Pucik (1993) and Kumar and Siddharthan (1994).

technical and scientific backgrounds and the presence of R&D collaborations with external partners) is positive and significant. Similar findings are obtained by Becchetti and Rossi (2000) for Italian firms; they find that R&D intensity does not increase neither the probability of being an exporter nor the share of exports on sales; instead, other innovation variables (such as the importance ascribed by firms to innovations) have a positive and significant effect.

By using a data base for more than 3,000 Canadian SMEs, Lefebvre and Lefebvre (2001) enlarge the usual set of indicators measuring the firms' technological capabilities; in effect, they also consider the level of automation, the degree of modernisation of equipment and machinery and the presence of unique know-how. They find that all these technology variables, along with the intensity of R&D and skilled labour, exert a positive influence on the export performance of Canadian SMEs. Consistent results arise from a study carried out in Italy and based on a sample of SMEs belonging to 'specialised suppliers' and 'supplier dominated' industries (Sterlacchini, 1999): the intensity of innovative activities other than R&D (namely, the expenditures on design and trial production and the technological level of capital stock) has a positive and significant impact on the firms' probability of exporting and export shares.

### 3. An empirical analysis for Italian manufacturing firms

The role of the different determinants of export performance, described in the previous section, has been examined by carrying out an empirical study concerned with 4,005 Italian manufacturing firms. For this purpose, I used the data base collected by Mediocredito Centrale<sup>11</sup> (a financial institution

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<sup>11</sup> The original data base was concerned with 4,100 firms. Ninety firms were eliminated because, for them, most of the data referring to 1991 were missing. In addition, five very large firms (with total sales greater than 1,970 millions of ECU) and five very

specialised in the provision of medium and long-term loans to Italian firms). Data were collected through questionnaires mailed to a stratified random sample of firms with less than 500 employees<sup>12</sup> (the overwhelming majority of Italian firms) and to the population of firms with a larger size. The share of exports in total sales of these firms refers to 1991 whereas most of the indicators that can be used as explanatory variables of export performance are available for the period 1989-91.

### 3.1. Descriptive analysis

In the overall sample of 4,005 firms, the share of exporters in 1991 amounts to 64.8%, but there are significant differences among firms of different size. By using total sales in 1991 and according to the criteria adopted by the European Commission in the early 1990s, the sample can be broken down into three size groups: small firms (with total sales lower than 5 millions of ECU), medium-sized firms (having from 5 to 20 MECU of total sales) and large firms (with total sales greater than 20 MECU)<sup>13</sup>.

Table 1 shows that in the sub-sample of small firms the percentage of exporters is far below the overall average, while the highest probability to export is recorded by medium-sized firms. However, looking at the share of exports in

small firms (with total sales lower than 0.13 MECU) have been excluded from the analysis. The same data base was used by Becchetti and Rossi (2000) in their empirical study quoted in the previous section.

<sup>12</sup> The sample was built according to their distribution in terms of size, sector and location.

<sup>13</sup> See Commission des Communautés Européennes (1993). Total sales in Italian Liras have been converted in ECU by using the average rate of change in 1991. The descriptive statistics by firm size do not significantly change when firms are distinguished according to the number of employees (less than 50 for small firms, less and more than 250 for, respectively, medium and large firms). Total sales - as a measure of size - are chosen in order to make consistent the descriptive with the regression analysis (cf. section 3.2).

total sales, medium-sized firms remain the most export-oriented but the relative performance of small firms improves.

As expected, the percentage of small firms that can be classified as subcontractors (with a share of sales due to subcontracting equal to or greater than 50%) is the highest within the sample. When subcontractors are excluded from the analysis (see the lower part of Table 1), the percentage of exporters among small firms increases from 46 to 53% and, also in terms of the other two indicators of export performance, the difference from larger firms decreases. Thus, in the analysis of the export performance of small firms, their nature as subcontractors cannot be neglected.

Table 1 - Descriptive statistics by firm size

Size classes (total sales)	Number of firms	Percentage of exporting firms	Mean of the firms' export shares (std.dev.)	Share of exports on sales	Percentage of subcontractors*
Small (with fewer than 5 MECU)	1278	46.2	13.6 (24.0)	16.7	21.1
Medium (from 5 to 20 MECU)	1284	74.1	25.5 (27.9)	26.7	6.2
Large (with more than 20 MECU)	1443	72.9	25.0 (27.0)	23.9	1.8
Total	4005	64.8	21.5 (27.0)	24.0	9.4
Only firms that are not subcontractors*					
Small	1008	53.1	16.0 (25.4)	18.8	
Medium	1205	76.1	26.4 (28.0)	27.5	
Large	1417	73.0	25.0 (27.0)	23.8	
Total	3657	68.5	23.0 (27.3)	24.0	

\* = A subcontractor is identified by a firm with a share of sales due to subcontracting equal to or greater than 50%.

Table 2 reports the distribution of the firms composing the sample and the different measures of export propensity by industry. The Mediocredito data base

provides a three-digit classification of Italian manufacturing industries; moreover, each industry is ascribed to one of the four groups of Pavitt's taxonomy (see section 2.1).

Table 2 - Descriptive statistics by industry

Industries	Number of firms	Percentage of exporting firms	Mean of the firms' export shares (std. dev.)	Share of exports on sales
<i>Science based industries</i>	158	59.5	13.6 (21.3)	16.2
Industrial and agricultural chemicals and Pharmaceuticals	91	65.9	16.4 (24.2)	15.0
Office & Computing machinery	23	30.4	6.7 (17.1)	19.2
Electrical measurement, Electro-medical and Telecommunication equipment	32	56.3	9.2 (13.8)	9.9
Aircraft	12	75.0	17.7 (18.4)	39.7
<i>Scale intensive industries</i>	1191	58.0	17.7 (23.9)	24.7
Basic chemical products, soaps, detergents and perfumes	98	63.3	19.4 (25.5)	22.2
Basic metal industries	129	63.6	18.3 (21.4)	21.9
Building materials, glass and pottery	193	52.3	17.6 (23.7)	17.1
Man-made fibres	8	50.0	17.1 (22.8)	22.9
Electrical apparatus, Radio, TV and Domestic appliances	302	68.2	24.8 (26.5)	28.1
Motor vehicles	67	76.1	25.1 (27.4)	44.8
Other means of transport	32	59.4	21.7 (25.1)	21.2
Paper, Printing and Publishing	322	41.9	6.9 (14.9)	15.0
Rubber products	39	79.5	31.5 (28.5)	26.2
<i>Specialised suppliers industries</i>	913	75.4	30.0 (29.4)	36.7
Glues, paints and other chemical products	36	69.4	11.9 (13.4)	27.7
Industrial and agricultural machinery	535	80.2	35.3 (29.4)	42.3
Installation and repairing of electrical and electronic equipment and apparatus	45	35.6	9.1 (19.5)	29.3
Precision instruments	53	71.7	28.9 (29.3)	27.3
Plastic products and tyres	172	75.0	20.8 (24.9)	28.1
Other manufacturing industries (Musical instruments, Toys, Packaging, Photographic labs., etc.)	72	70.8	35.0 (35.2)	29.3
<i>Supplier dominated industries</i>	1743	64.3	20.3(27.1)	19.4
Stones, Asbestos and other non-metallic minerals	43	48.8	14.2 (26.1)	18.4
Metal products	539	63.8	19.6 (25.0)	23.7
Food	147	53.7	8.1 (15.7)	6.5
Other food products, Beverages and Tobacco	85	55.3	6.8 (13.8)	7.3
Textiles	354	64.1	21.6 (26.6)	27.9
Leather and leather products	56	87.5	37.7 (29.8)	42.4
Clothing and Footwear	350	68.3	26.5 (31.2)	31.8
Wood and Furniture	169	68.0	20.6 (29.9)	29.6
<i>Total manufacturing</i>	4005	64.8	21.5 (27.0)	24.0

In order to emphasise the sectoral patterns of technological change, three-digit industries included in the same technological group as well as in the same two-digit industry have been merged. The result of this compromise between a three and a two-digit level of classification is a distribution of 27 industries.

Among them there are important differences in terms of export probability. In fact, above average percentages of exporters are recorded by 'specialised suppliers' and 'supplier dominated' industries. The same industries prevail also in terms of the mean of the firms' export shares whereas 'scale intensive' industries improve remarkably their performance when the industry share of exports in total sales is used. This suggests that, within this group, there are some large firms (in terms of total sales) that are much more export-oriented than the others belonging to the same industry (this is especially the case of Motor vehicles).

Most of the industries with the highest export propensity - whatever indicators is used - are those classified as 'specialised suppliers' (Industrial and agricultural machinery, Other manufacturing industries) or 'supplier dominated' (Leather and leather products, Clothing and Footwear). Only the industry of Rubber products, included in the 'scale intensive' group, records a comparable export performance. These findings are consistent with the Italian (sectoral) specialisation in international trade; in effect, greatest (revealed) comparative advantages are recorded by industries producing traditional consumer goods and machinery, while the export performance of 'science based' industries is weaker (cf. Amendola *et al.*, 1992).

Along with the size and industry distribution of firms, there are several reasons for taking also into consideration their geographical location. First, agglomeration economies or industrial districts (which, according to section 2.1, should enhance the export performance of SMEs) are not homogeneously distributed throughout the Italian territory. In fact, the extent of small firms'

agglomerations (or 'Marshallian districts') is particularly strong in the northern and some of the central regions while it is generally weak in southern regions (cf. Pyke *et al.*, 1990). Second, the Italian industries characterised by a greater export propensity are more concentrated in the north-eastern and central regions. Finally, a large share of Italian exports goes to Northern Europe (and, particularly, to Germany) so that the firms located in Northern Italy benefit more from the geographical proximity to export markets (cf. Conti and Menghinello, 1996).

Although with a high level of aggregation, the role of geographical location is taken into account by breaking down the sample of Italian firms in four macro-areas: North-west, North-east, Central and South. Table 3 shows that north-eastern firms are characterised by a probability to export similar to that of the firms located in the North-west but overcome the latter in terms of export shares.

Table 3 - Descriptive statistics by geographical area

Geographical areas	Number of firms	Percentage of exporting firms	Mean of the firms' export shares (std. dev.)	Share of exports on sales
North-west	1778	69.0	21.2 (25.4)	21.7
North-east	1304	69.4	25.2 (28.1)	30.2
Central	564	57.3	20.7 (29.4)	21.5
South	359	38.7	10.8 (22.7)	24.8
Total	4005	64.8	21.5 (27.0)	24.0

The firms located in central regions have a lower probability to export but improve their position when the other two indicators of export intensity are used. Finally, the worst performances are recorded by southern firms, especially

in terms of exporters and mean of the firms' export shares (although the standard deviation is very large). However, for this area, the share of exports in total sales is higher than that recorded by central and north-western regions, suggesting that some large southern firms, as opposed to their smaller counterparts, are characterised by a very high export intensity.

### 3.2. Regression analysis

The descriptive analysis has already shown that there are interesting linkages between the export propensity and some characteristics of Italian firms. To identify the most significant relationships, Probit and Tobit estimates have been carried out; the dependent variables are, respectively, the *probability to export* and the *share of exports in total sales in 1991*.

With respect to the intensity of exports, censored Tobit estimates have been preferred to OLS (in line with the majority of firm-level studies described in section 2). In effect, as it happens with our sample, when there are many firms that do not export at all and a few firms that derive all their sales from exports, OLS estimates are downward biased.

The independent variables are the following:

- *three dummy variables for small, medium-sized and large firms* which are computed by using total sales in 1990 or 1989 and according to the thresholds suggested by the European Commission; these binary variables are inserted in the regressions also as interaction dummies (i.e. multiplied by all the other explanatory variables) in order to test if the independent variables' coefficients are significantly different between the three size classes;

- the firms' size is measured by their *total sales in 1990 or in 1989* (millions of ECU); with a lag of one or two years, total sales are pre-determined with respect to the export probability and intensity and this alleviates the problem of endogeneity (although does not solve it)<sup>14</sup>; to test the presence of a non linear impact on the dependent variables, also the square of total sales is used;
- the propensity to work as a subcontractor is measured by the *percentage of sales due to subcontracting in 1991*;
- the affiliation of a firm with an industrial or business group is taken into account by using two dummy variables: *national group* (if the firm belongs to an Italian group) and *international group* (when the scope of the group is international);
- to control for geographical location, three dummy variables are inserted in the regressions: *North-east, Central and South*;
- industry fixed effects are controlled by including 26 dummies (see Table 3 in the previous section).

Moreover, the following indicators of innovative activities are considered:

- the *percentage of R&D employees*<sup>15</sup> in 1990 or 1989; although the intensity of R&D employees is, over time, more persistent than total sales, the rationale for introducing this lag is the same proposed for the size variable;

<sup>14</sup> In the regression analyses, it is assumed that the causality runs from size to export performance. To be rigorous, the direction of causality should be tested by using panel data but, unfortunately, in our data base the export variable is available only for 1991 and there are no information concerned with the first year in which a firm became exporter. Bernard and Wagner (1997) and Bernard and Jensen (1999) carried out this test by using data on firms' size, wages and productivity before and after the decision to enter foreign markets; they found that 'good firms' become exporters while exporting does not improve very much the firms' performances.

<sup>15</sup> The questionnaire included a specific question on the number of R&D employees. R&D expenditures, instead, had to be extracted from balance sheet data and are less reliable because many firms did not report them.

- four qualitative and discrete variables (ranging from 0 to 3) identifying the importance ascribed by firms to, respectively, *process R&D, product R&D, the substitution of (old) machinery with innovative one, the introduction of innovative machinery*; the latter variable, in particular, can be used as a proxy for the investment in advanced process technologies (embodied in machinery) associated with an expansion of productive capacity;
- a dummy variable that is equal to one if the firm received *R&D public subsidies in 1989-91* and zero otherwise

It must be pointed out that, a part from size and R&D intensity, the explanatory variables are not lagged with respect to the dependent ones because most of them identify firms' characteristics that do not change in the short-run. Moreover, the set of innovation indicators that can be derived from the Mediocredito data base is far from being satisfactory because, to consider innovative activities different from in-house R&D efforts (namely, process innovations embodied in machinery), it is necessary to rely on qualitative variables.

Table 4 presents the regression results with the size and R&D variables lagged one year. Since there are many firms (and especially those of small size) that did not report these data for 1990, the number of observations decreases from 4,005 to 3,659.

In a first stage, the estimates were carried out by including the size interaction dummies for all the explanatory variables (with the exception of industry dummies), that is without imposing any restrictions on the parameters. Subsequently, looking at the results, for some independent variables it was imposed the restriction that the coefficients were equal between the groups of small, medium-sized and large firms. This procedure went on until, on the basis

of a likelihood ratio (LR) test, the hypothesis that the restricted specification had to be preferred to the unrestricted one was rejected by the data<sup>16</sup>.

Table 4 - Probit and Tobit regressions (number of observations=3659)<sup>o</sup>

Dependent variables	Probability to export in 1991	Share of exports in total sales 1991
<i>Constant</i>		
Dummy small	-0.64 (-3.60)*	-24.21 (-4.86)*
Dummy medium	0.11 (0.30)	-2.13 (-0.26)
Dummy large	-0.16 (-1.00)	-0.46 (-0.12)
<i>Total sales 1990</i>		
ID (Interaction Dummy) small	0.52 (3.67)*	17.41 (4.55)*
ID medium	0.04 (0.80)	1.57 (1.09)
ID large	-0.002 (-3.35)*	-0.03 (-2.73)*
<i>(Total sales 1990)<sup>2</sup></i>		
ID small	-0.07 (-2.19)*	-2.19 (-3.19)*
ID medium	-0.002 (-0.52)	-0.05 (-0.63)
ID large	0.000002 (2.75)*	0.00002 (2.40)*
<i>Percentage of sales due to subcontracting 1991</i>		
ID small	-0.01 (-9.13)*	-0.34 (-9.45)*
ID medium	-0.009 (-5.18)*	-0.18 (-4.09)*
ID large	0.002 (0.47)	0.006 (0.07)
<i>National group (dummy var.)</i>		
ID small	-0.11 (-0.61)	-4.84 (-1.04)
ID medium	0.02 (0.21)	-2.54 (-1.05)
ID large	0.82 (7.95)*	13.49 (6.37)*
<i>International group (dummy var.)</i>		
ID small	-0.13 (-0.45)	4.96 (0.69)
ID medium	0.16 (0.90)	5.49 (1.47)
ID large	1.00 (7.80)*	15.55 (6.15)*
<i>North-east (dummy var.)</i>	0.02 (0.36)	
ID small		1.48 (0.58)
ID medium		5.46 (2.59)*
ID large		6.35 (3.08)*
<i>Central (dummy var.)</i>		
ID small	-0.47 (-3.92)*	-8.08 (-2.40)*
ID medium	-0.23 (-1.83)	2.29 (0.77)
ID large	-0.12 (-0.86)	-0.51 (-0.16)
<i>South (dummy var.)</i>	-0.66 (-7.43)*	-13.86 (-5.95)*

<sup>o</sup> = Industry dummies are not reported; T-statistics are in brackets. \* = significant at 0.05 level.

<sup>16</sup> The test is computed as  $LR = 2[\ln L(\text{unrestricted}) - \ln L(\text{restricted})]$  where  $\ln L$  stands for log-likelihood. The restricted specification is rejected when LR is lower than the critical value (at a 0.05 level of confidence) of the  $\chi^2$  distribution with degrees of freedom equal to the number of restrictions.

Table 4 - continued<sup>o</sup>

Dependent variables	Probability to export in 1991	Share of exports in total sales 1991
<i>Share of R&amp;D employees 1990</i>		0.25 (2.24)*
ID small	0.004 (0.54)	
ID medium	0.04 (2.66)*	
ID large	0.02 (1.87)	
<i>Process R&amp;D (0=not significant; 3=very important)</i>	0.04 (0.83)	-0.01 (-0.02)
<i>Product R&amp;D (0=not significant; 3=very important)</i>	0.21 (5.65)*	3.69 (5.52)*
<i>Substitution of machinery with innovative one (0=not significant; 3=very important)</i>	0.07 (2.68)*	1.67 (3.00)*
<i>Introduction of innovative machinery (0=not significant; 3=very important)</i>		
ID small	0.03 (0.66)	0.28 (0.26)
ID medium	0.10 (2.62)*	1.62 (2.01)*
ID large	0.20 (4.89)*	3.06 (4.03)*
<i>R&amp;D public subsidies (dummy var.)</i>	0.75 (7.37)*	10.92 (6.26)*
<i>Log-likelihood function</i>	-1738.79	-12530.28
<i>Percentage of cases correctly predicted</i>	77.2	
<i>Sigma</i>		31.52 (65.86)*

<sup>o</sup> = Industry dummies are not reported; T-statistics are in brackets. \* = significant at 0.05 level.

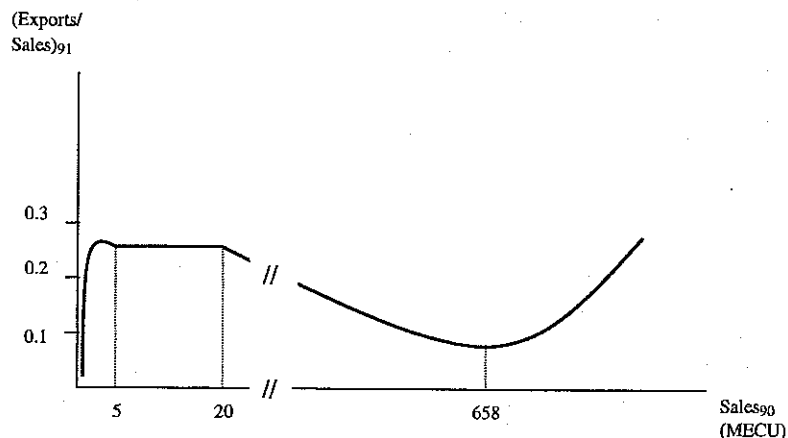
Thus, Table 4 shows the findings of the restricted specifications that passed the LR test. For the sake of brevity, the coefficients of industry dummies are not reported<sup>17</sup>.

Starting from the impact of firm size, either for the export probability or intensity the estimated equations present a negative and significant intercept for

<sup>17</sup> The findings concerned with industry dummies are consistent with the picture arising from the descriptive analysis (see Table 3). In both estimates, for instance, a negative and significant coefficient emerges for Office & computing machinery while Rubber

small firms. However, looking at the coefficients of lagged total sales it emerges that the relationship is positive and inverted U-shaped within the group of small firms, not significant for medium-sized firms and negative but U-shaped in the case of large firms.

Figure 3 – Export intensity and total sales: estimated relationship



According to the estimates, a rough picture of the relationship between export intensity and total sales is shown in Figure 3. For the whole range of sales the relationship resembles a cubic function. Only within the group of small firms (having less than 5 MECU of total sales) the firms' size exerts a positive impact on export shares, but there is a critical amount of sales (lower than 5 MECU) after which the relationship is slightly decreasing. Moving to medium-sized firms, further increases in size do not affect the intensity of exports until the conventional (i.e. approximate) threshold of 20 MECU is reached. After that -

and Plastic products, Textiles, Industrial and agricultural machinery, Leather products, Clothing & Footwear and Wood & Furniture get positive coefficients.

that is looking at large firms - the share of exports diminishes but there is again a critical level of sales (approaching 658 MECU) in which the sign of the relationship changes; this means that very large firms may record an intensity of exports similar or even greater than that of SMEs.

A plausible explanation of these findings is the following. *Ceteris paribus*, to become exporters and have a relevant share of exports in their total sales small firms must achieve a critical size. Probably, below this minimum size a firm does not own enough managerial, financial and commercial capabilities to become exporter. Above the same size the relationship between total sales and export performance is not significant but becomes U-shaped for large firms. A range of the size variable characterised by an inverse relationship may arise because large firms enjoy a greater domestic market power and have less incentives to exports (see section 2.1). However - i.e. notwithstanding their domestic market power - very large firms are likely to record a strong export propensity for, at least, two reasons. The first is that very large firms can enjoy market power also abroad and, thus, compete in an international oligopoly; if this is the case, they must be active, as much as possible, in many national markets. A second reason (which is a complement of the former) is that, by serving almost exclusively or only the home market, very large firms cannot minimise costs. In effect, as we shall see later, large firms that are more exported-oriented ascribe a greater importance to the introduction of innovative machinery; as a consequence, they strive to work with a more technology-advanced capital stock and, thus, to raise continuously their efficiency. In doing so, the level of output required to minimise costs can be far above that allowed by domestic market (see the discussion of Figure 2 in section 2.1).

Moving to the other explanatory variables, the percentage of sales due to subcontracting depresses both the probability of exporting and the export intensity of small and medium sized firms. Since the large majority of Italian



subcontractors are SMEs which work almost exclusively for larger contractors located in the same region or in Italy, this result is not surprising (cf. Sterlacchini, 1999).

The affiliation with a business group does not raise the export performance of SMEs while the impact is positive and significant for the larger ones and especially when the scope of the group is international.

As far as geographical location is concerned, whatever the size of firms, the location in Southern Italy depresses the export probability and intensity and, to a lower extent, the same happens to the small firms located in central regions. On the contrary, the location in north-eastern regions enhances, for all firms, the probability of exporting and, for medium-sized and large firms, also the export intensity.

With respect to innovation variables, the intensity of R&D exerts a positive impact on the export shares of all firms whereas, in terms of export probability, the positive effect is significant only for medium-sized firms. Independently of size, the importance ascribed by firms to the substitution of (old) machinery with an innovative one and, above all, the importance of product R&D increase both the export probability and intensity. Instead, the importance of process R&D is never significant while medium-sized and, especially, large firms that consider very important the introduction of innovative machinery record better export performances (see above). Finally, for all firms the achievement of R&D public subsidies is associated with a higher probability and intensity of exports.

Table 5 - Probit and Tobit regressions (number of observations=3439)<sup>o</sup>

<i>Dependent variables</i>	Probability to export in 1991	Share of exports in total sales 1991
<i>Constant</i>		
Dummy small	-0.59 (-3.41)*	-21.98 (-4.69)*
Dummy medium	0.30 (0.82)	2.58 (0.32)
Dummy large	-0.13 (-0.73)	-0.44 (-0.11)
<i>Total sales 1989</i>		
ID (Interaction Dummy) small	0.53 (3.94)*	15.51 (4.32)*
ID medium	0.005 (0.08)	1.03 (0.72)
ID large	-0.002 (-3.25)*	-0.03 (-3.29)*
<i>(Total sales 1989)<sup>2</sup></i>		
ID small	-0.06 (-2.69)*	-2.07 (-3.08)*
ID medium	0.0009 (0.32)	-0.02 (-0.56)
ID large	0.000002 (2.48)*	0.00002 (3.09)*
<i>Share of R&amp;D employees 1989</i>		0.19 (1.54)
ID small	0.002 (0.29)	
ID medium	0.04 (2.68)*	
ID large	0.01 (1.28)	

<sup>o</sup> = The regressions have been carried out with the complete set of explanatory variables (included industry dummies). Because their estimated coefficients do not significantly differ from those shown in Table 4, the remaining independent variables are not reported. T-statistics are in brackets.

\* = significant at 0.05 level.

When the size and R&D variables are inserted with a lag of two years, the maximum likelihood estimates do not change significantly, although the number of observations decreases from 3,569 to 3,439 (because some firms did not report data for 1989). Table 5 shows the findings concerned with the intercepts and the lagged variables only; by comparing them with those reported in Table 4, it can be seen that most of the coefficients are similar or identical and, with the sole exception of the coefficient of R&D intensity that arises in the Tobit model, all of them maintain the same level of significance.

#### 4. Concluding remarks

This paper aimed at stressing that, in order to provide a convincing explanation of why some firms are more export-oriented than others, a variety of factors must be taken into account. With regard to firm characteristics, this study has considered, along with firm size and industry, the nature of firms as subcontractors, their geographical location and affiliation with business groups. Moreover, together with the intensity of R&D, other technological features that could enhance a firm's export propensity (such as the relative importance of product versus process innovations and that ascribed to the introduction of innovative machinery) have been taken into account.

The main findings arising from the empirical analysis carried out for a large sample of Italian manufacturing firms can be summarised as follows.

First of all, as a general conclusion, it must be stressed that the determinants of export performance are different according to the size of firms. In effect, only in the case of small firms there is a positive and significant impact of size on export performances and the relationship is inverted U-shaped. Size is instead not significant within the group of medium-sized firms while a decreasing, although U-shaped, relationship emerges for large firms. As a consequence, it is possible to say that the upper limit after which the size of a firm does not increase its export propensity is not very high and, thus, this sort of 'minimum size' required to export can be achieved even by small firms.

Secondly, firms with a relevant share of sales due to subcontracting record lower export performances and this is especially the case of Italian SMEs which work mainly for domestic contractors. Large firms, as opposed to SMEs, take additional advantages from being affiliated with business groups and, particularly, those with an international dimension.

Finally, innovative activities increase export performances but, again, their relative impact changes with the size of firms. Small firms appear to benefit more from product than process innovations. In the case of medium-sized and large firms, the range of innovation indicators positively associated with export propensity is wider: the priority assigned to the introduction of innovative machinery enhances particularly the export performances of large firms while the intensity of R&D affects positively the probability to export of medium-sized firms.

#### References

- Amendola, G., P. Guerrieri and P.C. Padoan (1992) International patterns of technological accumulation and trade, *Journal of International and Comparative Economics*, 1.
- Bagella, M., L. Becchetti and S. Sacchi (1998) The positive link between geographical agglomeration and export intensity: The engine of Italian endogenous growth?, *Economic Notes*, 27 (1), 1-34.
- Basevi, G. (1970) Domestic demand and ability to export, *Journal of Political Economy*, 78, 330-337.
- Becchetti, L. and S. Rossi (2000) The positive effect of industrial district on the export performance of Italian firms, *Review of Industrial Organization*, 16(1), 53-68.
- Bernard, A.B. and J. Wagner (1997) Exports and success in German manufacturing, *Weltwirtschaftliches Archiv*, 133(1), 134-157.
- Bernard, A.B. and J.B. Jensen (1999) Exceptional exporter performance: cause, effect, or both?, *Journal of International Economics*, 47, 1-25.
- Bonaccorsi, A. (1992) On the relationship between firm size and export intensity, *Journal of International Business Studies*, 23, 605-635.
- Brusco, S. (1982) The Emilian model: Productive decentralisation and social integration, *Cambridge Journal of Economics*, 6, 143-153.
- Calof, J.L. (1993) The impact of size on internationalization, *Journal of Small Business Management*, 31 (4), 60-69.
- Commission des Communautés Européennes (1993) *Les actions de la Communauté Européenne intéressant les petites et moyennes entreprises: manuel pratique*, Office de publications officielles des Communautés Européennes, Luxembourg.

Conti, G. and S. Menghinello (1996) 'Territorio e competitività' (Territory and competitiveness), Ice (Institute for foreign trade), *Rapporto sul commercio estero 1995* (Report on foreign trade 1995), Ice, Rome.

Dosi, G., K. Pavitt and L. Soete (1990) *The Economics of Technical Change and International Trade*, Harvester Wheatsheaf, Brighton.

Fagerberg, J. (1988) International competitiveness, *Economic Journal*, 98, 355-374.

Glejser, H., A. Jaquemin and J. Petit (1982) Exports in an imperfect competition framework: An analysis of 1,446 exporters, *Quarterly Journal of Economics*, 94, 507-524.

Hirsch, S. and I. Bijaoui (1985) R&D Intensity and Export performance: a micro view, *Weltwirtschaftliches Archiv*, 121, 138-251.

Ito, K. and V. Pucik (1993) R&D spending, domestic competition, and export performance of Japanese manufacturing firms, *Strategic Management Journal*, 14, 61-75.

Kumar, N. and N.S. Siddharthan (1994) Technology, firm size and export behaviour in developing countries: The case of Indian enterprises, *Journal of Development Studies*, 31, 289-309.

Lefebvre, E., L.A. Lefebvre and M. Bourgault (1998) R&D-related capabilities as determinants of export performance, *Small Business Economics*, 10, 365-377.

Lefebvre, E. and L.A. Lefebvre (2001) 'Innovative capabilities as determinants of export behavior and performance: A longitudinal study of manufacturing SMEs', in Kleinknecht, A. and P. Mohnen (eds.) *Innovation and firm performance. Econometric exploration of survey data*, Palgrave, London.

Pavitt, K. (1984) Sectoral patterns of technical change: Towards a taxonomy and a theory, *Research Policy*, 13, 342-73.

Pyke, F., G. Becattini and W. Sengenberger (eds.) (1990) *Industrial Districts and Inter-firm Co-operation in Italy*, International Institute for Labour Studies, Geneva.

Sterlacchini, A. (1999) Do innovative activities matter to small firms in non-R&D-intensive industries? An application to export performance, *Research Policy*, 28, 819-832.

Wagner, J. (1995) Exports, firm size, and firm dynamics, *Small Business Economics*, 7, 29-39.

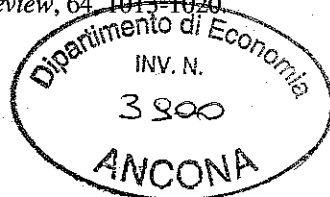
Wakelin, K. (1997) *Trade and Innovation: Theory and Evidence*, Edwar Elgar, Cheltenham, UK.

Wakelin, K. (1998) Innovation and export behaviour at firm level, *Research Policy*, 26, 829-841.

White, L. (1974) Industrial organization and international trade: Some theoretical considerations, *American Economic Review*, 64, 1013-1020.

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