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The U-shaped Productivity Dynamics of French Exporters

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Abstract

Sunk costs due to entry into foreign markets are used as the main justification of the relationship between firm productivity and exports. We use a large-scale dataset on French manufacturing firms to evaluate how sunk costs affect the productivity of new exporters. We find that the typical productivity dynamics of a new exporter is U-shaped. Prior to entry into export markets, firm productivity temporarily decreases. It recovers contemporaneously with entry, as the benefits from sales to foreign markets are harvested. This pattern is more pronounced for intensively exporting firms and for firms operating in capital intensive or high technology sectors.

1 Introduction

Analysis of firm heterogeneity has benefited from the field of international trade by exploiting the models provided by Melitz (2003) and Bernard, Eaton, Jensen, and Kortum (henceforth BEJK, 2003) in which firms' export behaviour is largely driven by differences in productivity. Both these models emphasise the notion of sunk costs for explaining the relationship between firm productive efficiency and participation in export activity. They contend that only the most productive firms find it profitable to serve distant markets and that less productive ones concentrate on domestic market. On the empirical side, there is a series of papers that document the superior productive

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efficiency of exporting firms compared to non exporting ones Bernard and Jensen (1995, 1999), Clerides et al. (1998), Bernard and Wagner (1997) and Aw et al. (2000). The hypothesis that firms self-select into export markets is further examined by comparing the productivity of future exporters and non- exporters at a particular point in time, prior to entry into export markets. The observed productive superiority of future exporters is usually interpreted as indirect evidence of the presence of sunk costs.

This paper contributes to this literature in providing a more accurate assessment of how sunk costs of entry into export markets impact the productivity dynamics of new exporters. Our research hypothesis is that sunk costs imply prior investments, which are compensated for by future rather than contemporaneous profits, namely those linked to the expansion of sales on foreign markets. This temporal disconnection between costs and receipts can be more or less significant depending on the nature of sunk costs (e.g. setting up new distribution channels, adapting the specifications of outputs and/or inputs, building new production facilities, investing in new technologies to fit specific requirements on international markets, etc...). In all cases, sunk entry costs associated to an export strategy imply time-to-build constraints which should decrease the productivity of future exporters for at least *some* period before actual entry into export. This implies that the productivity dynamics of future exporters should be U-shaped. We test for this pattern using a large scale micro-level dataset of French manufacturing firms over the period 1990-2002. It is notable that data on France have not yet been included in the available evidence on the relationship between export and firm productivity. A few recent papers on the export behaviour of French firms have examined the relationship between trade, agglomeration and firm structure[1] (see in particular Eaton et al. (2004) and Koenig (2005)). However, none of these studies specifically investigates the relationship between export and productivity dynamics.

Our methodology follows that suggested by Bernard and Jensen, with three notable amendments. First, we trace the relative performance of firms over a longer time span in order to depict the *dynamics* of the productivity gap between new exporters and their non-exporting counterparts, namely five years before and after entry into the export market. This eleven-year window enables us to identify a U-shaped productivity pattern while holding constant a host of factors that might influence it. Second, we unravel the productivity dynamics of exporters by setting the benchmark value for each firm at a unique point in time. This allows us to fully account for the presence of a U-Shaped pattern as we compare the performance of new exporters relatively to themselves and not only relatively to their non-exporting counterparts. Finally, we investigate how pre-entry costs and also post-entry gains behave according to the different types of industry, grouped by mean capital intensity and technological intensity. This enables us relate the sensitivity of the U-shaped productivity pattern with the type of productive activity the new exporter is involved in.

The results from the French data strongly support the idea that the productivity dynamic of new exporters is a U-shaped curve. The typical Total Factor Productivity (TFP) path of a new exporting firm in France is one along which its advantage (over non exporting firms) temporarily vanishes during the run-up to entry, on average three years, to appear again as a contemporaneous effect of entry into exporting. Labour productivity show a similar, albeit less pronounced, pattern, in which future exporters maintain their significant advantage over non-exporters even during the run-up phase. We interpret these results as suggesting that sunk costs linked to entry into export markets are primarily composed of capital and intermediate inputs as changes in those two components are what bear the most heavily on firm performance during the pre-entry period. Moreover, this U-shaped productivity dynamics is robust to different sub-sample composition. It is more pronounced for firms in the capital intensive and high technology sectors and for firms that commit significantly to exporting. This latter result is consistent with the idea that an intensively exporting firm is more likely to serve several foreign destinations. Consequently, it may face higher sunk costs due to trade-link investments that are market specific rather than product-specific (Andersson and Johansson (2006)).

The paper is organised as follows. Following a short review of the literature in Section 2, Section 3 describes the dataset used in this paper and provides preliminary evidence on exporting by French manufacturing firms. In Section 4, we provide information on the sources of the export *premium* in French manufacturing industries. In Section 5, we document the U-shaped productivity dynamics of firms preparing for foreign markets. Concluding remarks are presented in Section 6.

2 Literature Background

Since the pioneering work of Bernard and Jensen (1995, 1999), a growing body of empirical evidence has shown that firms that participate in export markets are more productive, larger, survive longer and pay higher wages, than firms that focus exclusively on domestic markets. Two main mechanisms have been proposed to explain the positive relationship between exports and productivity. First, only efficient firms find it profitable to export because only such firms can cope with the sunk costs associated with the penetration of foreign markets. This self-selection hypothesis has been incorporated into models of international trade involving firm heterogeneity and exporting sunk costs (Melitz, 2003; Bernard et al., 2003; Helpman et al., 2004; Yeaple, 2005; Melitz and Ottaviano, 2005; Jean, 2002; Medin, 2003). Second, firms participating in export markets have access to different knowledge and technical expertise from domestic markets, including new product designs and new production methods. This expertise results in improvements in the productive efficiency of exporting firms. This idea of learning-by-exporting, advanced by Westphal (1990), Pack and Page (1994), Evenson and Westphal (1995) and Nelson and Pack (1999) among others, was integrated by Clerides et al. (1998) into a theoretical model of the decision to export.

An increasing number of studies has attempted to evaluate the relative importance of these self-selection and learning mechanisms in explaining the positive correlation between productivity and exports at firm-level. All these studies use large scale longitudinal micro data-sets and apply advanced micro-econometrics techniques to investigate these issues[2]. They use a variety of methodologies ranging from panel data regressions to binary choice models to explain the decision to export. More recently, matching methods and difference-in-difference techniques have been applied in an attempt to explore more accurately whether an exporting firm can obtain additional improvements from exposure to foreign markets (see Girma et al. (2004) for a presentation of these methodologies).

To collect country case-studies is useful because the observed importance of self-selection mechanisms and learning-by-exporting effects is likely to vary across countries [3]. Recent surveys (Lopez, 2005; Greenaway and Kneller, 2005; Wagner, 2005) have nonetheless emphasised some significant common findings. First, most country-case studies document a significant productivity gap between future exporters and their non-exporting counterparts. This *ex ante* export premium has been interpreted as reflecting the presence of sunk costs associated with entry into foreign markets and then as supporting the self-selection hypothesis. Although persistent, the gap between future exporters and non-exporting firms varies across countries. The strongest selection effects were found for the US, Colombia and Canada, with a TFP advantage of about 7% for future exporting plants over non exporting ones[4]. At the other extreme, two studies, on Korea and Sweden respectively, failed to document any significant dufferences between exporters and non exporters. In Korea, Aw et al. (2000) refer to the specific role of government investment subsidies in weakening market selection forces. For Sweden, Greenaway et al. (2005) point to the remarkably high participation rate of Swedish firms in export markets (around 91%) to explain the lack of self-selection mechanisms. With a high degree of international exposure, non-exporters already compete with firms engaged in export activity and through import penetration.

On learning effects, the literature is far less unanimous. Overall, learning-by-exporting appears to be a more difficult concept than self-selection effects. In the case of industrialised countries, there is mixed evidence. For Germany (Bernard and Wagner, 1997), the US (Bernard and Jensen, 1999), Spain (Delgado et al., 2002) and Japan (Kimura and Kiyota, 2006), there is no evidence supporting learning mechanisms[5]; stronger evidence was found for Italy (Castellani, 2002), the UK (Girma et al., 2004) and Canada (Baldwin and Gu, 2003). It could be argued that one would expect plants or firms to learn more from participation in international trade in countries where the distance from the productivity frontier is greater. Studies on industrialising countries, however, do not yield more clear-cut evidence. Studies on Colombia, Mexico, and Morocco (Clerides et al., 1998), Taiwan and Korea (Aw et al., 2000) and Chili (Alvarez and Lopez, 2005) failed to find evidence of learning-by exporting. Only for China (Kraay, 1999) and for a panel of Sub-Saharan countries (Van Biesebroeck, 2005), have significant post-entry productivity gains been documented.

The present study adds to this literature in expanding the set of available evidence on self-selection and learning-by-exporting, to another important trade partner, namely France. We also go beyond previous studies by looking more accurately at the *dynamics* of future exporters' productivity. Our empirical investigation is driven by the idea that the sunk costs of entry into foreign markets involve prior investments which are compensated for by future not contemporaneous profits. This temporal disconnection is likely to be more or less pronounced depending on the contents of sunk entry costs into export markets. For instance, if the entry into export markets requires to set up new international distribution channels, instead of relying on existing ones, this will take more time. Also, if the entry into export markets requires to change the intermediate input and/or output mix, to build specific production capacities and/or to invest in specific technologies, the export strategy of the firm can encompass even stronger time-to-build constraints. All in all, sunk entry costs should weigh negatively, although temporarily, on the relative performance of exporting firms. Such a drop in relative TFP for otherwise successful firms was recently documented by Altomonte and Barratieri (2006) using Italian product and firm-level data. They show that firms in industries facing competition from low-wage countries have survived and grown because they changed their product-mix and accepted larger fixed costs, which produced a fall in average TFP for the industry. Bernard *et al.* (2005) theoretically modeled the possibility that, in switching products, the resulting average industry productivity might be lower, since the new products are characterised by higher fixed costs. In the context of new exporters, it is however likely that the decrease in the productivity of new exporters will be temporary. First, some of the sunk costs of entry to export markets are incurred only once (for instance, setting up the distribution channels). Second, the entry into export markets is likely to cause further increases in productivity. We consequently argue that the productivity dynamics of new exporters is U-shaped.

To investigate this, we exploited a large-scale firm-level dataset of manufacturing companies, covering the period 1990-2002. This dataset is particularly suited to our study for three main reasons. First, the series is long enough to track the relative performance of new exporters over a sufficient time span to depict the presence of a U-shaped pattern. Indeed, detecting the presence of sunk costs is not a case of measuring relative productive efficiency at one point in time, but involves the time lag between specific export investments and returns from exports. Consequently, focusing exclusively on a unique point estimate, typically one, two or three three years before entry into export markets is not appropriate. The productivity dynamics can only be captured by pushing the point estimates both further back in time and also nearer to the time of entry. In this way, we can examine not how wide the gap between exporters and non exporters is at a specific point in time, but in what direction and how quickly the gap changes before entry.

A second advantage of French data is that they are collected at firm rather than plant level. This allows us to depict more accurately the impact of the sunk entry costs. Indeed, suppose that a non-exporting firm comprising several establishments decides to export a share of its production to foreign markets. This firm will have to cope with a series of sunk costs which will appear on the balance sheets at the consolidated level via an above-normal increase in investments. Those investments may consist of building additional productive capacities (i.e. new plant), consolidating the distribution networks (i.e. setting up an office overseas), which will affect the parent company's balance sheet, but not that of the individual plants within the firm. Therefore, the use of firm-level data will likely identify sunk costs better than plant level data.

Finally, the French dataset provides information at the four-digit industry level classification level. This allows us to discriminate across fine-grained industry classifications according to their capital and technological intensity. If sunk costs associated with entry into export markets differ across industries, then the U-shaped could be more pronounced for firms operating in capital intensive and/or high technology industries. Indeed, in both types of industries, firms targeting export markets are likely to face stronger time-to build constraints prior to export due to specific requirements on foreign markets. In this paper, we also investigate whether the

U-shaped pattern is sensitive to the export intensity of the firm. Here the rational is different: if the export intensity of a firm is correlated with the number of foreign markets it serves, then entry cost into exports will be proportional to the export intensity at firm level.

3 The export *premium* in France

In order to characterise the relative performance of exporting firms within French manufacturing, we use the firm dataset collected by the French Ministry of Industry (SESSI). The French Manufacturing Census (known as EAE) is a unique survey designed to gather information on the financial statements and balance sheets of all manufacturing firms with at least 20 employees. This dataset covers about 23000 firms by year over the period from 1990 to 2002. Those firms represent only 25% of all manufacturing firms in France but account for 75% of employment and 80% of value added in French manufacturing. Having information on nominal gross output, a series of inputs (such as number of employees, intermediates inputs, investments, etc.), and exports, we can investigatethe relationship between exporting and productive efficiency in France.

[Table 1 about here.]

Table 1 summarizes basic information about the export behaviour of French firms. It displays the number of all manufacturing firms, and the percentage of exporting firms, i.e. the participation rate, by sector at the 2-digit level. It also displays export-to-sales ratios, i.e. export intensities, at both industry and firm levels[6]. The last column presents the size of exporting relative to non exporting firms. We can see that in all manufacturing sectors, there is a substantial number of firms (73%) engaged in foreign trade, suggesting that exporting and non exporting firms coexist in all types of productive activities[7]. Second, the arithmetic mean of firm export intensity is half that for sector export intensity for all manufacturing, implying that large firms export a larger share of their production[8].

[Table 2 about here.]

Overall, these figures show that French manufacturing firms participate substantially in international trade. But how do they compare with other OECD countries? Table 2 presents the participation rates and the (average) firm export intensities of other countries. Direct comparisons across countries are not really feasible because of the differences in data sources. In particular, plant-level data introduce a downward bias in participation rates compared to firm-level data, simply because exporting firms may have non exporting plants. Nevertheless,, table 2 reveals some interesting patterns: France scores higher than the US in terms of participation rate and firm export intensity; French manufacturing firms are more heavily involved in exporting than their British and Spanish counterparts, but less so than Swedish firms; French firms' export behaviour is closest to that of Italian firms, in terms of both participation and intensity; the mean value of export intensity at firm level is lower for France than for most other countries, except the US. These results suggest that, in general, a smaller proportion of French firms' sales go to export compared to other major players such as Great Britain, Spain and Sweden.

[Table 3 about here.]

Table 3 reports mean export intensity and participation rate by size of firms. There are two things to note from this table. First, the export-to-sales ratio of small firms is less than half that of larger firms (16.3% versus 34.4%). Based on the international evidence available here, we can see that the export intensity of small firms in French manufacturing is similar to that of small firms in Italy (Castellani, 2002) and less than that of Spanish firms, which is around 20%[9].On the other hand, large French firms do not show weaker export intensity than either Italian or Spanish firms. Second, the gap in the participation rates of small and large firms increases with the export-to-sales threshold. Whereas almost all large firms participate in international trade, only 60% of small firms are active in foreign markets. This gap widens as the minimum threshold of export intensity increases. For example, we find that 75% of very large firms export at least 10% of their sales. This ratio is three times larger than that for small firms. This implies that the SMEs are mainly responsible for the lower average export intensity in France; for large firms levels of both participation in international trade and export intensity are comparable to the findings from other studies (Bernard and Jensen, 1999; Delgado et al., 2002; Castellani, 2002).

Investigating why French SME's are less active in international trade than some of their European counterparts is beyond the scope of this paper. However, we can see that French exporters are much larger than their non-exporting counterparts, which is in line with the *export premia* documented below. *Export premia* are defined as systematic differences in *some* characteristics of exporting firms compared to non-exporting ones, that are over and above mere industry effects, year specific effects or cohort effects. Specifically, we look at a series of variables X_{it}, where subscripts i and t stand for firm i at time t, X is alternatively Output (Y), Labour (L), labour productivity (Y/L), capital intensity and wage per employees (these variables are fully described in Appendix A). We subtract from all X_{it} the industry fixed effect s_j, a year fixed effect d_t and cohort fixed effect v_c in order to obtain $X'_{it} = X_{it} - s_j - d_t - v_c$, where all fixed effect are defined as differences of group means from overall sample mean. Table 4 presents the results for all firms and each size class, together with the mean number of (non-) exporting firms per year. All reported values for firm characteristics are expressed relative to non-exporting firms.[10]

[Table 4 about here.]

For the whole sample of firms, Table 4 reveals a strong export *premium* for the five characteristics: relative to non-exporting firms, exporters produce 2.5 times more, are twice as large, are 40% more labour-productive, are 24% more capital intensive, and pay their employees 10% more. Moreover, in line with Bernard and Wagner (1997) and Castellani (2002)), we find that export premia do not disappear in more narrowly defined size-classes of firms. Within each of our four size-classes, the average French exporter displays a labour productivity advantage of around 30%.

4 The Sources of The Export Premium

The preceding section revealed the magnitude of the export *premium* in France. The next step is to investigate the relative importance of market selection forces *versus* learning-by-exporting in driving this export *premium*. We do this by examining the causal relationship between firm productive efficiency and firm export behaviour. We adopt the methodology proposed by Caves et al. (1982) and Good et al. (1997) to compute TFP indexes (see Appendix B for details). We then examine the relationship between firm-level relative TFP indexes and both export participation and export intensity variables.

4.1 The TFP *bonus* of French Exporters

TFP should be a more precise indicator of productive efficiency than *mere* labour productivity in that it accounts for both capital intensity and capital productivity. Table 5 presents the mean TFP values[11] for the four types of firms found in our dataset: those that always export (Always Exporters - AEs) over the whole time period, those that did not export initially, but became exporters between 1990 and 2002 (New Exporters - NewEs), those that year to year entered or exited from international markets (Switchers), those that concentrated exclusively on the domestic market (Never Exporters- NEs). Table 5 presents the results for firms present during the whole time span of the investigation (balanced panel) and for successful entrants, that is, entrants that survived at least 5 years.

[Table 5 about here.]

The first column of Table 5 reports the TFP mean values for all firms in the sample (export-to-sales ratio ≥ 0) with the mean TFP value of NEs, as the benchmark, set to 100. As expected, we can see that firms that participate in international trade are on average more productive than the ones which never export. This TFP *bonus* increases with persistency of export behaviour: NEs are less productive than Switchers; Switchers are less productive than NewEs, who in turn are less productive than AE's. Lastly, the *bonus* increases with the firm's commitment to international trade, as demonstrated by the export-to-sales ratio. The productivity *premium* widens as the firm's share of sales dedicated to international markets expands[12].

The sub-division of the sample into Continuing firms and Successful entrants shows where the best firms are "located". They belong to a sub-group of Entrants, which includes firms that were involved in exporting from the first year that they entered the market[13]. This sub-sample not only outperforms the sub-sample of Entrants which sequentially enter the market, and eventually begin to export (NewEs). It also outperforms the sub-sample of the most productive units in the class of continuing firms, namely the AEs. This result is in line with Hallward-Driemeier et al. (2002) recent findings for a panel of East-Asian Countries and Alvarez and Lopez (2005) findings for Chile. It may indicate that the selection of the firms which are going to export is not a random process determined by exogenous productivity shocks, as portrayed by Melitz (2003) canonical model. On the contrary, it could be that the firms that are established exporters are more productive than those that eventually become exporters, because they make conscious decisions about technologies when they target the export markets[14]. It is beyond the scope of this paper to try to discriminate between random and conscious self-selection, however. We turn now to the evaluation of how much of the productivity gap between NewEs and NEs is due to ex-ante differences in productivity performance and how much is due to post-entry differences.

4.2 Firm Performance *Before* Entry into Export

In a first step, we test the idea that firms that become exporters are more productive before they enter into foreign markets. If this holds, future exporters should outperform non exporting firms in terms of productive efficiency *some* years before entry into foreign markets. To validate this proposition, we follow Bernard and Wagner (1997) and Bernard and Jensen (1999) and select only those firms that do not export in $t-\tau$, $\cdots$, $t-2$ and $t-1$, but *may* export in t. Parameter τ takes alternatively values $\{3; 5\}$, controlling for different time lags in the productivity *premium* for future exporters. Thus, we select New Exporters (which do not export for at least τ years) and Never Exporters to regress the (log) value of TFP at time $t-\tau$ on the export status at time t[15]. We have:

$$\begin{aligned} \ln TFP_{i,t-\tau} = \alpha + \beta \times E_{it} + \gamma \times Size_{it-\tau} + \sum_{jt-\tau} \delta_{1jt-\tau} \times (S_j \cdot D_{t-\tau}) \\ + \sum_{c} \delta_{2c} \times C_c + \varepsilon_{i,t-\tau} \end{aligned} \tag{1}$$

where E_{it} is a dummy variable set to unity if firm i starts exporting at time t (i.e. New Exporters), $Size_{it}$ is the number of employees at time $t-\tau$ and S_j, $D_{t-\tau}$ and C_c are vectors of dummy variables controlling respectively for sector, time and cohort specific effects[16].

In addition to looking at differences in TFP levels, we also examine the run-up to exporting in terms of whether and how firms prepare for international markets. Thus, we consider firms' growth performance by regressing the TFP growth rates of New Exporters and Never Exporters on the same vector of explanatory and control variables, as follows:

$$\begin{aligned} \Delta \ln TFP_{i,\frac{t-\eta}{t-\tau}} &= \frac{1}{\tau-\eta} \times (\ln TFP_{i,t-\eta} - \ln TFP_{i,t-\tau}) \\ &= \alpha + \beta \times E_{it} + \gamma \times Size_{it-\tau} + \sum_{jt-\tau} \delta_{1jt-\tau} \times (S_j \cdot D_{t-\tau}) \\ &+ \sum_{c} \delta_{2c} \times C_c + \varepsilon_{i,\frac{t-\eta}{t-\tau}} \end{aligned} \tag{2}$$

where E_{it}, $Size_{it}$, S_j, $D_{t-\tau}$ and C_c are defined as before. Eq.2 tests whether the mean annual growth rate between $t-\tau$ and t is significantly different for New Exporters as opposed to Never Exporters. Furthermore, in order to grasp more accurately the timing of the run-up phase, we introduce the TFP growth rates between different time intervals, such that parameters η and τ take the successive values $\{3; 1; 0\}$ and $\{5; 3; 1\}$. This is useful to detect whether an observed change in TFP growth rate is contemporaneous with entry into the export market (Eq.2) and whether it is due to the preparation phaseprior to foreign market penetration.

The idea that new exporters self-select into export markets should translate into a significant and positive sign of β in either Eq.(1) or 2. Such a finding based on French data would be consistent with the self-selection hypothesis. Non significance would imply no self-selection, rejecting the view that only efficient firms can cope with the sunk costs associated with foreign market penetration. Negative significance would be more difficult to interpret as it would entail adverse selection.

Table 6 reports estimates for β for Eq.1 and Eq.2. Note that as TFP is the joint product of real output as a function of capital stocks, labour and intermediate inputs. We also show the results using the log values of Y (real output), K (real output), L (labour) and M (materials) as dependent variables, with labour productivity as an additional dependent variable for robustness checks.

[Table 6 about here.]

Looking first at the results of Eq.1, we find that five years before entry into foreign markets future exporters display a productivity advantage of more than 3% over the firms which will never export. However, three years before entry ($\tau = 3$), future exporters face a significant and negative TFP disadvantage; they appear to be 2% less productive than NEs. This result is at odds with prior empirical contributions, for example, Bernard and Jensen Bernard and Jensen (1999), which show that three years before exporting, future US exporting plants are 6% more productive (in terms of TFP) than their never exporting counterparts.

In fact, the decrease in TFP level of NewEs is principally due to the growth in capital stocks relative to NEs, of 30% larger than NEs (27% three years before entry). In turn, in terms of labour productivity, NewEs retain a small but significant advantage over NEs for the whole time span. This finding then validates the idea that new exporters have to face specific sunk costs before actual exports take place, such as building specific capital stocks and securing distribution channels. These investments are intrinsically time-consuming and may help to explain the lag in the productivity-export relationship. In our view, this sharp decrease corresponds to the sunk costs associated with entry into export markets, that are incurred.

Looking at growth rates in the three last Columns of table 6 (Eq.2), we find that future exporters cope with a 1.6 percentage points lower TFP growth rate lower than never exporters, between $t-5$ and $t-3$. This is the result of inputs growing faster than outputs, relative to Never Exporters. Column 4 presents estimates for the run-up phase between $t-3$ and $t-1$, and shows sustained growth for both inputs and output, implying that neither labour nor TFP grow at significantly different rates compared to those of Never Exporters. In fact, the changes in TFP and labour productivity growth rates are contemporaneous with the first year of export activity. Between $t-1$ and t, all characteristics of future exporters undergo considerable changes: output grows 14 percentage points faster than for Never Exporters; intermediate inputs grow by almost 20 percentage points; labour and capital stocks expand by *circa* 5 percentage points. Thus, exporters enjoy significantly faster growth rates, 8 and 3 percentage points respectively for labour productivity and TFP . In other words, firms starting to export, experience salient productivity improvements *contemporaneous* with the first year of export. This implies that exporting firms may also experience higher TFP growth rates than Never Exporters *after* their entry into foreign markets. This issue is investigated below.

4.3 Firm Performance *After* Entry into Export

In examining firm performance after entry into export markets, we would expect NewEs to outperform NEs. Recall that we found there was a TFP *bonus* for exporting firms and that this *bonus* disappears for NewEs during the run-up to entry into export markets. One could expect then to observe at least a recovery of the productivity advantage of exporters in the years after their entry into foreign markets. To evaluate the precise magnitude of ex-post productivity gains, we looked at the TFP performance of exporters relative to non exporters n years after entry into export markets at time t. With n set arbitrarily to 5 years, we have:

$$\begin{aligned}\ln TFP_{i,t+5} = \alpha + \beta_1 \times E_{it} + \beta_2 \times EI_{it} + \gamma \times Size_{it} + \sum_{jt} \delta_{1jt} \times (S_j \cdot D_t) \\ + \sum_{c} \delta_{2c} \times C_c + \varepsilon_{i,t+5}\end{aligned} \tag{3}$$

where again E_{it} is a dummy variable set to unity if firm i starts exporting at time t (i.e. New Exporters), and S_j, D_t and C_c are vectors of dummy variables controlling respectively for sector, time and cohort specific effects. As in Castellani (2002) and Girma et al. (2004), we augment the baseline specification using export intensity as an additional explanatory variable. The reason for this is to test whether in addition to the decision to export there is another driving force in the form of productive efficiency related to the share of production dedicated to export markets.

$$
\begin{aligned}
\Delta \ln TFP_{i,\frac{t+\eta}{t+\tau}} &= \frac{1}{\eta-\tau} \times (\ln TFP_{i,t+\eta} - \ln TFP_{i,t+\tau}) \\
&= \alpha + \beta_1 \times E_{it} + \beta_2 \times EI_{it} \\
&+ \gamma \times Size_{it} + \sum_{jt} \delta_{1jt} \times (S_j \cdot D_t) \\
&+ \sum_{c} \delta_{2c} \times C_c + \varepsilon_{i,\frac{t+\eta}{t+\tau}}
\end{aligned}
\tag{4}
$$

where E_{it}, S_j, D_{t-3} and C_c are defined as before, and parameters η and τ takes the successive values $\{5;3\}$ and $\{3;0\}$. Eq.4 tests whether the mean annual growth rate between $t+\tau$ and $t+\eta$ is significantly different for New Exporters relative to Never Exporters. In this case, a significant and positive sign for β_1 implies that New Exporters enjoy higher TFP growth rates in percentage points, compared to Never Exporters. This is the basic specification proposed by Bernard and Wagner (1997) and Bernard and Jensen (1999). Moreover, we augment the model following Castellani (2002) and Girma et al. (2004) and include export intensity (EI) in order to test whether the source of TFP growth is due to mere participation in international trade or is proportional to export intensity. Previous results suggest that β_2 could be expected to be significantly positive.

[Table 7 about here.]

Table 7 displays the results for Eqs.(3) to (4). The first two columns present the results when the dependent variable TFP is introduced in levels. There is a significant and positive effect for the export-to-sales ratio (β_2), whereas the export dummy (β_1) is at the borderline of significance. At the 10% level, NewEs are 2% more productive than NEs five years after their initial exports. Interestingly, firms that devote a larger share of their sales to exports are more productive: a 10 percentage-point rise in their export-to-sales ratio equates with almost a 0.7% increase in TFP differential relative to NEs (0.67%), and a 2% increase in labour productivity relative to Never Exporters (1.84%, at the 10% level)[17]. These results conceal sharper differences between both types of firms in all characteristics. Five years after first exports, NewEs produce almost 30% more than Never Exporters (29.9%) and have a 14% bigger labour force (13.8%, in terms of hours worked), and 40% larger capital stocks (38.0%).

The existence of post-entry TFP gains, larger the higher the export intensity, echoes previous results found by Castellani (2002) and Girma et al. (2004). It could reveal the presence of learning-by-exporting effects which, in the case of France, would concern only the small fraction of intensively exporting firms. However, we investigate the timing of these changes further by looking at the changes between t and $t+3$ and between $t+3$ and $t+5$ (Eq.4). Table 7 reveals that none of the average yearly TFP growth rates, either between t and $t+3$ or between $t+3$ and $t+5$ is significant. Those results do not comfort the learning-by exporting hypothesis [18].

This is not to say that exporting is not a source of productive efficiency gains. In fact, we can see that over a period of three years, the growth rates for all firm characteristics are significantly higher for NewEs. Thus firms that become exporters experience spectacular changes in terms of the size of their operations after entry into exporting. Since NewEs enjoy higher rates of output growth than their non-exporting counterparts (by almost 3 percentage points), it could be that improvements in the productive efficiency of exporters is due to the exploitation of latent scale economies rather than learning-by-exporting. To discriminate between learning effects and scale effects is beyond the scope of the paper[19]. Note however that the conjecture that scale effects may be important could be consistent with our view that exporting firms encounter a decrease in their relative performance during the run-up to export activity, and then, in a second step, benefit from the specific investments they made. In this case, they would reach the benefices of exporting through the enlargement of their scale of production while serving distant markets.

5 The U-Shaped Productivity Pattern of New Exporters

The findings in the previous section lead us to focus on the TFP dynamics of a typical French manufacturing firm when it decides to expand its activities to foreign markets. In order to fully account for the presence of a U-Shaped productivity pattern, we need then to unravel the productivity dynamics of new exporters. We do so by tracing back the TFP histories of new exporters setting the benchmark value for each firm at a unique point in time. Specifically, we follow Jacobson et al. (1993) and test the following econometric specification[20]:

$$\ln TFP_{it} = \alpha + \sum_{\substack{\tau=-5 \\ \tau\neq 0}}^{\tau=5} \lambda_\tau \times \mathrm{T}_\tau + \sum_t \delta_t \times D_t + \mu_i + \varepsilon_{it} \tag{5}$$

where α is a constant, δ_t catches the year D_t specific effect common to all firms, μ_i catches persistent but unobserved heterogeneity of firms, and ε_{it} is the error term with the usual distributional properties. Here, our parameters of interest are λ_τ, where $\tau \in \{-5; +5\}$ and T_τ is a dumy variable indicating the period prior or after first entry into export markets. Would the

U-shaped productivity pattern hold true, the series of parameter estimates for λ_τ should first decrease prior to entry into export markets to then increase contemporaneous, and perhaps after, entry into export markets. To facilitate interpretations, we choose the reference period to be at $\tau = 0$, the actual year of entry into foreign markets for new exporters.

[Table 8 about here.]

Table 8 comfirms the existence of the U-Shaped pattern. It shows that the TFP histories of new exporters can be decomposed in three phases. During a pre-entry phase, TPF significantly decreases while capital, and to a lesser extent, intermediate inputs increase. LP of new exporters keeps growing during all the pre-entry phase as output increases and labor input remains almost unchanged. Contemporaneous to the year of entry, new exporters experience dramatic changes in all variables: output grows by 21% the year of entry while labour grows by almost 6%, capital by 19% and intermediate inputs by 28%. These positive changes allow new exporters to recover high TFP levels, as TFP increases by no less than 4.5% the year of entry. LP also goes through a spectacular rise of about 15% contemporaneous to the year of entry. During the post-entry phase, LP keeps increasing at a steady rate of about 2 to 3% per year whereas TFP gains remain more uncertain, albeit significant for some period.

All in all, these results are consistent with the idea that new exporters endure specific sunk costs during a run-up phase preceding their entry into export markets. During this preparatory phase, TFP decreases sharply. After that, the exporting firm's TFP increases as it benefits from its earlier investments. This recovery is almost all contemporaneous with the first year of exports.

A crucial feature of the U-Shaped TFP pattern is that it may induce new exporters to temporarily loose their productivity advantage over non exporting firms. We further illustrate this feature in figure 1 below, which plots the TFP dynamics of New Exporters and Never Exporters across the eleven-year window, the median year 0 being the year of first exports[21]. What stands out in figure 1 is the sharp decrease in Relative TFP in the run-up phase.

[Figure 1 about here.]

To check the robustness of this feature more thoroughly, Table 9 presents the mean TFP values for NewEs relative to NEs for each period, controlling for industry-year, cohort and size-class specific effects and expressing all values relative to NEs[22]. The first column presents the results for the same sample of firms as that employed in the graph. Overall, the inverted ranking between NewEs and NEs some times before the entry into export markets is a persistent pattern.

Future exporters are significantly more productive five years before first exports and significantly less productive in the run-up phase to exports. We observe a sharp increase in relative TFP contemporaneous with the year of entry into foreign markets, of about 3 percentage points. In columns 2 and 3, we test the robustness of the U-shaped patterns in different ways. The second column excludes firms with TFP values in the bottom and top 1% of the TFP distribution at least once in the eleven-year window, screening out 471 firms (around 5% of firms). The TFP U-shaped pattern persists, with the difference that the initial productivity advantage loses its significance. The run-up phase to exports is still associated with TFP losses, relative to NEs, whereas exporting remains associated with significant improvement in productive efficiency for a period of three years. In column 3, we include firms already present at period $t-5$. Note that this reduces the number of NewEs and NEs by 65% and 27% respectively, implying that firms begin exporting at an early age. The U-shaped pattern is corroborated; future exporters are significantly more productive five years before first exports, then become significantly less productive the year immediately before starting their export activity. *Ex post* efficiency gains are less clearcut; no systematic differences can be observed between exporting and non exporting firms. However, this implies that there are TFP gains contemporaneous with the year of first exports[23].

[Table 9 about here.]

The remaining columns in Table 9, focus on specific sub-samples in the database in order to reveal the type of mechanisms underlying the U-shaped pattern. The fourth column includes only firms with an export intensity strictly above 5% at the year of first exports, which excludes nearly 2,000 exporting firms. We find a more pronounced U-shaped dynamic, where exporters first enjoy a TFP advantage of almost 3% at time $t-5$ to then coping with a significant and negative TFP gap between 2 and 4%. There are remarkable efficiency improvements after entry, with a prominent 6 percentage-point rise contemporaneous with entry. These results indicate that both pre-entry sunk costs and post-entry profits are proportional to export intensity. Concerning pre-entry sunk costs, we could hypothesise that at the time of the decision to export, sunk costs are variable in the sense that they are proportional to *expected* future profits. Notably, a greater export intensity is likely to be positively correlated with the number of destination markets, increasing sunk costs with each new foreign market added. Concerning *ex-post* TFP gains, the positive association between export intensity and TFP gains is consistent with the idea that learning effects are larger for firms which commit significantly into export markets.

In columns 5 and 6, we group industries by quartile of capital intensity (K/L), distinguishing between low (quartile 1) and high (quartile 4) capital intensive industries[24]. The objective is to determine the nature of the sunk costs in terms of capital deepening and/or variable costs. In more capital intensive industries, future exporters should face larger investments, which in turn should translate in a more pronounced U-shaped pattern than in less capital intensive industries. The results tend to confirm this intuition. Although not significantly different, the sunk costs of future exporters are higher for firms in capital intensive industries ($Q^4_{K/L}$) than for those in more labour intensive industries ($Q^1_{K/L}$), where the dynamic is flatter. Lastly columns 7 and 8 group industries according to the OECD definition of high-technology and low-technology sectors[25]. This allows us to investigate whether the U-shaped pattern is sensitive to sectoral technological intensity. Our main conjecture here is that sunk costs of entry into exports markets could be relatively higher in high tech-sectors as they are likely to be linked to investment in technology acquisition. We find that sunk costs are indeed higher in high tech industries, suggesting that technology acquisition is an important element of firms export strategies in those sectors. Surprisingly, *ex post* TFP gains look more uncertain in high tech industries. This conflicts with what we have observed thus far, namely that larger sunk costs usually equate with substantial increases in TFP levels after entry into export markets. We attribute this weakness to two main factors. First, technology acquisition acts like a transient negative shock on firm productive efficiency in that it disrupt existing coordination mechanisms. In this case, learning lags may endure for longer in high-technology industries. Second, investments in new technologies are usually associated with more rapid physical depreciation, exceeding the value of δ_t used in the perpetual inventory method (PIM) (Appendix A). Hence the PIM runs the risk of overestimating K and underestimating TFP, as firms invest in new technologies (**?**).

Overall, the U-shaped TFP dynamic is robust to all sub-sample decompositions, implying that future exporters, while initially more productive, have to cope with significant productivity losses prior to entry into export markets. TFP gains are mainly contemporaneous with entry, consistent with the view that firms first invest in enlarging their productive capacity and then reap the benefits of their sunk investments. This sequence is more pronounced when firms: commit significantly to export markets and belong to capital intensive and high technology sectors.

6 Conclusion

The relationship between Trade and Productivity, traditionally investigated within macro-economic frameworks, has received renewed attention in micro-econometric studies. This paper contributes to this surge of interest and extends the set of available micro-level evidence to France. In our study, we found that the typical productivity path of a French manufacturing firm that decides to enter into export activity is U-shaped. It is a path along which firms first have to cope with sunk costs in order to export, and reap the benefits of expanded sales to foreign markets. French data are consistent with recent theoretical advances in international trade theory that emphasise market selection as the main reason for the superior productivity of exporters relative to non-exporters. Nevertheless, our findings show that a good deal of the costs involved in entry to foreign markets occur before entry, temporarily decreasing the TFP of future exporters. This basic finding may open a new case in favor of export promotion policies as the latter may help efficient firms to face the transient difficulties due to the time lag between sunk investments and non-immediate returns. Behind those policy implications, our results suggest at least three avenues for future research.

First, it could be interesting to test whether the U-shaped productivity path holds for other countries. In the case of France, we showed that the productivity decrease of future exporters is large enough to invert the usual ranking in the performances of both exporting and non-exporting firms some times prior to entry into export markets. An explanation for this result, could be the relatively high rate of participation of French firms in international trade compared to its main industrialized trade partners. If one accepts the proposition that a higher participation rate equates with less efficient firms entering export markets, the end result would be to lower all annual mean points down to values where on average Never Exporters outperform New Exporters prior to entry. This view does not preclude other countries from having similar productivity dynamics, while it is compatible with the presence of a TFP bonus three years before entry.

A second avenue for future research concerns the evaluation of ex post productivity gains using matching methods. Such methods have been introduced recently in order to evaluate more accurately the benefits from entry into foreign markets (Girma et al., 2004). They require each exporting firm to be matched with its closest non-exporting counterpart - usually in the year prior to first exports. The comparison of productivity levels after entry into export markets is then based on two groups of firms with *supposedly* similar *ex ante* performance. However, if future exporters experience a drop in relative performance *because they are planning to export*, such matching techniques could paradoxically biased the estimation of TFP gains du to the entry into export markets.

The third suggestion for research is linked to the absence of clear evidence in favour of learning-by-exporting. Although consistent with most prior contributions, our results should be interpreted with care. The reason is that there could be a systematic underestimation of post-entry TFP gains for new exporters for two reasons. First, as previously mentioned, investments in new technologies increase the rate of physical depreciation above the rate used in PIM. Hence we overestimate K - underestimate TFP - as firms catch-up with the productivity frontier. Second, new exporters are likely to have less market power when they enter a distant market. Applying the domestic output price deflator may incorrectly lead to a systematic underestimation of Y - underestimation of TFP - which becomes more pronounced as firms export a large share of their sales to foreign markets. Future research should address error measurement in productivity in greater detail in order to either support or invalidate the learning-by-exporting hypothesis.

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Notes

[1]Those papers use a valuable data source that complements the one used in the present paper, provided by the French Customs Statistic Services, which includes firm-level information on the destinations of exports

[2]These studies differ, however, in a variety of ways: nature of the dataset - sample versus census; unit of analysis - plant versus firm; nature of the temporal series - continuous years versus non-continuous years; time span of the series; productivity measurement - labour productivity versus TFP; parametric approach versus non parametric approach; etc.

[3]There are two main sources of cross-country differences. First, the trade and competition policies of countries may differ (Tybout, 2001) and this is likely to alter the strength of market selection forces; second, countries may differ in terms of their relative distance from the technological frontier (Acemoglu et al., 2002), and this is likely to affect the possibilities for learning.

[4] US plant data Bernard and Jensen (1999) show a TFP advantage in favour of new exporters of 6-8% points on average 3 years before initial exports; Colombian plant data, Isgut (2001) report a Labour Productivity advantage of 20-24% in favour of new exporters, again 3 years prior to entry; Canadian plant-level data, Baldwin and Gu (2003) report a LP advantage of 15% and a TFP advantage of 7% for future exporters.

[5]Delgado *et al.* Delgado et al. (2002) found significant learning effects for only a sub-sample of young firms.

[6]The export intensity of the industry is calculated by summing sales and exports for all manufacturing firms and then computing the ratio at the industry level. The export intensity at firm level is the result of computing the ratio of export over sales for every firm and then computing the arithmetic average for exporting firms only.

[7]We computed the participation rate for manufacturing sectors at the 4 digit level, which yielded more than 286 subsectors. No subsector was exclusively focused on the domestic market, and very few (less than 5) were solely engaged in exporting. We found that for most subsectors (266) the participation rate was higher than 50%.

[8]Note that the broad picture conceals important sectoral differences. The size gap between exporters and non-exporters is particularly pronounced in sectors such as Automobiles, Transportation Machinery, Electrical and electronic components, and Electrical and electronic equipment. By contrast, in Pharmaceuticals where almost all firms (92%) participate in international trade, the average value of firm export intensity approaches sector export intensity.

[9]We thank Jose Carlos Farinas for having provided us with unpublished participation rates of Spanish firms by firm classes.

[10]Relative values for the export *premium* are computed as the ratio of the mean value of exporting firms ($\overline{X'_E}$) over non-exporting firms ($\overline{X'_{NE}}$), multiplied by a 100.

[11]The reported average values have been computed as follows. First, we computed the arithmetic mean value of all non exporters (NE). Next, we computed relative TFP of firm i as the difference between the log value of firm i's TFP and the mean value of NEs: $\ln TFP^r_{ijtc} = \ln TFP_{ijtc} - \overline{\ln TFP^{NE}_{jtc}}$, where subscripts j, t, and c denote industry, time and cohort, respectively. Finally, we computed the mean values $\overline{\ln TFP^r_{jtc}}$, to which Table 5 adds one and multiplies by a hundred for clarity.

[12]Note, however, that the TFP *premium* with respect to other exports (Switchers and NewEs) diminishes as the export-to-sales ratio increases for all these firms . A simple (unreported) t-test reveals that the distinction between AEs and NewEs is no longer relevant above an export intensity of 29%.

[13]Unfortunately, information on firm age is not available in the EAE survey. Consequently, firm entry in our database may not be its "true" entry into the market. As the EAE database includes only firms with more than 20 employees, it may be that a firm had been in existence for some times before its appearance in the database.

[14]Emami Namini and Lopez (2002) extended the Melitz model to allow for firms consciously deciding between a high-tech, more human capital intensive technology to become exporters, and a low-tech, less human capital intensive technology to become non-exporters. They also show that Chilean firms that began as exporters not only have higher levels of productivity than other classes of firms, but they also show systematic differences in the training of their work forces, and vintages of their capital equipment.

[15]It could be arguedthat the natural point of departure is to explain the causality underlying the firm's *decision* to export. This method was followed by Bernard and Jensen (1999), Castellani (2002) and Alvarez and Lopez (2005) by means of a binary response model, explaining the firm's decision to export as a function of firm characteristics. In our case however, we are interested in whether future exporters are more productive than Never Exporters some years before entry into export markets. Eq.(1) has the advantage of providing a readily available proxy for the productivity gap between New Exporters and Never Exporters in percentage points, controlling for other unobserved specific effects. As emphasised by Bernard and Jensen (1999), this estimate does not depict a causal relationship.

[16]by "cohort" we mean the group of firms which enter into the EAE dataset the same year. We can control for the date of entry of the firm back to 1984.

[17]Note that the variable Export Intensity, or export-to-sales ratio, is bounded between 0 and 1.

[18]Unreported results show that the yearly average TFP growth rate of NewEs turn to be significant higher than NEs between $t + 2$ and $t + 4$.

[19]Specifically, it would require to go beyond the constant-returns-to-scale assumption underlying our TFP computations.

[20]Jacobson et al. (1993) use a close form of this specification to estimate the magnitude and the temporal pattern of displaced workers' earning losses.

[21]This graph is based on the mean value of TFP for both New Exporters and Never Exporters. For Never Exporters, year 0 is the average age of New Exporters when they first export, which is 5 years. For Never Exporters that are present in the database for less than five years, year 0 is the firm-specific median year. The graph allows for entry and exit of both types of firms.

[22]Reported values are computed in three steps. First, we subtract from all $lnTFP_{it}$ the industry-year specific effect $s_j \times d_t$, a cohort fixed effect v_c and a size-class effect z_{sc} in order to obtain $lnTFP'_{it} = lnTFP_{it} - (s_j \times d_t) - v_c - z_{sc}$, where all fixed effects are defined as differences of group means from overall sample means. Second, we computed the TFP of NewEs relative to NEs as the difference between the transformed TFP value of firm i's TFP (TFP'_{it}) and the mean value of never exporters: $\ln TFP^{r'}_{it,E} = \ln TFP'_{it,E} - \overline{\ln TFP'_{NE}}$. Finally, we computed the

mean values $\overline{\ln TFP_E^{r'}}$, to which Table 9 adds 1 and multiplies by 100 for clarity.

[23]These results should be taken with caution due to the declining number of observations after period $t = 0$.

[24]To do this, we sum firm level capitals stocks K and labour L by industries at the three digit level (naf114), which corresponds to 53 industries. We then compute the capital intensity ratio (K/L) by industry and define industry groups according to their quartiles.

[25]We characterise the sectors according to R&D intensity as proposed by the OECD. Essentially this aggregates manufacturing industries into four categories based on average R&D intensity across a range of OECD countries: High-, Medium-High, Medium-Low, and Low technology.

A Main Variables Used in the Dataset

All nominal output and inputs variables are available at firm level. Industry level data are used for price indexes, worked hours and depreciation rates.

Output. Our Output variable is Gross output deflated using sectoral price indexes published by INSEE (French System of National Accounts).

Labour. We compute our Labour variable by multiplying the number of effective workers (i.e. number of employees plus number of outsourced workers minus workers taken from other firms) by average worked hours. The annual series for worked hours are available at the 2-digit industry level and provided by *GGDC Groningen Growth Development Center*). This choice was made because there are no data in the EAE survey on hours worked. Note also that between 1999 and 2000 there was a substantial drop in number of worked hours occurs due to the specific "French 35 hour working week policy" (On average, worked hours fell from 38.39 in 1999 to 36.87 in 2000).

Capital input Capital stocks are computed from investment and book value of tangible assets (we rely on book value reported at the end of the accounting exercise), following the traditional PIM

$$K_t = (1 - \delta_{t-1})\, K_{t-1} + I_t \tag{A-1}$$

where δ_t is the depreciation rate and I_t is real investment (deflated nominal investment). Both investment price indexes and depreciation rates are available at the 2-digit industrial classification from the INSEE data series.

Intermediate inputs. Intermediate inputs are defined as purchases of materials and merchandise, transport and travel, and miscellaneous expenses. They are deflated using sectoral price indexes for intermediate inputs published by INSEE (French System of National Accounts).

Input cost shares. With w, c and m respectively representing wage rate, user cost of capital and price index for intermediate inputs $CT_{kt} = w_{kt}L_{kt} + c_{It}K_{kt} + m_{It}M_{kt}$ represents the total cost of production of firm k at time t. Labour, capital and intermediate inputs cost shares are then respectively given by

$$s_{Lkt} = \frac{w_{kt}L_{kt}}{CT_{kt}}\ ;\ s_{Kkt} = \frac{c_{It}K_{kt}}{CT_{kt}}\ ;\ s_{Mkt} = \frac{m_{It}M_{kt}}{CT_{kt}} \tag{A-2}$$

To compute labour cost share, we rely on the variable "labour compensation" in the EAE survey. This value includes total wages paid to salaries, plus income tax withholding, and is used to approximate the theoretical variable $w_{kt}L_{kt}$. To compute the intermediate inputs cost share, we use variables for intermediate goods consumption in the EAE survey and the price index for intermediate inputs in industry I provided by INSEE.

We compute the user cost of capital using Hall's (1988) methodology where the user cost of capital (i.e. the rental of capital) in the presence of a proportional tax on business income and of a fiscal depreciation formula, is given by[26]

$$c_{It} = (r_t + \delta_{It} - \pi_t^e) \left(\frac{1 - \tau_t z_I}{1 - \tau_t} \right) p_{IKt} \tag{A-3}$$

where τ_t is the business income tax in period t and Z_I denotes the present value of the depreciation deduction on one nominal unit investment in industry I.Complex depreciation formula can be employed for tax purposes in France. To simplify, we chose to rely on the following depreciation formula $z_I = \sum_{t=1}^{n} \frac{(1-\bar{\delta}_I)^{t-1}\delta}{(1+\bar{r})^{t-1}}$ where $\bar{\delta}_I$ is a mean of the industrial deprecation rates for the period 1984-2002 and $\bar{r}$ is a mean of the nominal interest rate for the period 1990-2002.

B Computation of Total Factor Productivity

The methodology given in Caves et al. (1982) and Good et al. (1997) consists of computing the TFP index for firm i at time t as follows:

$$
\begin{aligned}
\ln TFP_{it} = \ln\ Y_{it} - \overline{\ln\ Y_t} + \sum_{\tau=2}^{t} \left(\overline{\ln\ Y_\tau} - \overline{\ln\ Y_{\tau-1}}\right) \\
- \left[\begin{array}{l} \sum_{n=1}^{N} \frac{1}{2} \left(S_{nit} + \overline{S_{nt}}\right) \left(\ln\ X_{nit} - \overline{\ln\ X_{nt}}\right) \\ + \sum_{\tau=2}^{t} \sum_{n=1}^{N} \frac{1}{2} \left(\overline{S_{n\tau}} + \overline{S_{n\tau-1}}\right) \left(\overline{\ln\ X_{n\tau}} - \overline{\ln\ X_{n\tau-1}}\right) \end{array} \right]
\end{aligned}
\tag{A-4}
$$

where Y_{it} denotes real gross output produced by firm i at time t using the set of n inputs X_{nit}, where input X is alternatively capital stocks (K), labour in terms of hours worked (L) and intermediate inputs (M). S_{nit} is the cost share of input X_{nit} in the total cost (Appendix Aprovides a full description of the variables). Subscripts τ and n are indices for time and inputs, respectively. Symbols with upper bars correspond to measures for the reference point (the hypothetical firm), computed as the means of the corresponding firm level variables, over all firms in year t. Note that Eq.(A-4) implies that references points $\overline{\ln Y}$ and $\overline{\ln X}$ are the geometric means of the firm's output quantities and input quantities respectively, whereas the cost shares of inputs for representative firms $\overline{S}$ are computed as the arithmetic mean of the cost share of all firms in the dataset.

This methodology was popularised in the export-productivity literature thanks to the contributions by Aw et al. (2000) and Delgado et al. (2002). It is particularly well suited to comparisons within firm-level panel data sets across industries as it guarantees the transitivity of any comparison between two firm-year observations in expressing each firm's input and output as deviations from a single reference point. Moreover, the index measures the proportional difference in the TFP of any firm i against the reference firm. This latter is computed once for the whole sample, implying that productivity measures at firm level also embody productivity differences across sectors. Lastly, first-differencing the logarithmic values of TFP measures can be interpreted as gaps in percentage points if they remain small.

Table 1: Descriptive Statistics of the Sample (Year 2002)

	Nb. firms	PR^a	Firm EI[b] (%)	Sector EI[c] (%)	Relative Size[d] (%)
All Manufacturing	20,726	72.8	23.1	41.2	287
Clothing	1,212	69.9	24.8	33.3	186
Printing and publishing	1,667	62.6	8.2	7.1	143
Pharmaceuticals	513	92.0	30.4	33.1	245
House equipment and furnishings	1,303	82.7	24.2	30.7	303
Automobile	559	76.4	24.4	50.6	812
Transportation machinery	307	77.2	34.5	57.7	678
Machinery and mechanical equipment	3,764	70.4	23.6	36.8	264
Electrical and Electronic equipment	1,131	74.6	30.3	48.1	374
Mineral industries	1,189	51.8	21.9	21.0	334
Textile	1,129	80.6	29.4	35.7	176
Wood and paper	1,276	68.6	19.0	28.9	252
Chemicals	2,177	83.8	25.4	37.9	221
Metallurgy. Iron and Steel	3,602	71.7	19.4	32.3	270
Electric and Electronic components	897	78.1	27.3	49.1	448

[a]PR: Participation Rate
[b]Firm EI: Arithmetic Mean of Export Intensity of firms
[c]Sector EI: Export Intensity of sector
[d]Relative size: size of exporters relative to non exporters

Table 2: Participation rates and mean export intensity in OECD countries

Country	Part. rate	Export Intensity	Sources
France	72%	21%	Our dataset Firm-level data (1990-2002) average figures
Germany	44%	40%	Bernard et Wagner (1997) Plant-level data (1978-1992) 1992 figures
Great Britain	66%	25%	Greeneway and Kneller (2005) Firm-level data (1991-1997) 1995 figures
Italy	73%	24%	Castellani (2002) Firm-level data (1994-1997) average figures
Spain	41%	25%	Delgado, Farinas et Ruano (2002) Firm-level data (1991-1996) average figures
Sweden	89%	36%	Hansson and Nan Ludin (2004) Firm-level data (1999 data)
United States	21%	12%	Bernard and Jensen (2004) Plant-level data (1987-1992) 1992 figures

Table 3: Firm Export Behaviour, by Size Classes

			PR[a], According to EI[a] Threshold					
Size class	Obs.(%)	EI[a]	> 0%	≥ 5%	≥10%	≥15%	≥35%	≥50%
All	100.0	20.5	71.5	47.1	37.0	30.3	15.6	9.3
20-49	57.0	16.3	62.8	36.2	26.8	21.1	9.9	5.8
50-249	34.1	22.3	80.4	56.7	45.5	37.6	19.4	11.8
250-499	4.9	30.1	91.5	76.0	65.5	56.8	33.1	20.2
≥500	3.9	34.4	95.6	84.2	75.8	68.1	43.5	26.3

[a]See previous table footnotes.

Table 4: The Export Premium, by Size Classes

	All firms	Number of employees 20-49	50-249	250-499	≥500
Mean Number of Non Exp. Firms	6,215	4,622	1,462	92	38
Mean Number of Exp. Firms	15,614	7,810	5,986	984	834
Output (Y)	257.2	143.8	153.0	134.8	182.4
Labour (L)	198.6	103.7	115.0	102.4	*102.0*
Labour Productivity (Y/L)	140.4	138.9	134.2	131.7	127.3
Capital Intensity (K/L)	124.5	115.4	120.6	115.5	*101.1*
Wage per employee	110.3	110.1	111.0	105.5	*101.9*

100 = Non exporting firms.
All differences significant at 1% level, except values reported in *italics*.
All values are net from industry, year and cohort specific effects.

Table 5: The TFP *bonus*, by Export Intensity Threshold

		Export intensity					
	Obs.	≥ 0%	≥5%	≥10%	≥20%	≥30%	≥40%
				All firms			
Always Exporters	15,918	104.5	104.5	104.7	104.9	105.2	105.5
New Exporters	3,360	101.9	103.6	104.2	105.1	105.7	105.8
Switchers	9,906	101.4	102.5	102.8	103.4	104.2	104.9
Never Exporters	4,581	100.0					
				Continuing firms (Balanced panel)			
Always Exporters	4,387	104.0	103.9	104.0	104.4	104.8	105.5
New Exporters	506	103.5	104.7	105.4	106.2	106.0	107.5
Switchers	3,025	101.5	102.1	102.0	102.6	104.0	104.9
Never Exporters	531	100.9					
				Successful entrants[a]			
Always Exporters	3,062	107.8	108.2	108.5	108.5	108.7	108.7
New Exporters	762	103.0	104.2	104.8	105.9	106.9	105.7
Switchers	2,533	102.8	104.6	105.1	105.6	106.3	107.0
Never Exporters	760	100.9					

[a]Successful Entrants are those firms which enter the database from 1990 to 1998 and survive at least 5 years.
All values are relative to the TFP of Never Exporters (row 4, all firms), controlling for industry, cohort, age and size class fixed effects.

Table 6: *Ex Ante* Performance of Exporters

	Levels (Eq.1)		Growth rates (Eq.2)		
	$t-5$	$t-3$	$\frac{t-3}{t-5}$	$\frac{t-1}{t-3}$	$\frac{t}{t-1}$
TFP	0.035	-0.019	-0.016	*0.000*	0.030
	[2.70]	[2.54]	[3.20]	*[0.12]*	[5.14]
Labour Productivity $(Y/L)^a$	0.128	0.075	*-0.008*	*0.011*	0.082
	[3.32]	[3.32]	*[0.77]*	*[1.95]*	[6.69]
Output (Y)	0.130	0.074	*0.009*	0.023	0.140
	[3.36]	[3.30]	*[0.76]*	[3.41]	[9.66]
Labour $(L)^a$	*-0.024*	*0.008*	0.017	0.012	0.057
	[0.50]	*[0.31]*	[2.04]	[2.40]	[6.44]
Capital Stocks (K)	0.191	0.271	*0.029*	0.026	0.048
	[2.07]	[5.18]	*[1.68]*	[3.22]	[3.78]
Intermediate Inputs (M)	0.212	0.247	0.041	0.032	0.188
	[3.08]	[6.14]	[2.24]	[3.12]	[8.35]

[a] *Size* not included in the vector of explanatory variables.
$N = 3,609$ for $\tau = 1; 3$, $N = 2,173$ for $\tau = 5$.
t-stat in brackets.
All parameters significant at 5% level, except those in *italics*.

Table 7: *Ex Post* Performance of Exporters

	Levels (Eq.3) $t+5$		Growth rates (Eq.4) $\frac{t+3}{t}$		$\frac{t+5}{t+3}$	
	β_1	β_2	β_1	β_2	β_1	β_2
TFP	*0.021*	0.067	*0.002*	*0.002*	*-0.005*	*0.011*
	[1.81]	[2.06]	*[0.68]*	*[0.33]*	*[1.26]*	*[0.93]*
Labour Productivity $(Y/L)^a$	0.315	*0.184*	0.013	*-0.022*	*-0.009*	*0.028*
	[8.08]	*[1.64]*	2.31	*[1.36]*	*[1.18]*	*[1.23]*
Output (Y)	0.299	*0.171*	0.027	*-0.012*	*0.000*	*0.018*
	[7.74]	*[1.54]*	[3.75]	*[0.61]*	*[0.05]*	*[0.67]*
Labour $(L)^a$	0.138	*0.111*	0.014	*0.009*	*0.010*	*-0.010*
	[2.61]	*[0.73]*	[2.64]	*[0.66]*	*[1.39]*	*[0.50]*
Capital Stocks (K)	0.380	*0.253*	0.026	*-0.007*	0.018	*-0.013*
	[5.05]	*[1.16]*	[3.45]	*[0.32]*	[2.05]	*[0.53]*
Intermediate inputs (M)	0.582	*0.007*	0.024	*-0.020*	*0.002*	*0.024*
	[9.34]	*[0.04]*	[2.62]	*[0.77]*	*[0.20]*	*[0.68]*

[a] *Size* not included in the vector of explanatory variables.
N = 1,944 for $\tau = 5$, N = 2,735 for $\tau = 3$
t-stat in brackets.
All parameters significant at 5% level, except those in *italics*.

Table 8: The U-Shaped TFP Dynamics of New Exporters

Period	TFP	LP (Y/L)	Output (Y)	Labour (L)	Capital stocks (C)	Intermediate inputs (M)
-5	-0.029	-0.227	-0.335	-0.107	-0.575	-0.457
-4	-0.031	-0.195	-0.296	-0.101	-0.484	-0.392
-3	-0.035	-0.185	-0.255	-0.070	-0.365	-0.346
-2	-0.040	-0.173	-0.234	-0.061	-0.294	-0.315
-1	-0.045	-0.154	-0.210	-0.056	-0.193	-0.277
0	0.000	0.000	0.000	0.000	0.000	0.000
1	*0.004*	0.021	0.052	0.030	0.122	0.041
2	*0.003*	0.045	0.103	0.058	0.238	0.101
3	0.014	0.076	0.151	0.075	0.326	0.141
4	*0.008*	0.098	0.185	0.087	0.403	0.188
5	0.019	0.129	0.216	0.087	0.470	0.218
Obs.	17,831	17,831	17,831	17,831	17,831	17,831
NewEs[a]	3,360	3,360	3,360	3,360	3,360	3,360
R^2	0.020	0.110	0.160	0.090	0.350	0.150

All values are net from industry-year, cohort and size class specific effects
All parameters significant at 5% level, except those in *italics*.
[a]NewEs: Number of New Exporters.

Table 9: Robustness checks of the U-Shaped pattern

Period	Pooled	]1; 99[	Bal.	$EI^{>5\%}$	$Q^1_{K/L}$	$Q^4_{K/L}$	LT[a]	HT[b]
-5	101.5	*100.8*	101.7	102.9	*100.9*	*100.7*	*101.8*	101.3
-4	*99.4*	99.1	*100.2*	*100.0*	*99.0*	*98.0*	*100.2*	96.8
-3	98.4	99.0	*99.9*	97.6	*99.2*	*97.2*	*99.2*	94.4
-2	98.2	99.1	*99.3*	95.7	*99.4*	*93.1*	*99.4*	97.7
-1	98.9	*99.7*	98.6	97.6	*100.3*	*97.1*	*101.1*	*98.9*
0	102.9	102.4	*100.7*	103.6	103.2	104.6	105.0	103.3
1	102.7	103.0	*100.8*	103.5	103.1	104.4	104.4	*100.9*
2	103.2	103.1	*99.7*	104.1	103.9	106.3	105.1	*101.1*
3	104.0	103.6	*100.2*	105.5	105.3	107.1	105.3	104.9
4	102.6	102.9	*100.4*	103.8	104.7	104.1	104.2	*100.5*
5	103.3	103.4	*100.7*	105.5	103.9	105.3	104.3	103.2
NewEs[c]	3,360	3,138	480	1,402	1,458	333	1,256	301
NEs[d]	4,581	4,322	1,693	4,581	1,980	772	1,959	380

100 = Never Exporters.
All values are net from industry-year, cohort and size class specific effects.
All parameters significant at 5% level, except those in *italics*.
[a]LT: Low technology sectors.
[b]HT: High technology sectors.
[c]NewEs: Number of New Exporters.
[d]NEs: Number of Never Exporters.

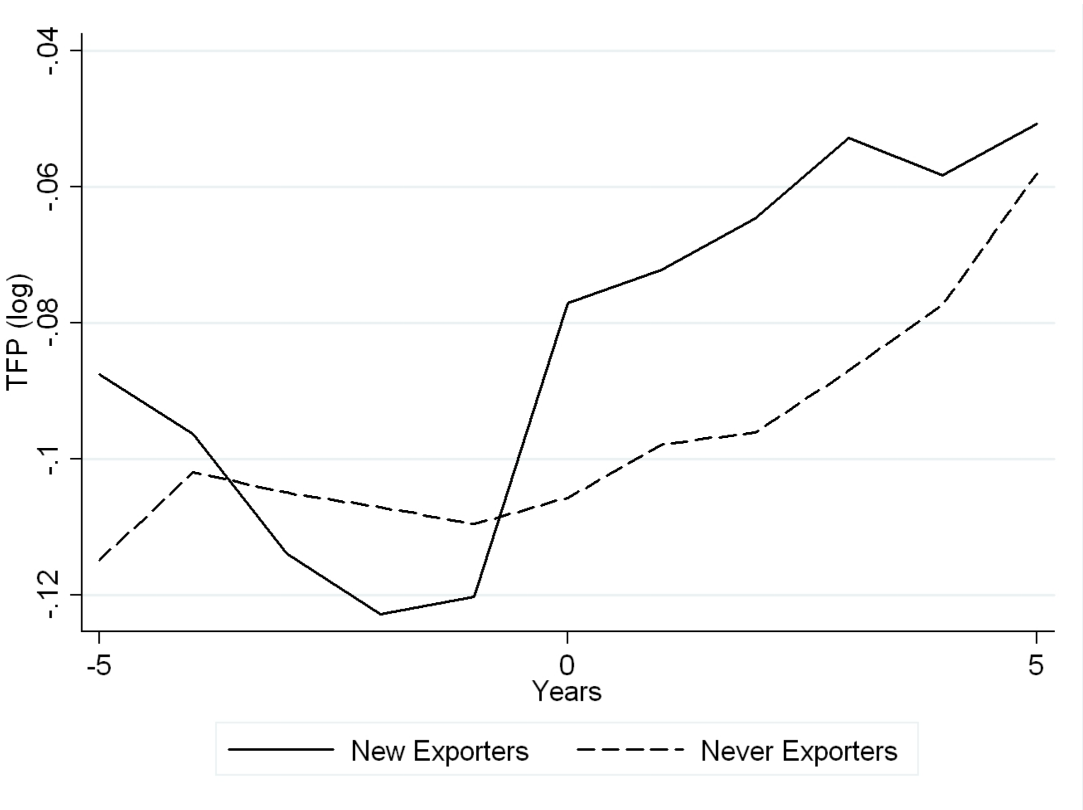

Figure 1: TFP Dynamics of New Exporters and Never Exporters