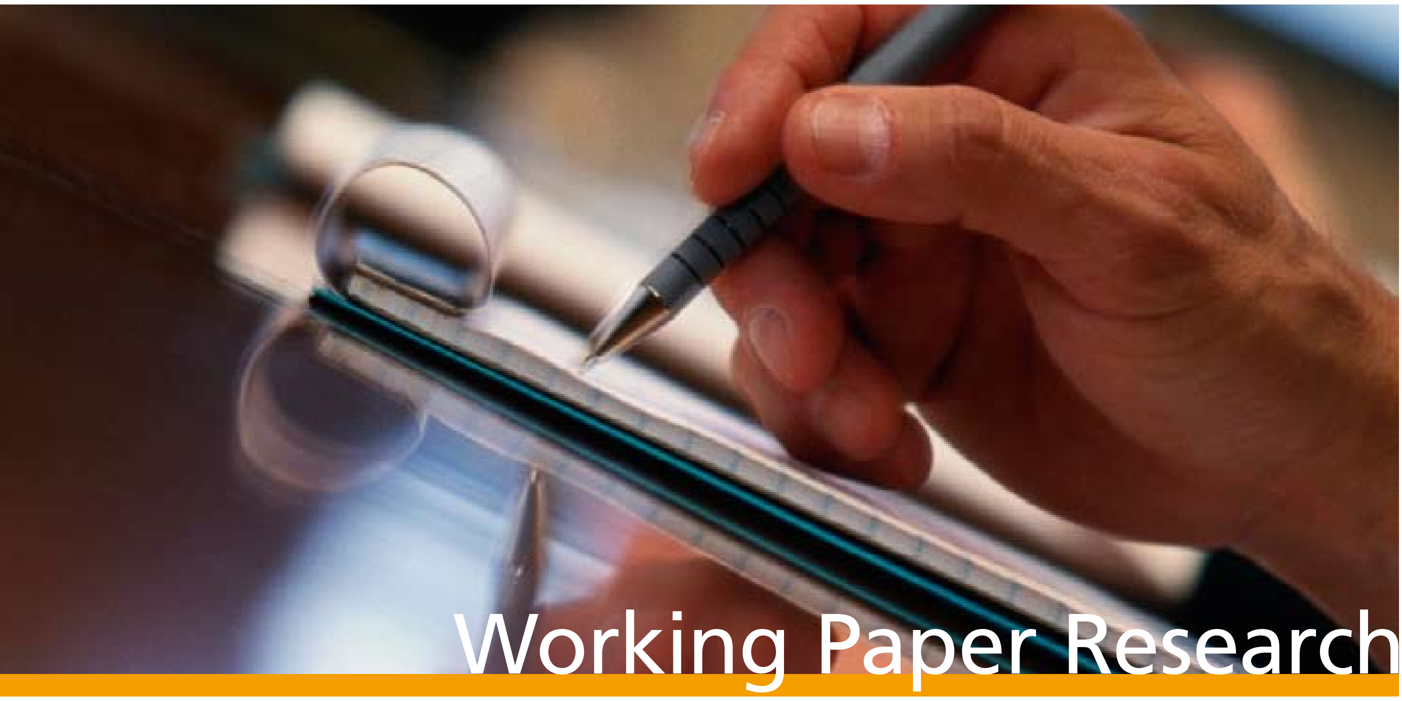
# Export destinations and learning-by-exporting: Evidence from Belgium




by Mauro Pisu

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## Abstract

This paper evaluates the causal effects of exports to different destination countries using a comprehensive dataset on Belgian manufacturing firms from 1998 to 2005. Initial evidence suggests that, before export market entry, exporters to more developed economies have superior productivity levels than non-exporters and firms exporting to less developed countries. Moreover, they seem to experience higher productivity growth rates in the post-entry period, suggesting learning-by-exporting effects. However, applying matching methodology to formally evaluate the causal effects of export market entry on productivity reveals no such impact. Thus, the productivity advantage of firms exporting to developed countries appears to be driven solely by self-selection.

JEL-code : L1, D24.
Key-words: learning-by-exporting, export destinations, productivity.

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# 1. Introduction

The cross-country macroeconomic literature has documented a positive relationship between trade and growth performance.[1] However, the causal link between exports and growth is still hotly debated.[2] Recently, evidence based at the level of the firm has shed new light on this issue. Bernard and Jensen (1995) and Aw and Hwang (1995) pioneered new literature on firm-level characteristics and export-market participation. These and many subsequent studies using data from different countries and time periods have established a positive link between export-market participation and productivity.

There are two, not mutually exclusive, explanations for this phenomenon: self-selection and learning by exporting. According to the former, because of sunk costs of exports, only the most productive companies find it profitable to meet these costs and start trading internationally. The second explanation has it that new exporters experience an acceleration in productivity growth after entering export markets because of learning in international markets. The self-selection versus learning-by-exporting debate has attracted the attention of many researchers.[3] As reported by Greenaway and Kneller (2007) and Wagner (2007) in their surveys of the literature, self-selection appears to be the more robust and convincing explanation. As regards the learning-by-exporting hypothesis, the evidence is more mixed.[4]

This paper takes another look at the effects of exports on productivity using a comprehensive set of data on Belgian manufacturing firms from 1996 to 2005 with information on export destinations. The characteristics of export markets are presumably important for learning-by-exporting effects. Some of the most convincing evidence of post-export market entry productivity improvement has been obtained in studies using such information. Damijan, Polanec and Prasnikar (2004) and De Loecker (2007) report

[1] See, for instance, Edwards (1998) and Frankel and Romer (1999).
[2] See Rodriguez and Rodrik (2000) and Rigobon and Rodrik (2005).
[3] The review of the literature on exports and productivity by Wagner (2007) features 57 studies produced since the seminal work of Bernard and Jensen (1995).
[4] It is worth noting that these studies are not easily comparable because of the different methodologies and productivity measures used. Thus, whereas the self-selection hypothesis appears to be a robust finding across different economic settings and methodologies, the learning-by-exporting hypothesis is not. Recently, the International Study Group on Exports and Productivity (2007) has provided cross-country comparable evidence on this topic. This study uses data from 14 countries. In line with the existing literature, this work finds strong evidence of self-selection and virtually no evidence of learning-by-exporting.

positive and significant learning-by-exporting effects for Slovenia, using data from the 1990s. More importantly, these appear to be positively associated with the development level of destination countries. This suggests that the current literature may have underestimated the productivity improvements that exports generate because of neglecting export market characteristics.

However, the specific development path Slovenia followed in the 1990s makes these findings hard to generalise to other countries. This was in fact characterised by a deep transition and restructuring process involving an opening up of the economy after a long period of relative economic isolation and regulation. In this context, exports can conceivably offer a relatively easy and fast access to technology and management practices not yet available at home, thereby leading exporting firms to higher productivity levels.

Learning-by-exporting effects are important not only from an academic point of view, but also from a policy standpoint. If exports lead to productivity improvements, then the numerous aids that many governments offer to firms to break into international markets can be justified because of the externalities higher productivity growth is supposed to generate.[5] If there are not these effects this use of public money is less tenable.[6]

This paper also takes special care in identifying the exact point in time in which learning-by- exporting effects take place to distinguish between real productivity improvements and increases in capacity utilisation.[7] To do this, following van Garderen and Shah (2001), this study proposes a more precise estimator of the variance of the percentage differences caused by dummy variables in semi-logarithmic equations.

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[5] This is the economic reasoning behind many forms of subsidies and tax breaks concerning R&D spending. Direct export subsidies are generally prohibited by free trade agreements. Nowadays, export state aids take subtler forms, such as easy financing for market research and participation in trade fairs, provision of information about foreign markets and potential customers, and so on.

[6] This does not mean that such policy interventions are totally unjustified. Exports can in principle generate positive externalities linked to factors besides higher productivity, such as higher employment and innovation levels leading to improvement in product quality rather than productivity.

[7] As underlined by Kostevc (2005), apparent productivity gains realised the same year as firms start exporting could be actually due to higher capacity utilisation rather than upward shifts in the production function. Firms may need indeed some time before they can implement those changes necessary to increase productivity..

The results in this paper indicate that the productivity differences between new exporters and non-exporters the year before exports begin tend to increase with the level of development of destination countries. This suggests that sunk costs of exports may be country-specific and higher in advanced and sophisticated markets. Also, initial results suggest that firms beginning to ship goods abroad experience significant productivity gains vis-à-vis companies that focus solely on the domestic market. These productivity gains are more pronounced for firms beginning to export to more developed countries, suggesting learning-by-exporting effects. In addition, these productivity gains appear to accrue the year after firms start shipping goods abroad and are sustained over time.

However, applying matching methodology to formally evaluate the causal effects of exports to different destinations on productivity yields statistically insignificant results. Thus, in Belgium unlike in Slovenia, as reported by Damijan, Polanec and Prasnikar (2004) and De Loecker (2007), the positive association between productivity and the development level of destination countries can not be attributed to learning-by-exporting.

## 2. Firm-level characteristics and export destinations

Wagner (2007) and Greenaway and Kneller (2007) have recently reviewed the burgeoning firm-level literature on exports and productivity. The most robust explanation for the superior firm-level characteristics of exporters with respect to non-exporters is that the best enterprises self-select into export markets. Because of sunk costs of exports and the coexistence of firms with different productivity levels within the same industry, only the most productive companies will find it profitable to pay such up-front costs and start selling abroad. Melitz (2003) and Bernard, Eaton, Jensen and Kortum (2003) have incorporated this empirical regularity into formal theoretical international trade models with heterogeneous firms.

The alternative hypothesis, namely that exports lead to increases in productivity, has received mixed support, at best.[8] There are different channels through which exports could

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[8] For instance, considering developed countries, Baldwin and Gu (2004) for Canada, and Castellani (2002) for Italy, find evidence of productivity increases following export market entry, whereas Wagner (2002), for Germany, finds no evidence in favour of this phenomenon.

generate productivity gains. Exporting firms may get access to technical and management knowledge accumulated in international markets and foreign countries, as argued by Grossman and Helpman (1991, pg. 166) and Clerides, Lach and Tybout (1995). A second channel through which exports could increase productivity is through higher competition in foreign markets. Empirical studies by Nickell (1996), Blundell, Griffith and Van Reenen (1999), Aghion, Bloom, Blundell, Griffith and Howitt (2005) have found positive effects of product market competition on productivity growth.[9] More recently, Verhoogen (2008) has argued that tougher competition and/or higher quality standards in foreign markets might spur exporting firms to innovate, upgrade production technologies, and change the skill composition of their personnel towards highly-educated workers. He finds robust evidence in support of this hypothesis using a sample of Mexican manufacturing plants.

Researchers have recently started to investigate the number and characteristics of export markets firms serve and their relationships with their performance. This is potentially important to identify learning-by-exporting effects since the productivity gains from exporting, if they exist, are likely to depend on characteristics of destination countries. Because of the advanced technologies used in developed countries, exports to such locations may be expected to generate more learning opportunities than shipping goods to less developed destinations. Also, markets in developed countries are generally more competitive than those in developing countries. The latter are usually affected by heavy regulations limiting the entry and exit of firms, protection for incumbents, price setting and other types of state intervention, all of which hamper competitive pressures.

The few papers investigating the learning-by-exporting effects across different destinations find encouraging results in this respect.[10] Damijan, Polanec and Prasnikar (2004) find that Slovenian firms' productivity is positively associated with the number of destinations they serve.[11] Also, sunk costs seem to be higher for exports to developed destinations (i.e.

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[9] Aghion, Bloom, Blundell, Griffith and Howitt (2005) show that the relationship between innovation and productivity has an inverted U shape.

[10] Eaton, Kortum and Kramarz (2004) have provided the first study analysing exports to different export destinations. They examine a cross section of French firms in 1986 and show that there is a negative relationship between the number of firms selling to multiple markets and the number of foreign markets they serve. The focus of their study is more on explaining the variation of French exports across destinations in the extensive and intensive margin than on the different productivity levels of firms exporting to different destinations.

[11] They analyse a Slovenian firm-level dataset from 1994 to 2002.

OECD countries in their study). In their empirical exercise, the superior productivity levels of would-be exporters is fully explained by companies starting to ship goods to advanced countries. As regards the learning-by-exporting hypothesis, Damijan, Polanec and Prasnikar (2004) find evidence of post-export market entry productivity improvements. Also, their findings suggest that these productivity gains are driven by exports to developed countries only. In a study using a similar dataset of Slovenian firms, De Loecker (2007) corroborates this finding, using a matching methodology to formally evaluate the causal effect of exports on productivity. He reports that new exporting companies enjoy significant productivity gains with respect to non-exporters. These are bigger for firms exporting to high-income countries.[12] Park, Yang, Shi and Jiang (2007) have recently reported similar findings. Using a dataset of *foreign-owned* Chinese firms from 1995 to 1998, they show that exports lead to higher productivity levels and that these gains are stronger for firms exporting to more developed countries.

The studies provide evidence of learning by exporting effects varying across export destinations. However, whether or not these findings can be generalised to other countries on a different development path is an open question. Arguably, because of their specific development process and fast opening-up of their economy, exporting firms from countries such as China or Slovenia may have access to superior know-how, technologies and management practices not available at home and not easily accessible through other channels. Using a dataset of Belgian firms, this paper provides fresh evidence on whether or not this may be true for developed countries.

## 3. Empirical methodology

If any learning-by-exporting effect is present, we would expect productivity to rise after export market entry. To start investigating this point, we estimate the following model using only non-exporters and new-exporters:

$$\ln y_{it} = \rho + \sum_{s=-1}^{3} \beta_{t+s} EXP_{it-s} + \gamma \ln emp_{it} + \phi \, control_{it} + \varepsilon_{it} \qquad (1)$$

[12] However, it should be stressed that the learning process of foreign firms could be radically different from that of domestic companies. Thus, the results of this paper may not apply to the latter set of firms, which is, arguably, the most interesting one from a policy perspective.

$EXP_{it}$ is a dummy variable taking the value of one if firm *i* exports at time *t* and zero otherwise. The $\beta$s parameter captures the difference in productivity between exporting and non-exporting firms from the year before the start of export to three years after. In order to compare exporters with truly non-exporting companies, the latter are defined as those firms that do not export for six consecutive years.[13] In the specification above, we also add the log employment (*ln emp*) to control for the size of the firm and a vector of additional *control* variable including year and two-digit industry dummies.[14] It is worth noting that $EXP_{it-s}$ is one as long as firm *i* keeps exporting. In the data, there is a significant number of firms that exit export markets after just one or two years of exporting. These are likely to be unsuccessful exporters. Restricting the sample to successful exporters, i.e. those that export for three consecutive years, will probably result in upward-biased estimates of the causal effect of exports on productivity.

Since (1) is a semi-logarithmic equation, the estimated effects of export dummies ($\beta_{t+s}$) expressed in percentage term ($p_{t+s}$) and their standard errors are estimated following van Garderen and Shah (2001), using (A-3) (A-6) in the Appendix. In this paper, we are also interested in identifying the time in which productivity improvements are realised. The issue of timing is important since as underlined by Kostvec (2005), productivity gains made only in the year in which firms started to export can be conceivably due to increased capacity utilisation rather than any upward shift in the production function. Truly convincing learning-by-exporting effects should not be a one-off phenomenon only, but should probably take some time before they are realised and be sustained over time.[15]

Given the estimates in percentage term ($\hat{p}_{t+s}$), it is possible to test the nulls, i.e. $H_0$: $\hat{p}_{t+s} - \hat{p}_{t-1} = 0$ for $s = 0,1,2,3$, to test if there is any significant productivity improvement,

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[13] Since the dataset spans the 1998-2005 period and is unbalanced, this six-year window gradually shrinks from 2002 onwards. The observations from 2002 onwards are used to estimate the post-entry effect for a progressively shorter time interval after entry into the export market.

[14] To control for the effect of export market exit on firms' productivity, the vector *control* also includes a dummy that is one in the year of exit (i.e. the period after the last year of export). However, the results are not very sensitive to the inclusion of this variable.

[15] Productivity increases are not likely to take place in year *t*, if they are due to the adoption of new technologies, management practices, or innovations. All these changes may require some time to be fully implemented and before they yield any result. In the annual data usually available to researchers, there is no information about the exact date of the start of exports within a given year. Whereas it is possible that firms starting to export at the beginning of the year may have time to introduce the productivity-enhancing changes and reap the benefits arising from them within the same year in which they started to export, this becomes more unlikely as firms begin to export later on. Then, productivity gains are more likely to appear in the years following the start of exports.

with respect to non-exporters, $s$ year(s) after export market entry. The standard error of the statistics $\hat{p}_{t+s} - \hat{p}_{t-1}$ is not the same as that of $\hat{\beta}_{t+s} - \hat{\beta}_{t-1}$ since $\hat{p}$ is a non-linear function of $\hat{\beta}$. The corrected standard errors are derived in (A-7)in the Appendix in.

Regression (1) is useful to obtain prima facie evidence on the different productivity trajectories of newly-exporting firms compared to non-exporters. However, it would be a mistake to ascribe these differences to export market entry since they could also be the result of the self-selection into export markets of those firms that are going to experience higher productivity growth rates anyhow. In this case the causality would run the other way round: from higher productivity growth prospects to entry into export market. To formally evaluate the causal effects of exports on productivity we employ matching methodology. Let $EXP_{it} \in \{0,1\}$ be an indicator of whether domestic firm $i$ starts to export at time $t$, and let $y^1_{it+s}$ be the productivity level at time $t+s$, $s \geq 0$. Also, denote by $y^0_{it+s}$ the productivity level of the firm *had it not started to export*. The causal effect of starting to sell internationally on productivity of firm $i$ at time period $t + s$ is defined as $y^1_{it+s} - y^0_{it+s}$.

The fundamental problem of causal inference is that the quantity $y^0_{it+s}$ is unobservable. Thus, the analysis can be viewed as confronting a missing-data problem. Following the micro-econometric evaluation literature (e.g. Heckman, Ichimura and Todd, 1997), we define the *average* effect of exports on newly exporting firms as[16]

$$E\{y^1_{it+s} - y^0_{it+s} \mid EXP_{it} = 1\} = E\{y^1_{it+s} \mid EXP_{it} = 1\} - E\{y^0_{it+s} \mid EXP_{it} = 1\} \qquad (2)$$

Casual inference relies on the construction of the counterfactual for the last term in (2), which is the outcome the exporting firms would have experienced, on average, had they not started exporting. This is estimated by the average outcome variable of a selected group of firms that did not start exporting: $E\{y^0_{it+s} \mid EXP_{it} = 0\}$.

The central feature of the evaluation literature is the selection of a valid control group. One way of doing so is by employing matching techniques. The purpose of matching is to pair

[16] In the evaluation literature, this is denoted as the average treatment effect on the treated (ATT).

each exporting firm with an enterprise that did not start selling abroad having similar, ideally the same, characteristics to the exporting one. The observable variables on which matching is performed are supposed to affect the export decision and future productivity growth.

In this exercise, we use two matching methodologies. The first, proposed by Rosenbaum and Rubin (1983), matches treated and non-treated firms based on their propensity score alone. This involves estimating the probability of receiving treatment (export market entry in this study). Denoting with $e(\mathbf{x})$ the propensity score (i.e. the conditional probability of receiving the treatment), they show that firms or individuals having the same value of $e(\mathbf{x})$ will also have the same distribution of $\mathbf{x}$. Therefore, exact matching on $e(\mathbf{x})$ will balance the distributions of the covariates in the treated and control group. This methodology, although easy and intuitive, presents some drawbacks. Firstly, achieving exact matches is unlikely and, secondly, the functional form of $e(\mathbf{x})$ is rarely known.

Thus, this paper also uses the approach proposed by Rosenbaum and Rubin (1985) which combines Mahalanobis metric matching using the observable variables of interests *and* the propensity score. They show that this methodology produces better matches than matching on the propensity score only. In this paper, the results obtained using the matched sample are based on this matching methodology since I find that it performs better than the other.

Both matching methodologies first require an estimate of the probability of starting to export to each destination group. To do this, the multinomial logit model $P(EXP^g_i = 1 \mid X_i) = F(\mathbf{x}_i)$ is estimated where $P(EXP^g_i = 1)$ is the probability of firm *i* to export to country group *g*,[17], $\mathbf{x}_i$ is a vector of the lag of these variables (all in logs): TFP, TFP growth, labour productivity, labour productivity growth, employment, wage per employee, capital per employee and all their squared terms. The choice of these variables is motivated by the existing literature, as discussed in the previous section. These regressions were estimated for each year and two-digit industry separately.

[17] There are five mutually exclusive choices: no export, export to low-, lower-middle, upper-middle and high-income countries. These groups are described in more detail in the next section.

Now let $P^g{}_i$ denote the predicted probability of firm *i* to export to destination group *g*. The matching based on the propensity score only is performed using the nearest-neighbour method with caliper. This involves matching each treated firm with the non-treated firm whose propensity score is closest to that of the treated company and which falls within a pre-specified range. More formally, and for each newly-exporting firm *i* to country group *g*, a non-exporting firm *j* is selected such that

$$\lambda > \left| P^g{}_i - P^g{}_j \right| = \min_{k \in \{non-exporting\}} \{ | P^g{}_i - P^g{}_k | \}$$

where λ is a pre-specified scalar, which is set at a very conservative 0.01 in our analysis. Furthermore, we impose the so-called common support condition in the matching algorithm. This involves dropping newly-exporting firms whose propensity score is higher than the maximum or less than the minimum propensity score of the control group.

The Mahalanobis metric matching involves matching to the treated firm *i* the non-treated firm *j* which is the closest to *i* in terms of the Mahalanobis distance. The Mahalanobis distance is computed as the square root of $(\boldsymbol{z}_i - \boldsymbol{z}_j)' \boldsymbol{V}^{-1} (\boldsymbol{z}_i - \boldsymbol{z}_j)$ where $\boldsymbol{z}$ includes the covariates in $\boldsymbol{x}$, but their square terms, *plus* the estimated propensity score; $\boldsymbol{V}^{-1}$ is the inverse of their sample covariance matrix. Common support was again imposed and the matching was performed with replacement.[18]

Both matching methodologies were performed for each year and two-digit NACE industry separately. This ensures that only exporting and non-exporting firms at the same point of the business cycle and operating in the same market will be matched. This yields higher-quality matches.[19] Having constructed the comparison group (C) of firms that are similar to treated firms (T), the simplest form of a matching estimator of the causal effect of starting to export on the outcome *y* can be written as

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[18] This involves a non-treated firm being matched with more than one non-treated company. All matching procedures were performed using psmatch2 in Stata 10.

[19] Heckman, Ichimura and Todd (1997) have compared the *non-experimental* treatment effects, estimated through different methodologies, with the *experimental* causal effects. They have used data from a US job training programme (namely the JPTA) and its impact on earnings. They find that the two most important sources of bias are due to matching treated and non-treated agents that: 1) do not have the same distributions of observable variables; and 2) are not part of the same economic environment. They argue that the former can be eliminated by matching only over the region of common support, whereas the latter can be eliminated, rather simply, by matching agents operating in the same market.

$$\beta_{t+s} = \frac{1}{N^T} \sum_{i \in T} \left( y_{it+s} - \sum_{j \in C(i)} w(p_i, p_j)\, y_{jt+s} \right) \tag{3}$$

where $y_{it+s}$ is the outcome of interest at time $t+s$ (with $s = 0, 1,2,3$), $N^T$ is the number of matched treated, $C(i)$ is the set of firms in the control group that have been matched to treated firm $i$ and $w(p_i, p_j)$ is the weight placed on the comparison firm $j$, generated by the matching algorithm.[20] In this paper, we exploit the panel nature of our data to estimate the following regressions by OLS using only the matched firms:

$$\ln y_{it+s} = \delta_0 + \beta_{t+s}\, EXP^g_{it} + \delta\, control_{it+s} + \eta_i + \epsilon_{it+s} \tag{4}$$

where $EXP^g_{it}$ is a dummy taking the value of one if firm $i$ started to export to destination $g$ at time $t$, and zero otherwise; *control* is a vector of year and two-digit industry dummy; $\eta_i$ is a time-invariant firm-level fixed effect and $\epsilon_{it+s}$ is a classical error term. Then, $\beta_{t+s}$ will capture the difference in the outcome variable between non-exporting and newly-exporting firms $s$ year(s) after the start of exports.

Regression (4) is estimated using the weights $w(p_i,p_j)$. This weighted regression without the additional *control* variables would yield an estimate of treatment effect $\beta_{t+s}$ equivalent to the one obtained using (3). The advantage of using the regression approach is that it is possible to take into account other factors, such as year and industry shocks, affecting productivity in the post-entry period.[21]

The robustness of these estimates can be checked employing the difference-in-difference approach. In this case, the outcome variable is differenced with respect to its value before the treatment (i.e. at time $t-1$). Therefore, we estimate

$$\ln y_{it+s} - \ln y_{it-1} = \delta_0 + \beta_{t+s}\, EXP^g_{it} + \delta\, control_{it+s} + \epsilon_{it+s} \tag{5}$$

$\beta_{t+s}$ captures the difference in the growth rate of the outcome variable between the two groups of firms before and after the treatment. The use of this methodology is motivated

[20] $w(p_i, p_j) = 1/ N^C(i)$ where $N^C(i)$ is the number of non-exporting firms that have been matched to treated firm $i$.

[21] It is worth noting that, in order to estimate regression (4), all cohorts of matched firms, constructed year by year, and their subsequent observations, were appended to each other. That is, if a non-exporting firm is matched, say, in 2000 and 2001, it will appear twice in the dataset used to estimate regression (4), once with observations from 2000 to 2003 and a second time with observations from 2001 to 2004. This reflects the fact that, in estimating the causal effects year by year, the first set of observations would be used to get the 2000 estimates and the second set to obtain the 2001 estimates. This study does not report year-by-year results because of the low number of yearly matches and, for this reason, it exploits the panel nature of the data correctly.

by the fact that matching methods can only deal with selection on observables. Therefore, they may result in biased estimates, if there is selection on factors uncontrolled for, such as $\eta_i$. Difference in difference methodology, eliminating $\eta_i$, will result in more reliable estimates. As underlined by Blundell and Costa Dias (2000, p. 438), matching in combination with difference-in-differences methodology can have the potential to "...improve the quality of non-experimental evaluation results significantly". As before, since (4) and (5) are semi-logarithmic equations, the estimated effects of export market entry, in percentage term, are estimated using (A-3) and (A-6) in the Appendix.

# 4. Description of the data and sample coverage

The dataset used in this study is the Belgian Balance Sheet Transaction Trade Dataset (BBSTTD). Muûls and Pisu (2007) describe it in detail. The BBSTTD is the result of a merger between firm-level accounts and custom trade data. The firm-level accounts come from the Central Balance Sheet Office at the National Bank of Belgium (NBB). It collects the annual accounts of all companies registered in Belgium. Most limited liability enterprises, plus some other firms, have to file their annual accounts and/or consolidated group accounts with the Central Balance Sheet Office every year. Large companies have to file the full-format balance sheet. Small companies may use the abbreviated format.[22] There are some exceptions. Some enterprises do not have to file any annual accounts.[23] For this study, we selected those companies operating in the manufacturing sector that filed a full-format or abbreviated balance sheet between 1996 and 2005.[24] To avoid double counting, we did not select firms filing consolidated balance sheets.

The information about exports comes from intra-EU (Intrastat) and extra-EU (Extrastat) trade declarations. The two sources of information were merged using the value added tax number, which identifies each firm. Only a minority of firms in the custom data, between

[22] Under the Belgian Company Code, a company is regarded as large if: the annual average of its workforce exceeds 100 persons or more than one of the following criteria are exceeded: 1) annual average of workforce: 50; 2) annual turnover (excluding VAT): 7,300,000 euro; 3) balance sheet total: 3,650,000 euro.

[23] These include: sole traders; small companies whose members have unlimited liability: general partnerships, ordinary limited partnerships, cooperative limited liability companies; large companies whose members have unlimited liability, if none of the members is a legal entity; public utilities; agricultural partnerships; hospitals, unless they have taken the form of a trading company with limited liability; health insurance funds, professional associations, schools and higher education institutions.

[24] I do not consider the catch-all sector NACE 36 "Manufacturing not elsewhere classified".

7 and 5 p.c. of them, were not merged with the balance sheet data set. These are legal entities having a VAT number, but not filing any accounts in Belgium.[25]

I drop from the dataset the top and bottom one percent tails of the distribution of the growth rate of value added, employment and capital. This avoids our productivity estimates being affected by firms experiencing abnormal growth rates. This leaves us with around 19,000 firms per year in the merged dataset. This paper reports results based on labour productivity and total factor productivity (TFP). TFP is estimated with the Olley and Pakes (1996) method of, using value added production.[26] Value added was deflated with producer price indices, at two-digit NACE level[27] Capital stock is measured using its book value and employment is the average of full-time equivalent employees over one year. The investment variable necessary to compute productivity comes from VAT returns on capital expenditure that firms are obliged to file annually.[28]

Table 1 exhibits the number of firms, exporters and new exporters by year. It is noteworthy that we classify as new exporters those firms that did not export for at least two consecutive years before entering export markets.[29] This avoids identifying as new exporters firms that switch on and off foreign markets in consecutive years.[30] From Table 1, it is possible to see that between 24 and 27 p.c. of the total number of firms export each year. These figures are larger than those reported by Bernard and Jensen (1995) and Eaton, Kortum and Kramarz (2004). The former find that, in the US, excluding small plants, 14.6 p.c. of manufacturers export. The latter, using a cross-section dataset for all French firms in 1986 find that 17.4 p.c. of firms export. The larger share of exporters in Belgium is most likely due to the small size of the domestic market. This may push firms

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[25] These entities can well be firms that are part of a larger group filing consolidated accounts. Even with consolidated accounts, it would be extremely difficult to disentangle the data related to those firms trading internationally, but not filing accounts, from the information concerning other firms in the group.

[26] Another widely used method is the extension of Olley and Pakes (1996) put forward by Levinsohn and Petrin (2003). Ackerberg, Caves and Frazer (2006) have recently criticised the latter on the grounds that it can not identify the parameters of the production function because of collinearity problems. They conclude that Olley and Pakes (1996) is a better alternative.

[27] Producer price indices to deflate value added were derived by the two-digit gross value added figures in constant and current prices available from Belgostat.

[28] This avoids the problems involved in inferring investment from the difference in capital stock between two consecutive periods.

[29] This forces us to conduct our analysis from 1998 onwards.

[30] Roberts and Tybout (1997) argue that the investment necessary to start exporting may depreciate relatively quickly. After two years of not exporting, it is likely that firms will have to pay the sunk costs of exports again to resume exporting.

to start exporting in order to reap the benefits from increasing returns to scale. The dataset contains between 330 and 480 new exporting firms every year. Export market entry is therefore relatively rare. Sunk costs are likely to be the cause of this since only the most productive firms will find it profitable to meet them and start to sell abroad.

In this study, we are interested in investigating the potentially different learning-by-exporting effects across various export destinations. To divide countries according to their technology level and the degree of market sophistication, this paper uses the World Bank classification based on their 2006 gross national income (GNI) per capita. This classification covers all World Bank member countries (185), plus all economies with populations of more than 30,000 (209 total).[31] Therefore, it virtually includes all export destinations. Countries are divided into four groups: low income (with GNI per capita of $875 or less), lower-middle income, ($876–3,465), upper-middle income ($3,466–10,725), and high income ($10,726 or more). Although GNI per capita is not a perfect gauge of the development status of economies, it is likely to be highly correlated with their productivity, technology, and competition levels. This measure does not allow one to identify the exact channel, i.e. technology or competition, through which productivity improvements due to exports may take place. Both are likely to be important, but this paper does not focus on disentangling them because of the data problems this would involve.[32]

Table 2 shows the percentage of exporters selling to countries in different income groups. Not surprisingly, the percentage of exporters shipping goods to a particular set of destinations increases monotonically with their income level. More developed and rich countries have larger markets and therefore are likely to offer more export opportunities.

[31] This classification is publicly available at the website of the World Bank and therefore is not detailed further here.

[32] Indices more closely associated with actual technology levels, such as R&D spending from the OECD, are available only for developed or relatively developed countries. Therefore, using this measure would considerably restrict the variation in the export destination data. With regard to the competition level, it is difficult to measure it in a consistent way across different countries because of the disparate measures governments take to restrict competition. The Economic Freedom Index of the Fraser Institute (Gwartney, Lawson, Sobel and Leeson 2007) is a probably the most reliable measure for comparing the competition level across different economies. This index can gauge the degree of competition in the domestic market since it encompasses different anti-competitive measures. These are: size of government, legal structure and security of property rights, access to sound money, freedom to trade internationally, regulation of credit, labour and business. This index is available on a consistent basis for 127 countries covering nearly all export destinations of Belgian firms. The World Bank classification of economic development based on countries' GNI per capita used in this paper is in fact highly correlated with the Fraser Institute's Index of Economic Freedom. The Pearson correlation is 0.69. I have obtained this correlation numbering countries with different income per capita from one to four (low-income countries are one, high-income countries are four) and taking the median of the Fraser Institute index from 1995 to 2005 (the index varies from one, for the least free countries, to ten, for the most free).

Table 3 shows the percentage of new exporters (reported in column three of Table 1) starting to export to just one group of countries. Again, there seems to be a positive relationship between the number of firms beginning to export to each destination group and its development level. Between 50 and 60 p.c. of new exporters start shipping goods to high-income countries only. Upper-middle-income countries are the recipients of the exports of 10 to 20 p.c. of new-exporting firms from Belgium. About 10 p.c. of them begin trading internationally with either lower-middle- or low-income countries.[33]

The variation in the figures given in Table 2 and Table 3 is likely to reflect factors other than the technology and development level of destinations. The empirical literature in international trade based on the gravity equation has shown that sharing a border, proximity, having a common language, colonial ties and a common currency are important determinants of bilateral trade relationships. Several countries in the high-income group have one or more of these characteristics. Some of them are relatively close to Belgium (all Western Europe) or share the same currency (the euro from 1999 onwards) or have the same official language (France and the Netherlands) or border on Belgium (Germany, France, the Netherlands and Luxemburg). This study focuses only on how the technological and development level of export destinations affect the productivity trajectory of new exporters with respect to that of non-exporters. The issue as to why some firms start exporting to a group of countries whereas others to another is left to future research.

Table 4 and Table 5 report the difference in firm-level characteristics, in levels and growth rates, between non-exporters and exporters to different destinations.[34] Productivity and other company-level variables in different industrial sectors are not easily comparable. To make like-to-like comparisons and take year shocks into account, these tables show the percentage differences between exporters and non-exporters obtained running OLS regression of firms' characteristics and their growth rates on an export dummy, year and two-digit NACE industry dummies. Since these are semi-logarithmic equations, the

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[33] For each year, the sum of these percentages is around 90 p.c. The remaining 10 p.c. of new export firms start exporting to more than one income group.

[34] For these tables, we use all firms, also those exporting to multiple destination groups.

correct percentage estimates in Table 4 and Table 5 and their standard errors have been obtained using the statistics in (A-3) and (A-4).[35]

From Table 4, there appears to be a positive relationship between firms' performance and per capita income of export destinations: companies exporting to high-income countries have the best performance characteristics and those exporting to low-income countries the lowest. It is interesting to note that there is a large difference in firms' characteristics between exporters to high-income countries and all the other firms. The gap across all performance measures (with the exception of labour productivity) between exporters to high-income countries and those exporting to the upper-middle group is in a fact larger than that between the latter and exporters to lower-middle or low-income countries. This may be a result of the fact that sophisticated and technologically advanced markets, such as those in high-income countries, are characterised by higher sunk costs of exports and thus a stricter self-selection process, as the evidence of Damijan, Polanec and Prasnikar (2004) suggests. They could also offer more learning opportunities, thus enabling firms to improve their performance after export market entry.

Table 5 shows the percentage differences of yearly growth rates. There does not seem to be any clear relationship between firms' growth rates and the level of development of destination countries. TFP growth does not appear to follow any precise pattern with respect to the income per capita of destination countries; it is larger for firms exporting to low-income countries and lower for those exporting to high-income markets and insignificant for exporters to middle-income countries.

As we have seen in Table 2, export market entry is a relatively rare phenomenon. Thus, the comparisons shown above are likely to be heavily affected by established exporters

[35] I have also produced the same type of results without considering export destinations. Overall, they confirm the familiar picture emerging from the wide range of literature on the exporting behaviour of firms: exporting firms have superior firm-level characteristics to non-exporters. Belgian firms shipping goods overseas have about 511 p.c. more employees than non-exporting ones. They also pay higher wages, the difference being around 29 p.c., and have considerably larger value added, investment and capital stock. In addition, they enjoy also higher productivity levels. Exporters have a labour productivity level 19 p.c. higher than that of exporters. In terms of TFP, the difference is even larger, being around 58 p.c. The same differences in terms of growth rates are lower and in some case they are even negative. Exporting companies have significantly lower productivity growth rates than non-exporting ones. However, the differences are small, being in the order of -0.05 p.c. for labour productivity and -0.2 p.c. for TFP. These results are not reported for the sake of brevity, but are available upon request from the author.

rather firms switching export status. The former are likely to be mature firms, present in international markets for a number of years and therefore have more limited growth opportunities. To understand the relationship between export market entry and productivity, it is therefore necessary to focus on those firms entering export markets and study their productivity trajectories before and after foreign market entry.

## 5. Causal effects of exports on productivity

This section first reports the results using the un-matched sample and after those obtained using matching methodology. Table 6 shows the results for labour productivity and total factor productivity, without considering different export destinations, obtained estimating regression (1). As can be seen, the pre- and post-export market entry productivity differences are positive and significant considering both productivity measures. At time *t-1*, would-be exporters have a productivity advantage of around 15 and 10 p.c. in terms of labour productivity and TFP respectively. This is consistent with the existence of sunk costs of exports: only the most productive firms can meet them and therefore start exporting.

More interestingly, the productivity advantage of new export firms appears to grow after export market entry. This is suggestive of learning-by-exporting effects. After three years of exports, the productivity gap rises to about 35 and 23 p.c. The tests for the differences in the pre-and post-entry productivity gaps, in percentage terms (i.e. $H_0$: $\hat{p}_{t+s} - \hat{p}_{t-1} = 0$ for $s = 01,2,3$) are positive and significant, but for year $s = 0$. Thus, the productivity benefits generated by exports appear to accrue from $t+1$ onwards. This is suggestive of actual productivity effects rather than any increase in capacity utilisation.

Arguably, these estimates could mask considerable variation across different export destinations. Table 7 reports the results obtained distinguishing export market entry to different groups of countries based on the World Bank classification of income per capita.[36] The results point to the fact that there are dissimilarities among firms exporting to different export markets. Only companies starting to export to upper-middle or high-

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[36] These results were obtained from estimates (5) with a different set of export dummies for each destination group.

income countries have significantly higher productivity levels the year before they export. In terms of total factor productivity, the efficiency gaps are in the order of 10 and 13 percent for upper-middle and high-income countries. These are larger considering labour productivity.[37]

This finding indicates that the severity of the self-selection process differs according to the development level of destination markets. It appears to be stronger for more mature and sophisticated markets. In these places, sunk costs of exports could be higher than in less developed countries because of tougher competition, which might require more in-depth market research, higher product quality, stricter product regulations and so on.

Moreover, the post-entry productivity behaviour differs according to destination markets. Only firms exporting to high-income destinations appear to enjoy productivity gains over non-exporters, which are sustained over time. This is in accordance with the evidence provided by De Loecker (2007) and Damijan, Polanec and Prasnikar (2004) for a sample of Slovenian firms. After three years of exporting, the TFP gap between firms exporting to high-income countries and companies focusing on the domestic market only increases from 13 to 24 p.c. Again, productivity gains seem to accrue from *t+1* onwards only. Although companies starting to export to upper-middle countries exhibit higher productivity levels at time *t-1*, there does not seem to be any further productivity gain in the post-entry period. Similar results are obtained when considering labour productivity. In this case, the productivity gains after the start of exports to high-income countries appear to be even larger than those in terms of TFP.[38]

The results presented thus far are suggestive of the existence of productivity increases generated by exports to high-income countries. To investigate more formally the causal relationship between them, we turn to matching methodology. This provides a reliable and robust method for estimating the effects of exports, if matched observations have similar characteristics. As emphasised by Rosenbaum and Rubin (1983) and Dehejia and Wahba

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[37] It is worth noting that the statistical insignificance of the pre-export market entry productivity advantage of firms exporting to less developed countries could in principle be due to the lower number of firms starting to export there. However, the point estimates are considerably lower than those obtained for upper-middle and high-income countries whereas their standard errors are in the same order of magnitude.

[38] This could be related to the fact that exports to such destinations require capital deepening.

(2002), amongst others, it is important to verify whether or not the matching method achieves the balancing of covariates.

Table 8 presents the balancing test of covariates considering the two different matching methodologies used in this paper. In the unmatched sample, there are large and statistically significant differences in the firm-level variables between treated and non-treated companies. These are drastically reduced in the matched samples. However, the Mahalanobis metric matching is more successful in this than the propensity score matching. Using the former, all differences among firms' characteristics are statistically insignificant, whereas this is not the case using the latter.[39] The rest of the analysis is therefore based on the Mahalanobis metric matching methodology only.[40]

Table 9 exhibits the causal results of the effects of starting to export on productivity, running regression (3) on the matched sample only. The parameter estimates are reported in percentage terms using (A-5) and standard errors using (A-6). Overall, there does not seem to be any causal effect of exports on productivity. The differences in productivity between newly-exporting companies and non-exporters from year $t$ to $t+3$ are lower than those estimates using the unmatched sample. Besides, these differences are statistically insignificant considering both productivity measures.

These results could nevertheless hide substantial variations across different export destinations. Table 10 reports the causal effects for the four country groups. The estimates again suggest that there is no causal effect of exports and productivity irrespective of the development level of destination countries. So, the positive relationship between exports and post-export market entry productivity levels detected using the unmatched sample appears to be totally driven by self-selection.

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[39] The result that Mahalanobis metric matching on the covariates *and* the propensity score performs better than matching on the propensity score only in balancing the covariates is consistent with the findings of Rosenbaum and Rubin (1985).

[40] It is worth stressing that the following results presented in the following tables are unlikely to be affected by imports. Using the same dataset, Muûls and Pisu (2007), have shown that most of the productivity advantage of exporters is actually explained by imports. Thus, there is the possibility that exporting firms have been matched with companies that do not export but import, thereby making our comparison group less reliable. However, tabulations, not reported for lack of space, reveal that only a minority of matched firms used in the following regressions are actually importers. The percentage figures range from five to around ten p.c. These results are available upon request from the author upon request.

As a robustness check, Table 11 and Table 12 report the difference-in-difference results. As highlighted in the previous sections, simple matching could result in biased estimates because of unobserved heterogeneity and selection on unobservable factors. Overall, also the results in Table 11 and Table 12 indicate that exports do not cause any faster productivity growth. Moreover, the similarities between the estimates obtained through simple matching (Table 9 and Table 10) and those obtained in combination with difference in difference (Table 11 and Table 12) suggest that selection on unobservables is a not a major source of bias.[41]

The findings of this study contrast with those obtained by De Loecker (2007) using a similar methodology and by Damijan, Polanec and Prasnikar (2004), for a sample of Slovenian firms in the 1990s. They have detected a positive causal effect of exports on productivity. The effect is stronger for firms exporting to high-income countries. The different results for Belgium and Slovenia can probably be explained by the drastically different development paths experienced by these two countries in the same period. In the 1990s, Slovenia was undergoing a deep transition process. This was characterised by an opening up of its economy, and liberalisation reforms after decades of relative economic isolation and low productivity growth. In this particular environment, exporting can generate substantial productivity improvements because it offers a relatively easy and fast access to a stock of knowledge (i.e. better technologies, management and production practices) not available at home. Exports from already highly open and developed countries such as Belgium may not offer such direct learning opportunities when compared to other sources of knowledge. Both exporting and non-exporting firms may in fact have access to advanced technologies, management and production practices through many different channels, such as imports, foreign direct investment, participation in trade and technology fairs, which are independent on export-market participation.

[41] This is consistent with the analysis of Heckman, Ichimura and Todd (1997). In their extensive empirical analysis on the different biases affecting matching estimates, they note that selection of unobservables is the least important.

## 6. Conclusion

This paper investigates the effects of exports on productivity across different destinations using a comprehensive set of data on Belgian manufacturing firms from 1998 to 2005. Countries are divided into four categories according to their GNI per capita level as reported by the World Bank.

Initial empirical findings indicate that there is a positive relationship between productivity and the development level of destination countries. The pre-export market entry productivity difference between would-be exporters and non-exporters increases with the level of development of export destinations. This suggests that sunk costs of exports may be country-specific and larger in advanced and sophisticated markets. Moreover, there is evidence suggesting learning-by-exporting effects: firms beginning to ship goods abroad experience significant productivity gains vis-à-vis companies that focus on the domestic market only. These productivity gains are more pronounced for firms that begin to export to richer countries.

However, applying matching methodology, to compare like-to-like firms and formally evaluate the causal impacts of exports to different destinations on productivity, suggests that exports do not cause faster productivity growth. These findings lead to the conclusion that, in Belgium, unlike in Slovenia and China as reported by Damijan, Polanec and Prasnikar (2004), De Loecker (2007) and Park, Yang, Shi and Jiang (2007), there is no evidence of learning-by-exporting effects, irrespective of the characteristics of destination markets. Then, these results indicate that such effects may also depend on the specific development path of origin countries, besides the characteristics of destination countries.

# Appendix

When estimating semilogarithmic equations where the dependent variables are expressed in levels, such as $lnY = \alpha + \sum_j \beta_j D_j + \eta$, the marginal effect, in percentage terms, of the dummy variable $D_j$ is usually estimated as $\hat{p}_j = 100(\exp\{\hat{\beta}_j\} - 1)$, where $\hat{\beta}_j$ is the estimate of $\beta_j$.[42] Kennedy (1981) noted that this expression will yield biased estimates of the percentage changes because of its non-linearity.[43] To overcome this problem, Van Garderen and Shah (2002) have derived the exact minimum variance unbiased estimator, that is (the subscript $i$ is excluded for simplicity ):

$$\hat{p} = 100\left\{\exp(\hat{\beta})\,{}_0F_1\left(m : -\frac{1}{2}m\hat{V}(\hat{\beta})\right) - 1\right\} \qquad \text{(A-1)}$$

where $\hat{\beta}$ and $\hat{V}(\hat{\beta})$ are the OLS estimates of $\beta$ and of $V(\hat{\beta})$; $m = (n\text{-}k)/2$, with $n$ being the number of observations and $k$ the number of dummy and continuous regressors plus the intercept; ${}_0F_1$ is the hypergeometric function explained in Appendix 1 of Van Garderen and Shah (2002). They derive the exact minimum variance unbiased estimator of the variance of , that is

$$\hat{V}(\hat{p}) = 100^2 \exp(2\hat{\beta}_j)\left\{\left[{}_0F_1\left(m : -\frac{1}{2}m\hat{V}(\hat{\beta})\right)\right]^2 - {}_0F_1\left(m : -2m\hat{V}(\hat{\beta})\right)\right\} \qquad \text{(A-2)}$$

These estimators are computationally intensive. Van Garderen and Shah (2002) shows that (A-1) and (A-2) can be approximated by

$$\tilde{p} = 100\left[\exp\left(\hat{\beta} - 1/2 * \hat{V}(\hat{\beta})\right) - 1\right] \qquad \text{(A-3)}$$

$$\tilde{V}(\hat{p}) = 100^2 \exp(2\hat{\beta})\left[\exp\left(-\hat{V}(\hat{\beta})\right) - \exp\left(-2 * \hat{V}(\hat{\beta})\right)\right] \qquad \text{(A-4)}$$

These approximations will tend to the exact estimators as the sample size goes to infinity. In their empirical exercise with around *30* observations and ten parameters, Van Garderen and Shah (2002) show that these approximations are virtually identical to the exact estimators.[44]

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[42] This was suggested by Halvorsen and Palmquist (1980).

[43] This is true irrespective of whether $\hat{\beta}_j$ is biased or not because for any $x$ random variable we have that that $E[f(x)]$ is not equal to $f[E(x)]$.

[44] $\tilde{p}$ was originally proposed by Kennedy (1981).

In this exercise, we are interested in estimating and making statistical inference on the difference in the percentage effects of two dummy variables, $D_i$ and $D_j$, on $y$: $z = p_i - p_j$. The exact minimum variance unbiased estimator of $z$ is obviously $\hat{z} = \hat{p}_i - \hat{p}_j$. In the paper for computational simplicity, we use the approximation (A-3) instead of the exact estimator (A-1). To conduct statistical inference, one needs an estimator of V( $\hat{z}$ ). Note that $V(\hat{z}) = V(\hat{p}_i) + V(\hat{p}_j) - 2C(\hat{p}_i, \hat{p}_j)$. The first two terms of the right hand side of $V(\hat{z})$ can be conveniently estimated with (A-4). The only thing we need then is an estimate of $C(\hat{p}_i, \hat{p}_j)$. Since $C(\hat{p}_i, \hat{p}_j) = E(\hat{p}_i \hat{p}_j) - E(\hat{p}_i)E(\hat{p}_j)$ and using (A-1), it is possible to write

$$C(\hat{p}_i, \hat{p}_j) = 100^2 \left\{ \begin{array}{l} E\left[ \begin{array}{l} \exp(\hat{\beta}_i + \hat{\beta}_j)\, {}_0F_1\left(m : -\frac{1}{2} m\hat{V}(\hat{\beta}_i)\right) {}_0F_1\left(m : -\frac{1}{2} m\hat{V}(\hat{\beta}_j)\right) \\ -\exp(\hat{\beta}_i)\, {}_0F_1\left(m : -\frac{1}{2} m\hat{V}(\hat{\beta}_i)\right) - \exp(\hat{\beta}_j)\, {}_0F_1\left(m : -\frac{1}{2} m\hat{V}(\hat{\beta}_j)\right) + 1 \end{array} \right] \\ -\left(\exp(\beta_i) - 1\right)\left(\exp(\beta_j) - 1\right) \end{array} \right\} \quad \text{(A-5)}$$

where we have exploited the fact that $\hat{p}$ is an unbiased estimator of the true percentage change, i.e. E( $\hat{p}$ )= 100 [exp( $\beta$ )-1] = $p$. Now, since $\hat{\beta}_i$ is independent of $\hat{V}(\hat{\beta}_i))$ and $\hat{V}(\hat{\beta}_i)$ is independent of $\hat{V}(\hat{\beta}_j)$ the factors inside the expectation operator in (A-5) are independent from each other. So, since $E(\exp(\hat{\beta}_i)) = \exp(\beta + 1/2V(\hat{\beta}_i))$, this is because $\hat{\beta}_i \sim N(\beta, V(\hat{\beta}_i))$, and $E\left[{}_0F_1(m : -1/2m\hat{V}(\hat{\beta}_i))\right] = \exp(-1/2V(\hat{\beta}_i))$, see Appendix 1 in van Garderen and Shah (2002)), we can write

$$C(\hat{p}_i, \hat{p}_j) = 100^2 \left\{ \begin{array}{l} \exp\left(\beta_i + \beta_j + \frac{1}{2} V(\hat{\beta}_i + \hat{\beta}_j)\right) \exp\left(-\frac{1}{2} V(\hat{\beta}_i)\right) \exp\left(-\frac{1}{2} \hat{V}(\hat{\beta}_j)\right) \\ -\exp\left(\beta_i + \frac{1}{2} V(\hat{\beta}_i)\right) \exp\left(-\frac{1}{2} V(\hat{\beta}_i)\right) - \exp\left(\hat{\beta}_j + \frac{1}{2} V(\hat{\beta}_j)\right) \exp\left(-\frac{1}{2} V(\hat{\beta}_j)\right) + 1 \\ -\left(\exp(\beta_i) - 1\right)\left(\exp(\beta_j) - 1\right) \end{array} \right\}$$

After some algebraic manipulations, it is possible to obtain

$$C(\hat{p}_i, \hat{p}_j) = 100^2 \left\{ \exp\left(\beta_i + \beta_j\right) \left( \exp\left(C(\hat{\beta}_i, \hat{\beta}_j)\right) - 1 \right) \right\} \quad \text{(A-6)}$$

It is worth noting that, rather intuitively, if $C(\hat{\beta}_i, \hat{\beta}_j) = 0$, then $C(\hat{p}_i, \hat{p}_j) = 0$, and if $C(\hat{\beta}_i, \hat{\beta}_j)$ is positive (negative), then $C(\hat{p}_i, \hat{p}_j)$ is positive (negative). An estimator of $C(\hat{p}_i, \hat{p}_j)$ can be obtained as

$$\tilde{C}(\hat{p}_i, \hat{p}_j) = 100^2 \left\{ \exp\left(\hat{\beta}_i + \hat{\beta}_j\right) \left[ \exp\left(\hat{C}(\hat{\beta}_i, \hat{\beta}_j)\right) - 1 \right] \right\}$$

where $\hat{C}(\hat{\beta}_i, \hat{\beta}_j)$ is the OLS covariance estimator. An approximate estimator of $V(\hat{z}) = V(\hat{p}_i - \hat{p}_j)$ is

$$\tilde{V}(\hat{z}) = \tilde{V}(\hat{p}_i) + \tilde{V}(\hat{p}_j) - 2\tilde{C}(\hat{p}_i, \hat{p}_j) \qquad \text{(A-7)}$$

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**Table 1: Number of firms and exporters**

| Year | Firms | Exporters | New-exporters |
|---|---|---|---|
| 1998 | 18,574 | 5180 | 331 |
| 1999 | 19,229 | 5267 | 330 |
| 2000 | 19,540 | 5246 | 479 |
| 2001 | 19,420 | 5272 | 482 |
| 2002 | 19,296 | 5183 | 457 |
| 2003 | 19,487 | 5171 | 434 |
| 2004 | 19,887 | 5098 | 360 |
| 2005 | 20,066 | 4906 | 374 |
| Total | 173181 | 47169 | 3247 |

**Table 2: Percentage of exporters selling to countries of different income levels**

| Year | Low | Lower-middle | Upper middle | High |
|---|---|---|---|---|
| 1997 | 20.20% | 29.37% | 39.41% | 93.47% |
| 1998 | 22.49% | 33.57% | 44.92% | 88.88% |
| 1999 | 21.36% | 33.13% | 43.78% | 89.67% |
| 2000 | 21.65% | 33.63% | 45.10% | 88.96% |
| 2001 | 22.02% | 33.90% | 46.34% | 88.98% |
| 2002 | 21.44% | 34.15% | 46.83% | 89.23% |
| 2003 | 21.56% | 34.42% | 49.29% | 89.52% |
| 2004 | 22.71% | 35.97% | 49.08% | 90.41% |
| 2005 | 23.11% | 36.93% | 47.94% | 91.83% |

Notes: Destinations are classified as low, lower-middle, upper-middle and high-income countries using the World Bank ranking based on GNI per capita.

**Table 3: Percentage of export entrants starting to sell to just one group of country**

| Year | Low | Lower-middle | Upper-middle | High |
|---|---|---|---|---|
| 1998 | 13.29% | 8.76% | 18.73% | 49.55% |
| 1999 | 8.79% | 11.52% | 20.00% | 51.82% |
| 2000 | 11.69% | 8.56% | 14.82% | 56.78% |
| 2001 | 11.00% | 9.34% | 18.88% | 50.83% |
| 2002 | 9.63% | 10.50% | 18.16% | 52.52% |
| 2003 | 8.29% | 10.14% | 16.82% | 54.38% |
| 2004 | 13.06% | 14.72% | 11.11% | 52.50% |
| 2005 | 14.44% | 10.96% | 8.56% | 58.02% |

Notes: Destinations are classified as low, lower-middle, upper-middle and high-income countries using the World Bank ranking based on GNI per capita.

**Table 4: Export dummy regressions: levels**

| | Employment | Wage | Value added | Investment | Capital stock | Labour productivity | TFP |
|---|---|---|---|---|---|---|---|
| Export to | | | | | | | |
| Low | 80.995 | 9.222 | 110.713 | 78.951 | 89.316 | 6.171 | 16.905 |
| | (6.251)** | (0.770)** | (7.919)** | (7.904)** | (8.276)** | (1.275)** | (1.528)** |
| Lower-middle | 72.603 | 7.267 | 92.920 | 81.894 | 74.788 | 6.710 | 17.011 |
| | (4.723)** | (0.645)** | (5.788)** | (6.454)** | (6.203)** | (1.148)** | (1.251)** |
| Upper-middle | 83.818 | 7.955 | 118.067 | 102.201 | 103.375 | 9.639 | 20.313 |
| | (4.617)** | (0.593)** | (6.029)** | (6.444)** | (6.670)** | (1.082)** | (1.172)** |
| High | 296.719 | 21.204 | 635.569 | 362.173 | 454.602 | 11.851 | 38.338 |
| | (8.402)** | (0.576)** | (17.485)** | (12.151)** | (15.462)** | (0.934)** | (1.136)** |
| Industry dummies | yes | yes | yes | yes | yes | yes | yes |
| Year dummies | yes | yes | yes | yes | yes | yes | yes |
| Observations | 126567 | 126562 | 161883 | 142463 | 164106 | 124576 | 122234 |
| R-squared | 0.37 | 0.19 | 0.388 | 0.252 | 0.276 | 0.085 | 0.54 |

Notes: Clustered standard errors in parentheses; * significant at 5%; ** significant at 1%; estimates are in percentage terms; they and the respective standard errors have been computed using formulas (A-3) and (A-4). Industry dummies are at two-digit level. Destinations are classified as low, lower-middle, upper-middle and high-income countries using the World Bank ranking based on GNI per capita.

**Table 5: Export dummy regression: yearly growth rates**

| | Employment | Wage | Value added | Capital stock | Labour productivity | TFP |
|---|---|---|---|---|---|---|
| Export to... | | | | | | |
| Low | -1.038 | 0.130 | 0.012 | 0.409 | 1.011 | 1.149 |
| | (0.398)** | (0.324) | (0.587) | (0.627) | (0.482)* | (0.485)** |
| Lower-middle | -0.896 | -0.035 | -1.040 | 0.160 | 0.133 | -0.142 |
| | (0.421)* | (0.332) | (0.557)* | (0.638) | (0.487) | (0.468) |
| Upper-middle | 0.961 | -0.214 | 1.575 | 0.472 | 0.009 | 0.284 |
| | (0.380)** | (0.304) | (0.503)** | (0.572) | (0.432) | (0.406) |
| High | 0.033 | -1.706 | -1.409 | 1.168 | -0.486 | -0.614 |
| | (0.278) | (0.218)** | (0.366)** | (0.407)** | (0.304) | (0.283)* |
| Industry dummies | yes | yes | yes | yes | yes | yes |
| Year dummies | yes | yes | yes | yes | yes | yes |
| Observations | 122903 | 122900 | 157983 | 162966 | 102421 | 100330 |
| R-squared | 0.006 | 0.024 | 0.01 | 0.002 | 0.019 | 0.023 |

Notes: Clustered standard errors in parentheses; * significant at 5%; ** significant at 1%; estimates are in percentage terms. Industry dummies are at two-digit level.

**Table 6: Ex-ante and ex-post export market entry productivity differentials**

| | | | | | |
|---|---|---|---|---|---|
| | Labour productivity | | | | |
| | $p_{t-1}$ | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| Export | 15.213 | 17.279 | 29.62 | 34.823 | 35.004 |
| | (1.811)** | (1.784)** | (3.105)** | (4.219)** | (5.439)** |
| *t-test* | | $p_t - p_{t-1}$ | $p_{t+1} - p_{t-1}$ | $p_{t+2} - p_{t-1}$ | $p_{t+3} - p_{t-1}$ |
| | | 2.066 | 14.407 | 19.61 | 19.791 |
| | | (1.597) | (3.042)** | (4.173)** | (5.366)** |
| Observ. | | | 56799 | | |
| Firms | | | 11600 | | |
| *of which* | | | | | |
| Export starters | | | 1824 | | |
| | TFP | | | | |
| | $p_{t-1}$ | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| Export | 10.317 | 12.295 | 21.158 | 25.158 | 23.027 |
| | (1.635)** | (1.59)** | (2.782)** | (3.67)** | (4.743)** |
| *t-test* | | $p_t - p_{t-1}$ | $p_{t+1} - p_{t-1}$ | $p_{t+2} - p_{t-1}$ | $p_{t+3} - p_{t-1}$ |
| | | 1.978 | 10.841 | 14.841 | 12.71 |
| | | (1.471) | (2.744)** | (3.67)** | (4.698)** |
| Observ. | | | 55629 | | |
| Firms | | | 11466 | | |
| *of which* | | | | | |
| Export starters | | | 1803 | | |

Notes: Clustered standard errors in parentheses; * significant at 5%; ** significant at 1%; estimates are in percentage terms; they and the respective standard errors have been computed using formulas (A-3) and (A-4); *t-test* tests the null $H_0$: $p_{t+s}-p_{t-1} = 0$ (with $s = 0,1,2,3$); their standard errors are computed using (A-7) in the Appendix. Industry dummies are at two-digit level.

**Table 7a: Ex-ante and ex-post export market entry productivity differentials (different export destinations)**

| | Labour productivity | | | | |
|---|---|---|---|---|---|
| Low | $p_{t-1}$ | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | 4.949 | 11.961** | 27.952 | 31.807 | 18.288 |
| | (4.311) | (4.135) | (15.963) | (16.238) | (35.39) |
| *t-test* | | $p_t$ - $p_{t-1}$ | $p_{t+1}$ - $p_{t-1}$ | $p_{t+2}$ - $p_{t-1}$ | $p_{t+3}$ - $p_{t-1}$ |
| | | 7.012 | 23.002 | 26.858 | 13.339 |
| | | (4.43) | (16.103) | (16.572) | (35.516) |
| Lower-middle | $p_{t-1}$ | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | 0.287 | 6.132 | 16.973 | 12.025 | 17.717 |
| | (5.513) | (5.218) | (9.137) | (17.505) | (26.955) |
| *t-test* | | $p_t$ - $p_{t-1}$ | $p_{t+1}$ - $p_{t-1}$ | $p_{t+2}$ - $p_{t-1}$ | $p_{t+3}$ - $p_{t-1}$ |
| | | 5.845 | 16.687 | 11.739 | 17.43 |
| | | (5.695) | (10.145) | (17.989) | (27.283) |
| Upper-middle | $p_{t-1}$ | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | 12.99 | 17.186 | 23.23 | 7.592 | 24.416 |
| | (4.018)** | (4.065)** | (9.114)* | (14.581) | (16.945) |
| *t-test* | | $p_t$ - $p_{t-1}$ | $p_{t+1}$ - $p_{t-1}$ | $p_{t+2}$ - $p_{t-1}$ | $p_{t+3}$ - $p_{t-1}$ |
| | | 4.196 | 10.24 | -5.398 | 11.426 |
| | | (3.712) | (8.959) | (14.93) | (17.225) |
| High | $p_{t-1}$ | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | 18.833 | 22.571 | 33.843 | 39.351 | 38.032 |
| | (2.502)** | (2.445)** | (3.392)** | (4.888)** | (5.747)** |
| *t-test* | | $p_t$ - $p_{t-1}$ | $p_{t+1}$ - $p_{t-1}$ | $p_{t+2}$ - $p_{t-1}$ | $p_{t+3}$ - $p_{t-1}$ |
| | | 3.738 | 15.01 | 20.518 | 19.199 |
| | | (2.181) | (3.544)** | (4.834)** | (5.742)** |
| Observ. | | | 56220 | | |
| Firms | | | 11588 | | |
| *of which export starters to* | | | | | |
| Low | | | 179 | | |
| Lower-middle | | | 183 | | |
| Upper-middle | | | 264 | | |
| High | | | 1021 | | |

Notes: Clustered standard errors in parentheses; * significant at 5%; ** significant at 1%; estimates are in percentage terms; they and the respective standard errors have been computed using formulas (A-3) and (A-4), respectively; *F-test* tests the null $H_0$: $p_{t+s}-p_{t-1} = 0$ (with $s = 0,1,2,3$); their standard errors are computed using (A-7) in the Appendix. Industry dummies are at two-digit level. Destinations are classified as low, lower-middle, upper-middle and high-income countries using the World Bank ranking based on GNI per capita.

**Table 7b: Ex-ante and ex-post export market entry productivity differentials (different export destinations)**

| | TFP | | | | |
|---|---|---|---|---|---|
| Low | $p_{t-1}$ | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | 2.925 | 9.902 | 23.083 | 17.449 | 18.782 |
| | (3.852) | (3.579)** | (14.55) | (12.728) | (30.768) |
| *t-test* | | $p_t - p_{t-1}$ | $p_{t+1} - p_{t-1}$ | $p_{t+2} - p_{t-1}$ | $p_{t+3} - p_{t-1}$ |
| | | 6.977 | 20.157 | 14.524 | 15.857 |
| | | (3.954) | (14.7) | (13.071) | (30.891) |
| Lower-middle | $p_{t-1}$ | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | -2.534 | 2.834 | 10.591 | 4.059 | 8.221 |
| | (5.244) | (4.533) | (7.939) | (13.95) | (22.143) |
| *t-test* | | $p_t - p_{t-1}$ | $p_{t+1} - p_{t-1}$ | $p_{t+2} - p_{t-1}$ | $p_{t+3} - p_{t-1}$ |
| | | 5.367 | 13.125 | 6.592 | 10.754 |
| | | (5.442) | (9.154) | (14.61) | (22.636) |
| Upper-middle | $p_{t-1}$ | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | 9.887 | 14.177 | 13.868 | -0.022 | 15.825 |
| | (3.502)** | (3.573)** | (8.052) | (12.982) | (15.312) |
| *t-test* | | $p_t - p_{t-1}$ | $p_{t+1} - p_{t-1}$ | $p_{t+2} - p_{t-1}$ | $p_{t+3} - p_{t-1}$ |
| | | 4.291 | 3.982 | -9.909 | 5.938 |
| | | (3.509) | (7.964) | (13.269) | (15.531) |
| High | $p_{t-1}$ | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | 12.86 | 15.962 | 24.479 | 27.691 | 24.13 |
| | (2.252)** | (2.169)** | (2.981)** | (4.099)** | (5.075)** |
| *t-test* | | $p_t - p_{t-1}$ | $p_{t+1} - p_{t-1}$ | $p_{t+2} - p_{t-1}$ | $p_{t+3} - p_{t-1}$ |
| | | 3.102 | 11.619 | 14.831 | 11.27 |
| | | (1.963) | (3.175)** | (4.113)** | (5.091)* |
| Observ. | | | 55061 | | |
| Firms | | | 11453 | | |
| *of which export starters to* | | | | | |
| Low | | | 178 | | |
| Lower-middle | | | 182 | | |
| Upper-middle | | | 261 | | |
| High | | | 1007 | | |

Notes: Clustered standard errors in parentheses; * significant at 5%; ** significant at 1%; estimates are in percentage terms; they and the respective standard errors have been computed using formulas (A-3) and (A-4), respectively; *F-test* tests the null $H_0$: $p_{t+s}-p_{t-1} = 0$ (with $s = 0,1,2,3$); their standard errors are computed using (A-7) in the Appendix. Industry dummies are at two-digit level. Destinations are classified as low, lower-middle, upper-middle and high-income countries using the World Bank ranking based on GNI per capita.

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## Table 8: Balancing test of covariates

| Variable | Unmatched | Matched | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Propensity score | | | | | Mahalanobis | | | | |
| | | All destinations | Low | Lower-middle | Upper-mid | High | All destinations | Low | Lower-mid | Upper-mid | High |
| Employment | 0.679 | 0.261 | -0.101 | -0.515 | -0.539 | 0.620 | -0.057 | 0.016 | 0.038 | -0.321 | 0.006 |
| | (0.029)** | (0.097)** | (0.262) | (0.322) | (0.252)* | (0.118)** | (0.089) | (0.216) | (0.342) | (0.226) | (0.111) |
| Wage | 0.109 | 0.005 | -0.008 | -0.008 | -0.220 | 0.065 | -0.031 | -0.043 | -0.023 | -0.088 | -0.011 |
| | (0.010)** | (0.027) | (0.066) | (0.097) | (0.065)** | (0.035) | (0.023) | (0.055) | (0.093) | (0.059) | (0.029) |
| Capital / Emp | 0.143 | 0.059 | 0.145 | -0.229 | -0.127 | 0.124 | 0.025 | -0.022 | -0.142 | 0.014 | 0.063 |
| | (0.037)** | (0.102) | (0.258) | (0.403) | (0.268) | (0.124) | (0.100) | (0.283) | (0.427) | (0.275) | (0.121) |
| TFP | 0.137 | 0.074 | -0.084 | -0.308 | -0.134 | 0.201 | -0.038 | -0.040 | -0.146 | -0.143 | 0.008 |
| | (0.017)** | (0.054) | (0.116) | (0.261) | (0.124) | (0.066)** | (0.051) | (0.127) | (0.168) | (0.134) | (0.063) |
| Growth TFP | 0.008 | 0.022 | -0.108 | 0.018 | -0.048 | 0.062 | -0.029 | -0.046 | -0.088 | -0.017 | -0.022 |
| | (0.011) | (0.025) | (0.072) | (0.083) | (0.073) | (0.029)* | (0.024) | (0.094) | (0.118) | (0.083) | (0.023) |
| VAD / Emp. | 0.048 | 0.014 | -0.166 | -0.218 | -0.122 | 0.114 | -0.020 | -0.077 | -0.068 | -0.055 | 0.010 |
| | (0.016)** | (0.046) | (0.099) | (0.252) | (0.119) | (0.053)* | (0.039) | (0.117) | (0.141) | (0.126) | (0.043) |
| Growth VAD/Emp. | -0.000 | 0.013 | -0.127 | 0.069 | -0.065 | 0.050 | -0.029 | -0.052 | -0.069 | -0.013 | -0.024 |
| | (0.012) | (0.027) | (0.081) | (0.101) | (0.076) | (0.031) | (0.025) | (0.100) | (0.122) | (0.084) | (0.025) |
| *Number of firms* | | | | | | | | | | | |
| Non-exporters | 115767 | 366 | 51 | 31 | 59 | 233 | 306 | 34 | 20 | 45 | 207 |
| Exporters | 2370 | 398 | 42 | 35 | 65 | 256 | 386 | 40 | 34 | 63 | 249 |

Notes: Standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%; the matching is performed for each industry (two-digit NACE) and year separately. The propensity score is estimated, for each year and two-digit NACE industry, running the multinomial logit for exports to different groups of countries for each year and industry; the right hand side variables are the same as those in the first column of this table plus their squared terms. The propensity score matching is by nearest neighbour with common support and no replacement (imposing a caliper 0.01). The Mahalanobis matching is performed with common support and replacement and is based on the variables in this table and the estimated propensity score.

## Table 9: Estimates on matched sample

| | Labour productivity | | | |
|---|---|---|---|---|
| | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| Exports | -3.931 | -5.966 | -6.767 | 8.963 |
| | (3.976) | (4.714) | (5.214) | (6.165) |
| Firms | 583 | 438 | 360 | 279 |
| *of which* | | | | |
| Export starters | 378 | 278 | 224 | 172 |
| | TFP | | | |
| | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| Exports | 1.733 | -1.176 | -1.173 | 8.293 |
| | (3.698) | (4.505) | (5.091) | (5.612) |
| Firms | 582 | 436 | 358 | 278 |
| *of which* | | | | |
| Export starters | 378 | 277 | 224 | 172 |

Notes: Robust standard errors in parentheses; * significant at 5%; ** significant at 1%; estimates are in percentage terms; they and the respective standard errors have been computed using formulas (A-3) and (A-4), respectively. Year and two-digit industry dummies are included in all specifications.

**Table 10a: Estimates on matched sample (different export destinations)**

| | Labour productivity | | | |
|---|---|---|---|---|
| | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | Low income countries | | | |
| | 2.283 | -18.036 | -26.746 | -14.033 |
| | (10.829) | (11.143) | (13.233) | (18.791) |
| Firms | 60 | 45 | 36 | 33 |
| *of which* | | | | |
| Export starters | 40 | 30 | 25 | 23 |
| | Lower-middle income countries | | | |
| | -2.192 | 11.892 | 12.222 | 67.697 |
| | (22.182) | (25.231) | (26.113) | (36.041) |
| Firms | 52 | 31 | 24 | 16 |
| *of which* | | | | |
| Export starters | 33 | 20 | 18 | 10 |
| | Upper-middle income countries | | | |
| | -13.289 | -13.322 | -15.507 | 29.226 |
| | (10.822 | (12.199) | (16.286) | (24.565) |
| Firms | 91 | 81 | 75 | 56 |
| *of which* | | | | |
| Export starters | 60 | 52 | 46 | 34 |
| | High-income countries | | | |
| | -2.052 | -4.633 | -0.637 | 5.99 |
| | (4.726) | (5.725) | (6.332) | (6.67) |
| Firms | 383 | 283 | 226 | 175 |
| *of which* | | | | |
| export starters | 245 | 176 | 135 | 105 |

Notes: Robust standard errors in parentheses; * significant at 5%; ** significant at 1%; estimates are in percentage terms; they and the respective standard errors have been computed using formulas (A-3) and (A-4), respectively. Year and two-digit industry dummies are included in all specifications. Destinations are classified as low, lower-middle, upper-middle and high-income countries using the World Bank ranking based on GNI per capita.

**Table 10b: Estimates on matched sample (different export destinations)**

| | TFP | | | |
|---|---|---|---|---|
| | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | Low income countries | | | |
| | 8.949 | -16.051 | -23.749 | -16.849 |
| | (14.287) | (12.54) | (13.212) | (16.654) |
| Firms | 60 | 45 | 36 | 33 |
| *of which* | | | | |
| export starters | 40 | 30 | 25 | 23 |
| | Lower-middle income coutries | | | |
| | -11.456 | -15.134 | -7.905 | 38.886 |
| | (15.505) | (19.912) | (18.634) | (28.241) |
| Firms | 51 | 30 | 24 | 16 |
| *of which* | | | | |
| export starters | 33 | 20 | 18 | 10 |
| | Upper-middle countries | | | |
| | -9.835 | -11.182 | -16.588 | 15.297 |
| | (8.259) | (9.619) | (14.908) | (17.255) |
| Firms | 91 | 81 | 74 | 55 |
| *of which* | | | | |
| export starters | 60 | 52 | 46 | 34 |
| | High income countries | | | |
| | 4.846 | 3.1 | 8.964 | 11.126 |
| | (4.871) | (6.263) | (6.656) | (7.134) |
| Firms | 383 | 282 | 225 | 175 |
| *of which* | | | | |
| export starters | 245 | 175 | 135 | 105 |

Notes: Robust standard errors in parenthesis; * significant at 5%; ** significant at 1%; estimates are in percentage terms; they and the respective standard errors have been computed using formulas (A-3) and (A-4), respectively. Year and two-digit industry dummies are included in all specifications. Destinations are classified as low, lower-middle, upper-middle and high-income countries using the World Bank ranking based on GNI per capita.

**Table 11: Estimates on matched sample: difference in difference results**

| | Labour productivity | | | |
|---|---|---|---|---|
| | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | -3.784 | -6.169 | -7.724 | 6.511 |
| | (2.514) | (3.289) | (4.334) | (5.029) |
| Firms | 583 | 438 | 360 | 279 |
| *of which* | | | | |
| export starters | 378 | 278 | 224 | 172 |
| | TFP | | | |
| | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | -2.975 | -6.133 | -5.83 | 3.483 |
| | (2.292) | (2.976) | (4.108) | (4.487) |
| Firms | 582 | 436 | 358 | 278 |
| *of which* | | | | |
| export starters | 378 | 277 | 224 | 172 |

Notes: Robust standard errors in parenthesis; * significant at 5%; ** significant at 1%; estimates are in percentage terms; they and the respective standard errors have been computed using formulas (A-3) and (A-4), respectively. Year and two-digit industry dummies are included in all specifications.

**Table 12a: Estimates on matched sample: difference in difference specifications (different export destinations)**

| | Labour productivity | | | |
|---|---|---|---|---|
| | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | Low income countries | | | |
| | 13.051 | -6.17 | -9.164 | 8.277 |
| | (10.29) | (10.529) | (17.599) | (23.467) |
| Firms | 60 | 45 | 36 | 33 |
| *of which* | | | | |
| export starters | 40 | 30 | 25 | 23 |
| | Lower-middle countries | | | |
| | -17.89 | -29.162 | -22.041 | 35.994 |
| | (15.592) | (20.272) | (13.589) | (25.879) |
| Firms | 52 | 31 | 24 | 16 |
| *of which* | | | | |
| export starters | 33 | 20 | 18 | 10 |
| | Upper middle countries | | | |
| | -6.929 | -6.835 | -17.138 | 20.797 |
| | (5.432) | (6.91) | (13.676) | (12.724) |
| Firms | 91 | 81 | 75 | 56 |
| *of which* | | | | |
| export starters | 60 | 52 | 46 | 34 |
| | High income countries | | | |
| | -5.181 | -7.666 | -6.694 | 0.276 |
| | (2.984) | (4.095) | (4.866) | (5.464) |
| Firms | 383 | 283 | 226 | 175 |
| *of which* | | | | |
| export starters | 245 | 176 | 135 | 105 |

Notes: Robust standard errors in parenthesis; * significant at 5%; ** significant at 1%; estimates are in percentage terms; they and the respective standard errors have been computed using formulas (A-3) and (A-4), respectively. Year and two-digit industry dummies are included in all specifications. Destinations are classified as low, lower-middle, upper-middle and high-income countries using the World Bank ranking based on GNI per capita.

**Table 12b: Estimates on matched sample: difference in difference specifications (different export destinations)**

| | TFP | | | |
|---|---|---|---|---|
| | $p_t$ | $p_{t+1}$ | $p_{t+2}$ | $p_{t+3}$ |
| | Low income countries | | | |
| | 11.909 | -8.756 | -9.824 | -2.786 |
| | (10.277) | (10.566) | (16.022) | (21.143) |
| Firms | 60 | 45 | 36 | 33 |
| *of which* | | | | |
| export starters | 40 | 30 | 25 | 23 |
| | Lower-middle countries | | | |
| | -21.689 | -34.079 | -20.34 | 29.204 |
| | (11.689) | (16.536)* | (12.758) | (26.363) |
| Firms | 51 | 30 | 24 | 16 |
| *of which* | | | | |
| export starters | 33 | 20 | 18 | 10 |
| | Upper-middle countries | | | |
| | -4.674 | -5.216 | -14.931 | 13.576 |
| | (5.333) | (6.501) | (13.612) | (9.223) |
| Firms | 91 | 81 | 74 | 55 |
| *of which* | | | | |
| export starters | 60 | 52 | 46 | 34 |
| | High income countries | | | |
| | -3.791 | -6.454 | -3.396 | 0.449 |
| | (2.816) | (3.813) | (4.717) | (5.246) |
| Firms | 383 | 282 | 225 | 175 |
| *of which* | | | | |
| export starters | 245 | 175 | 135 | 105 |

Notes: Robust standard errors in parenthesis; * significant at 5%; ** significant at 1%; estimates are in percentage terms; they and the respective standard errors have been computed using formulas (A-3) and (A-4), respectively. Year and two-digit industry dummies are included in all specifications. Destinations are classified as low, lower-middle, upper-middle and high-income countries using the World Bank ranking based on GNI per capita.

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