

Learning by Exporting or Self-selection into exporting?

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1. Introduction

Export-market participation is a good predictor of productivity growth. Trade openness is one of the key factors explaining cross-country variations in long-run economic growth (see, for instance, [Sachs and Warner, 1995](#); [Hall and Jones, 1999](#)). An illustration of this fact is the experience of export-led development strategies in countries such as Japan, Korea, Singapore, and Taiwan. At the firm level, this aggregate connection between export and productivity growth is characterized as the exporter premium: exporting firms tend to perform better than their domestically-oriented counterparts ([Bernard and Jensen, 1995; 1999](#)).¹

Although there is widespread consensus on the productivity-enhancing role of export participation, the direction of causation between exports and productivity is a topic of continued debate. Two main alternative hypotheses have been identified to explain why exporters are expected to perform better than non-exporters. The first one is the self-selection hypothesis, suggesting that more productive firms self-select into export markets because they are able to bear additional sunk costs of exporting for the first time.² ([Roberts & Tybout, 1997](#); [Clerides *et al.* 1998](#); [Bernard & Wagner, 2001](#)). The implication of the self-selection argument is that the direction of causality runs from productivity to export participation.

The second argument is that firms learn from exporting, which suggests that export participation is a driver of productivity. This idea explains why trade policy has traditionally been used to promote exports and boost firm performance. Trade liberalization, by bringing domestic firms into contact with international best practices, is expected to provide firms with the opportunity to benefit from the technical expertise of foreign buyers. The learning process may operate through technical assistance from overseas buyers ([Grossman and Helpman 1991, p. 166](#); [World Bank 1993; 1997 Pack & Saggi, 2001](#)) or/and through the exposition to international competition ([Evenson and Westphal, 1995](#)).

Whereas most studies on advanced economies find evidence that the export premium is due to a self-selection process ([Bernard and Jensen, 1999](#); and [Clerides, Lach and Tybout, 1998](#); [Aw *et al.* 2000](#); [Delgado *et al.*, 2002](#); [Girma & *al.*, 2004](#); [Greenaway *et al.*, 2005](#)), more recent studies focusing on less developed economies tend to confirm the learning effect ([Kraay, 1999](#); [Castellani, 2002](#); [Balwin & Gu, 2003](#); [Bigsten *et al.*, 2004](#); [Blalock and Gertler, 2004](#); [Fernandes & Isgut, 2005](#); [De Loecker, 2007](#); [Mallick and Yang, 2013](#)).

Notwithstanding its valuable insights, the first strand of the literature, finding that exporting does not necessarily improve productivity, is challenging on three important grounds. The first one is related to the cross-country differences in economic and technological development. Indeed, in less developed countries, future exporters are likely to be less efficient than their trading partners from developed countries. It is therefore reasonable to imagine that firms in developing countries breaking into export markets are likely to learn from export participation. Thus, in contrast to studies using data from advanced countries, most papers on developing economies find strong evidence of learning from exporting. The

¹ See [Wagner \(2007a\)](#) for a recent survey of the firm-level evidence on this issue.

² Sunk start-up costs include any extra costs of locating foreign demand and competition, establishing distribution networks, adjusting product characteristics to meet foreign tastes, regulations and standards.

second one is the role of firm export experience, that is, the number of years in exporting.³ It also seems reasonable to suppose that not all exporters have the same history of involvement in export markets: recent entrants are much more likely to learn from exporting than established exporters.

Similarly, while some firms only export occasionally, some others are actively and constantly involved in international markets. The third one is that simply comparing exporters and non-exporters does not tell us the extent to which exporting improves productivity. Some firms export only very low levels of their export to output ratio, whereas some others export almost all of their output. This suggests that not only export-market participation is important, but also the extent of exporting should be accounted for. Another underlying missing link is the so-called “threshold of internationalization”. On the one hand, highly internationally-engaged firms realize substantial economies of scale in exporting and access new and sophisticated technologies. On the other hand, an increasing international expansion may adversely affect firm productivity, due to an increased vulnerability to external shocks. It is therefore reasonable to think of the export-productivity link as displaying an optimal level of firm’s international involvement.

The purpose of this paper is to revisit the relationship between export participation and productivity, accounting for these drawbacks of the existing empirical literature. Specifically, we make three important contributions to the literature. First, we directly test the self-selection hypothesis against that of the learning-by-exporting hypothesis using a propensity-score matching difference-in-difference approach to get rid of any potential bias generated by confounding factors. Second, we make the first attempt to formally reconcile the two alternative hypotheses by highlighting the fundamental role of the level of development of destination countries. The underlying idea is that exporting to Organization for Economic Co-Operation and Development (OECD) countries, for example, does not necessarily involve substantial sunk costs of entry into export markets because of the technical assistance provided by such importers. In contrast, exporting to Non-OECD developing countries is more likely to be associated with substantial sunk costs. This suggests that firms exporting to advanced countries are more likely to learn from exporting, whereas those exporting to developing countries are more likely to self-select into exporting.

Third, we use data from a developing country, namely Egypt. Questioning the exports-productivity link in the Egyptian context is of considerable research interest in many respects. Egypt has experienced a high level of trade restrictions in the recent past, suggesting that both the sunk costs of starting exporting and the learning effects are much more likely to coexist than in more developed economies. The implementation of the trade liberalization beginning in 1991 was followed by a rapid growth in the number of exporting firms.⁴

Our results suggest that both labor productivity and total factor productivity are significantly higher for exporters than for non-exporters. On average, labor productivity and total factor productivity are, respectively, 46% and 63% higher for exporting firms than for their

³ This argument is in line with work on learning-by-doing such as [Arrow \(1962\)](#).

⁴ The “El-Infitah” or “Opening”.

domestically-oriented counterparts. When we differentiate between pre-entry and post-entry differences in productivity, it turns out that this export premium is mainly driven by a learning-by-exporting process rather than just a self-selection of more productive firms into exporting. This evidence of the learning argument reflects the importance of the level of development of destination countries. In contrast to firms that export to OECD countries, exporters to Non-OECD countries self-select into export markets, signaling the importance of the technical assistance from advanced countries.

The rest of the paper is organized as follows. In Section 2, we present a brief review of the theoretical and empirical literature. Section 3 describes the trade liberalization in Egypt, while Section 4 explains our empirical strategy. The main results are discussed in Section 5 and concluding remarks are presented in Section 6.

2. Exports and Productivity: Theoretical and Empirical Literature

2.1. Theoretical arguments

Exporting firms are expected to be larger and more productive than non-exporting firms, mainly due to the self-selection of more productive firms into export markets and the role of learning-by-exporting (Bernard & Jensen, 1999; Wagner, 2007a). On the one hand, the more productive firms self-select into exporting because of the sunk costs of starting exporting and financial constraints. Thus, only firms that can successfully overcome these additional costs, or that are financially liquid, become exporters. These additional costs therefore represent barriers to entering foreign markets. The self-selection mechanism can operate randomly or consciously. The idea of random self-selection is that exposure to trade randomly leads to a selection of the most productive firms into exporting, forcing the least productive to exit (Melitz, 2003). Self-selection happens consciously when there is an underlying rationality effect. Future exporters plan and prepare themselves to enter the export market so that they increase their productivity before facing international competition (Yeaple, 2005). So, exporting increases the expected revenue and the productivity threshold of survival in international markets.

On the other hand, exporting improves firm productivity because exporters learn from international buyers and competitors. Foreign consumers and competitors transfer their knowledge and technology to domestic exporters, suggesting a transition from traditional technologies to modern technologies (Rodrik, 1988; Grossman & Helpman, 1991; Clerides *et al.*, 1998).⁵ This learning effect is more likely in poor countries, as demand from advanced countries requires a certain degree of standardization. Because production techniques in developing countries are not sophisticated enough to meet the quality standards of export markets, importers in developed countries provide technology to exporters located in developing countries (Pack and Saggi, 2001).

⁵ Exporters may also be more efficient by reducing X-inefficiency, while using the same technology (Nishimizu & Robinson, 1984).

Exporting firms may also learn from the exposure to intense competition in international markets. The exposure to international competition forces exporting firms to adopt the most sophisticated technologies. Otherwise, they cannot survive in more competitive international markets. In contrast to domestically-oriented firms, which often produce with increasing returns to scale, foreign-oriented firms need to fully exploit economies of scale to survive.⁶

2.2. A brief survey of evidence

Since the seminal paper by [Bernard & Jensen \(1995\)](#), an extensive empirical literature on the relationship between exports and productivity has grown.⁷ The familiar picture is that exporters are more productive than non-exporters. The evidence suggests that the exporter premia are mainly due to a self-selection of firms into exporting, while exporters do not necessarily learn from exporting. [Bernard & Jensen \(1995\)](#) use a panel dataset of U.S. manufacturing firms over the period 1976-1987 and find that exporters have a third greater labor productivity than non-exporters, suggesting an export premium of about 15%. [Aw & Hwang \(1995\)](#), in the case of Taiwan, find that labor productivity is 36% higher for exporting firms, as compared with their counterparts selling on the domestic market only. Furthermore, even though [Clerides et al. \(1998\)](#) construct a model of export participation with learning effects, they find that the association between exports and productivity is much more in favor of the self-selection hypothesis. Using data from the Indonesian manufacturing industry, [Sjoholm \(1999\)](#) finds that exporters experience higher levels and growth rates of labor productivity than non-exporters and that this export premium is increasing with the export to output ratio. Even after controlling for unobserved firm-level heterogeneity, [Bernard & Wagner \(1997, 2001\)](#) find that future export entry is strongly and positively associated with higher productivity, mainly due to sunk costs of starting exporting. The same picture is found in other studies, with pre-entry export premia varying across industries and with the level of economic development (see, for instance, [Isgut, 2001](#); [Wagner, 2002](#); [Castellani, 2002](#); [Aw et al., \(2000\)](#); [Delgado et al., 2002](#); [Hansson and Lundin, 2004](#); [Aw & Huang, 1995](#); [Liu et al., 1999](#); [Girma et al., 2004](#); [Greenaway & Kneller, 2004](#); [Greenaway & Yu, 2004](#); [Bernard & Jensen, 2004](#)).

On the other there is mounting evidence for learning from exporting from studies focusing on lesser developed countries. [Blalock and Gertler \(2004\)](#) emphasized the shortcomings of previous attempts to test the leaning-by-exporting hypothesis in more developed economies. They point to the fact that the traditional lack of evidence for learning from exporting is due to cross-country differences in economic development. The learning effect is much more likely to be found in poorest countries, where future exporters have much more to learn from foreign buyers and competitors in terms of best practices and efficiency. Using data for the Indonesian manufacturing industry over the period 1990-1996, their results strongly support the learning hypothesis. Very similar results were obtained, among others, by [Kraay \(1999\)](#) in China, [Bigsten et al. \(2004\)](#) and [Van Biesebroeck \(2005\)](#) in African countries, [Fernandes &](#)

⁶ Domestically-oriented firms are often protected from international competition, especially in developing economies. Participation in international markets allows achieving economies of scale, mainly due to increased demand. This idea is consistent with [Van Biesebroeck \(2005\)](#) who finds that because of financial constraints and contract enforcement, domestically-oriented firms do not fully exploit scale economies.

⁷ [Wagner \(2007a\)](#) reviews 54 empirical studies covering 34 countries that address this issue.

Isgut (2005) in Colombia, De Loecker (2007) in Slovenia, and Mallick and Yang (2013) in India. A more recent study by Atkin et al. (2014) also finds supporting evidence of learning-by-exporting for rug producers in Egypt using a randomized control trial. So, exporting improves firm productivity in developing economies, although these learning effects may vary with samples and estimation methods.

3. Trade policy and manufacturing exports in Egypt

Since the initiation of the stabilization program in the early 1990s, Egypt has implemented a gradual but progressive trade liberalization. Most tariff measures have been reduced and the domestic sector has been reformed in a market-friendly manner.⁸ Egypt's average most-favored-nation (MFN) tariff fell to 20.0% in 2005 from 26.8% in 1998. The number of tariff bands has also been significantly reduced since the 1990s. The government does not grant any export subsidies but promotes exports through an Export Promotion Law adopted in 2002. Although exporters need to be registered in the Commercial Register with the General Organization for Export and Import Control, no export approval is required. Unlike imports, exports are not restricted to Egyptian nationals. Regarding export taxation, Egypt does not apply any export taxes, charges or levies. There are no export quotas, licences, or prohibitions. Exports are not subject to any quotas, licences, or prohibitions and are also exempt from the general sales tax introduced in 1991.

Various incentives are used to encourage export-oriented activities. These include the promotion of (i) the establishment of free zones, (ii) the access to finance, insurance, and guarantees for exporting firms,⁹ and (iii) the market assistance through a number of government agencies.¹⁰ The manufacturing sector is at the core of Egypt's export development strategy, although exports of petroleum and natural gas constitute a major source of foreign exchange earnings. Apart from agricultural products, the four priority areas are processed food products, textiles and garments, chemicals and pharmaceuticals, and building materials. These reforms, by introducing a greater degree of competition both domestically and externally, have helped spur exports beginning in the early 2000s. The increase in exports has made a switch from chronic current account deficits to growing surpluses since 2000s (WTO, 2005). Non-oil exports, particularly manufacturing exports, have increased, mainly driven by the tariff reductions for imported inputs and the New Intellectual Property Legislation entered into force in 2002.

The sample period of this study is from 2003 to 2008, and therefore, covers the episode of exports expansion in Egypt resulting from the trade liberalization. The dataset includes the main manufacturing industries of the Egyptian economy. The number of exporting firms, as a

⁸ However, as Eibl and Malik (2016) show, non-tariff measures remain important in sectors with substantial number of politically connected firms.

⁹ Since its establishment in 1983, the Export Development Bank of Egypt (EDBE), provides short- and medium-term loans to finance capital assets of exporting firms. It also provides bank guarantees required for financing exports. The Export Credit and Guarantee Company, established in 1992 by the EDBE, supports exporters by issuing export credit insurance guarantees covering up to 80% of any losses incurred.

¹⁰ These agencies mainly include the Commercial Representation Body, the General Organization for International Exhibitions and Fairs, the International Trade Point under UNCTAD's initiative, and the Egyptian Export Promotion Centre.

percentage of manufacturing firms, has increased significantly, moving from 20% in 2003 to 30% in 2008 (Table 1). Furthermore, the generalization of the exporting activity occurs mainly in the garments, textiles, food and metal industries (Table 2), confirming the overall structure of the Egypt's export sector described by the 2005 Trade Policy Review (WTO, 2005).

Table 1: Number of exporters and non-exporters, by year

Year	Number of exporters	Number of non-exporters	Total
2003	136	532	668
2004	185	572	757
2005	215	579	794
2006	259	663	922
2007	299	721	1020
2008	329	737	1066

4. Empirical Strategy

4.1. Measuring productivity performance

In the empirical literature on the export-productivity relationship, productivity measurement is still an important and controversial issue. Productivity can be defined as the ability of the firm to transform inputs into output. Productivity is generally measured using partial productivity measures (output per worker, for example) or using proxies for total factor productivity (TFP). TFP measures are often preferred because they allow accounting for the use of multifactor inputs in production. A basic non-parametric measure of TFP can be defined by the profitability ratio as follows:

$$\pi = \frac{p' y}{\omega' x} = \frac{\sum p_i y_i}{\sum \omega_k x_k} \quad (1)$$

where y denotes the output vector using the input x . p and ω represent the corresponding output and input price vectors, respectively. This ratio is however limited because output and input prices could vary across firms, requiring the use of more elaborated proxies for TFP. One alternative is the multilateral productivity index introduced by Caves *et al.* (1982). Such a productivity index allows for direct comparisons between any two firm-year observations and takes the following form:

$$\begin{aligned} TFP = & y_{iy} - \bar{y}_t + \sum_{t=2}^T (\bar{y}_t - \bar{y}_{t-1}) - \left[\sum_{k=1}^K \frac{1}{2} (c_{kit} + \bar{c}_{kt})(x_{kit} + \bar{x}_{kt}) + \right. \\ & \left. + \sum_{t=2}^T \sum_{k=1}^K \frac{1}{2} (\bar{c}_{kt} + \bar{c}_{k(t-1)})(\bar{x}_{kt} + \bar{x}_{k(t-1)}) \right] \end{aligned} \quad (2)$$

where y_{it} is the output of firm i in period t using the input vector x_{it} . c_{kit} is the cost share of the input vector x_{it} is the total cost.

Thus, TFP is computed using the deviations of inputs and output from the reference situation, that is, a situation in which output and inputs represent sample geometric means and input cost-based shares reflect the sample arithmetic mean. This proxy for TFP measure is commonly used in the export-productivity literature (see, for instance, [Aw et al., 2000](#); [Delgado et al., 2002](#); [Bellone et al., 2010](#)). However, one drawback of such a measure is that it does not take into account the endogenous nature of capital input. The reason is that firm choice on input quantities, notably those of capital input, depends on its productivity ([Olley & Pakes, 1996](#)).

We account for this shortcoming by using the productivity measure proposed by [Levinsohn & Petrin \(2003\)](#). The basic insight is to instrument capital input with intermediate inputs¹¹. This procedure is done by estimating the following log-linear production function:

$$\ln Y_t = \alpha + \beta_k \ln K_t + \beta_l \ln L_t + \beta_m \ln M_t + \varepsilon_t \quad (3)$$

where Y_t , K_t , L_t , and M_t are respectively firm's output, capital, labor and intermediate input in period t . Here, value added is used as the output indicator and raw material inputs are used as a proxy for a firm's intermediate inputs. L and M are assumed to be free variables, while K is a state variable. $\varepsilon_t = \varpi_t + \eta_t$ is an additively separable error term including two components: a transmitted productivity component (ϖ_t) and an *i.i.d.* component (η_t). This procedure allows correcting for the potential correlation between input levels and the unobserved firm-specific productivity shock to the production technology. In this setting, intermediate inputs are set as a function of a firm's state variables K . TFP is then consistently estimated using the OLS estimator of the following structural model:

$$\begin{cases} \ln Y_t = \beta_l \ln L_t + \phi_t(K_t, M_t) + \eta_t \\ \phi(K_t, M_t) = \alpha + \beta_k \ln K_t + \varpi_t(K_t, M_t) \end{cases} \quad (4)$$

As a robustness check, we also use the LP index, considered here as the value added per worker.

4.2. The data

We exploit data from an unbalanced panel of 1,655 manufacturing firms over the period 2003-2008, taken from the World Bank *Enterprise Surveys database*.¹² The surveys focus on domestic firms having at least 10 employees. Exporting firms are defined as establishments

¹¹ In a similar approach [Olley & Pakes \(1996\)](#) use investment to control for this simultaneity issue.

¹² This period was obtained by exploiting the information provided for the year preceding each survey year (2004, 2006, and 2008). The World Bank's Enterprise Survey database is available at: <http://www.enterprisesurveys.org/>.

that export directly, implying that firms exporting indirectly through a distributor are not considered as exporters.

Table 2: Distribution of exporter status across manufacturing industries

Industries	Exporters		Export starter		Export continuer		Export quitter		Non-exporters	
	N	%	N	%	N	%	N	%	N	%
Garments	138	19.22	25	3.48	70	9.75	25	3.48	580	80.78
Textiles	209	20.73	42	4.17	103	10.22	42	4.17	799	79.27
Machinery & equipment	70	32.41	11	5.09	40	18.52	11	5.09	146	67.59
Chemicals	208	28.57	24	3.30	113	15.52	24	3.30	520	71.43
Electronics	50	27.17	5	2.72	23	12.50	5	2.72	134	72.83
Metal industries	233	23.49	39	3.93	122	12.30	39	3.93	759	76.51
Nonmetal industries	61	22.93	13	4.89	35	13.16	13	4.89	205	77.07
Agro industries	161	25.08	18	2.80	82	12.77	18	2.80	481	74.92
Other industries	293	19.48	66	4.39	145	9.64	66	4.39	1211	80.52
Total	1423	22.74	243	3.88	733	11.71	340	5.43	4835	77.26

The export dummy takes the value of 1 if a given firm exports directly in the given year and 0 otherwise. The distribution of the exporter status across manufacturing industries is given in Table 2. As in most developing countries, there are fewer exporters (22.74%) than non-exporters (77.26%), although export participation varies significantly across industries. The Machinery & equipment and Chemicals sectors appear to be the leading export industries, whereas Garments and Textiles are the relatively small export industries.¹³ Our sample includes 3.88% of export starters, 11.71% of export continuers, and 5.43% of export quitters, with substantial heterogeneity between industries.

Table 3 provides firm characteristics for exporters, starters, and continuers, as compared to non-exporters. Both labor productivity and total factor productivity are noticeably higher for exporters than for non-exporters. Consistent with earlier studies, it is clear that exporters tend to be larger (in terms of number of employees) and more capital intensive than non-exporters (see, for instance, [Bernard and Jensen, 1995](#); [Bernard and Wagner, 1997](#); [Blalock and Gertler, 2004](#)). Exporting firms also pay higher wages per employee, reflecting their higher productivity level. On average, domestically-oriented firms experience more severe financial constraints than export-oriented firms. Non-exporters also tend to finance their working capital with internal funds or retained earnings, in line with their limited access to external financing sources. Finally, exporters are older than non-exporting firms, although the difference is only statistically significant at the 10 percent level.

¹³ This feature is consistent with the structure of the Egyptian export sector depicted in the 2005 Trade Policy Review ([WTO, 2005](#)).

Table 3: Comparison of exporters, starters, and continuers with non-exporters

Means	Exporters	Export starters	Export continuers	Non-exporters
Log of employment	5.399 (0.000)	5.274 (0.000)	5.441 (0.000)	3.509
Capital intensive	1475.938 (0.007)	1456.253 (0.040)	1312.116 (0.057)	366.507
Log of average wage	1.824 (0.000)	2.021 (0.000)	1.828 (0.000)	1.584
Log of LP	3.402 (0.000)	3.220 (0.002)	3.751 (0.000)	2.803
Log of TFP	6.582 (0.000)	6.619 (0.000)	6.576 (0.000)	5.060
Financial constraint	0.376 (0.001)	0.343 (0.047)	0.357 (0.007)	0.435
Internal liquidity	82.055 (0.000)	81.806 (0.018)	82.281 (0.000)	86.029
Log of firm age	2.894 (0.092)	2.854 (0.883)	2.926 (0.081)	2.846

Notes: Mean comparison t-test for H_0 : difference of means=0, with p-values in parentheses. Financial constraint is a dummy variable defined to take 1 if the access to external financing is a major problem for their operation and growth. Internal liquidity is the share of working capital financed by internal funds or retained earnings.

Even when we differentiate between export starters and continuers, it is apparent that they are also larger and more capital intensive, have higher labor productivity and total factor productivity than non-exporters. They are less financially constrained and rely less on internal funds to finance their working capital. However, because some of these firm characteristics are used as matching variables, we make sure that the means of firms' characteristics do not differ systematically between treated and control firms. These unconditional differences between exporters and non-exporters put into question a possible causal effect of export-market participation on productivity. The underlying issue is the determinants of these productivity differentials between exporters and non-exporters: self-selection, learning-by-exporting, or both?

4.3. Empirical specification

In this section, we first investigate whether exporters are more productive than non-exporters, and then check if the anticipated productivity differential is due to a self-selection process or/and to the role of leaning-by-exporting. In so doing, we use a propensity score matching approach that allows adjusting for potentially confounding firm characteristics. Here, the point is to match each exporter to a non-exporter whose observed characteristics are as similar as possible. In contrast to regression analysis, propensity score estimates are more robust to differences in the distribution of the confounding variables. In order to test the two alternative hypotheses discussed above, we define two groups of exporter: export-starters and export-continuers. Let's consider the export-market participation dummy as $Exporter_{it} = 1$ if firm i is an export directly in period t .¹⁴ In year t , export-starters ($Strater_t$) are defined as establishments that did not export in year $t - 1$ but export in year t .¹⁵ Export continuers (

¹⁴ The precision "directly" is important because in developing countries some exporters used to export through a distributor and therefore are much less concerned with the issue of sunk costs. As mentioned above, the sunk costs are at the core of the self-selection hypothesis. In the survey data we will be using, the question on the export status is expressed as follows: *What percent of your establishment's sales in 2007 were (i) sold domestically, (ii) exported directly, (iii) exporter indirectly through a distributor. The responses indicate that 18% of total exporters were indirect exporters.*

¹⁵ This definition of export-starters, export-continuers and export-quitters, constrained by the limited time period, is more restrictive than that of [Wagner \(2002\)](#), who uses 3-year windows.

Continuer_t) are firms that exported in years $t - 1$ and continue to export in year t . Similarly, export quitters (*Quitter_t*) are defined as establishments having exported in year $t - 1$ but not in year t . We follow the empirical literature on the export-productivity link and specify the following econometric model:¹⁶

$$PT_{it} = \alpha + \beta_1 \text{Exporter}_{it} + \beta_2 \text{Control}_{it} + \delta \text{Industry}_i + \mu_i + \lambda_t + \varepsilon_{it} \quad (5)$$

where PT_{it} is the productivity indicator (in level) for firm i in period t . In the baseline situation, where we just look at the export premium, Exporter_{it} represents a dummy taking 1 if the firm i exports in period t .

The idea behind the self-selection hypothesis is that future exporters prepare themselves to enter the export market so that they are expected to have a productivity boost over the period just before starting to export. As for the learning effect, the point is that exporting increases firm performance so that firms are expected to experience a jump in productivity over the period following the first year of exporting. To test these two hypotheses, we modify (5) as follows:

$$\Delta PT_{it} = \alpha + \beta_1 \text{Starter}_{it} + \beta_2 \text{Control}_{it} + \delta \text{Industry}_i + \mu_i + \lambda_t + \varepsilon_{it} \quad (6)$$

$$\Delta PT_{it} = \alpha + \beta_1 \text{Continuer}_{it} + \beta_2 \text{Control}_{it} + \delta \text{Industry}_i + \mu_i + \lambda_t + \varepsilon_{it} \quad (7)$$

Here, ΔPT_{it} is the indicator of productivity growth for firm i between $t - 1$ and t .

Consistent with the above definitions, (6) and (7) allow testing for the presence of self-selection and learning effects, respectively. To consistently identify the export premium as well as the pre-and post-entry premia, we make use of a propensity score matching method. To evaluate the productivity effect of export participation, we estimate the average treatment effect on the treated (ATT) in the following way:

$$ATT = E[PT_{i1} | \text{Exporter}_i = 1] - E[PT_{i0} | \text{Exporter}_i = 1] \quad (8)$$

where $PT_{i0} | \text{Exporter}_i = 1$ is the productivity level that firm i would have if it had been a non-exporter and $PT_{i1} | \text{Exporter}_i = 1$ its actual level. The selection and learning effects are given, respectively, by:

$$ATT_s = E[\Delta PT_{i1} | \text{Starter}_i = 1] - E[PT_{i0} | \text{Starter}_i = 1] \quad (9)$$

$$ATT_s = E[\Delta PT_{i1} | \text{Continuer}_i = 1] - E[PT_{i0} | \text{Continuer}_i = 1] \quad (10)$$

¹⁶ See [Wagner \(2002\)](#) who estimates the causal effects of exports on firm size and labor productivity in Germany using this matching approach.

However, one fundamental problem in this estimation is that $PT_{i0} | Exporter_i = 1$ is not observable. The export premium would be contaminated if the export decision is not random. If the decision to export is correlated with observable factors such as internal liquidity, employment and wages, the so-called “selection on observables” problem would arise. To account for this problem, we use the propensity score matching procedure. The treatment effects given in (8) can therefore be rewritten as follows:

$$ATT = E[PT_{i1} | Exporter_i = 1, p(X_i)] - E[PT_{i0} | Exporter_i = 1, p(X_i)] \quad (11)$$

where X is a set of observable covariates and $p(X)$ is the propensity score generated from a Logit estimate of the probability of exporting, conditional on X . X includes the log of employment, the log of average wage (as a proxy for human capital), the firm’s financial health and the log of firm age. We also control for the localization in an industrial zone, thus accounting for horizontal integration and therefore for any regional positive externalities. Indeed, the presence in an industrial zone can improve the likelihood of exporting because the concentration of exporters in such a zone generates positive externalities to other firms. The one-period lagged values of covariates are used to alleviate potential endogeneity on the estimation of the propensity score. The export premium, defined as the *ceteris paribus* productivity difference (in percentage points) between exporters and non-exporters is given by:

$$100[\exp(ATT) - 1].$$

In other words, the export premium is the productivity differential (in percentage points) that’s generated exclusively by export participation.

To test the self-selection hypothesis, we compare productivity between today’s exporters and non-exporters, one year before starting to export, controlling for firm characteristics included in X . Similarly, the learning hypothesis is tested by computing the productivity differential between today’s exporters and their counterparts which do no export during the year after entering the foreign market, controlling for X . More formally,

$$ATT_s = E[\Delta PT_{i1} | Starter_i = 1, p(X_i)] - E[PT_{i0} | Starter_i = 1, p(X_i)] \quad (9)$$

$$ATT_s = E[\Delta PT_{i1} | Continuer_i = 1, p(X_i)] - E[PT_{i0} | Continuer_i = 1, p(X_i)] \quad (10)$$

We use the nearest neighbor matching with replacement method, consisting in matching each treated firm with the control firm that experiences the closest propensity score. The algorithm of [Becker and Ichino \(2002\)](#) was used to make sure that the matching was successful. The difference in means of firms’ characteristics is not statistically different between treated and control firms. In addition, we make sure of the validity of the common support condition by

dropping treated units with a propensity score higher than the maximum or lower than the minimum propensity score of the control units.

5. Main results

5.1. Estimating the propensity scores

The results of Logit regressions to generate the propensity score are reported in Table 4, when simply using the export dummy as the treatment variable. The results using the export starter and export continuer dummies as treatment variables are presented in Tables A1 and A2 in the appendix. In Table 4, the values of the Pseudo-R-squares—ranging from 28.7% to 32.1%—suggest that the Logit regressions fit the data well (see [Domencich and McFadden \(1975\)](#) and [Louviere *et al.* \(2000\)](#) for detailed discussion on goodness-of-fit tests).¹⁷

In the baseline specification, we simply control for the log of employment, the log of average wage, the log of firm age, the share of working capital and new investments financed by internal funds or retained earnings, and a dummy variable indicating whether the firm has a department specialized in research and development. As shown in Table 3, firms that export tend to hire more, to pay more, and are older than non-exporters. They do not rely heavily on internal funds to finance working capital and new investments. In addition, exporters typically spend more than domestically-oriented firms to finance research and development activities.

¹⁷ The same picture is observed in Tables A1 and A2, when the export starter and export continuer dummy variables are used as the treatment variables (see the appendix).

Table 4: Logit estimates of the propensity scores, exporter dummy

Dependent variable	=1 if exporter					
	(1)	(2)	(3)	(4)	(5)	(6)
Log of employment	0.516*** (0.032)	0.527*** (0.033)	0.497*** (0.033)	1.228*** (0.167)	0.408*** (0.052)	0.643*** (0.044)
Log of average wage	0.070** (0.035)	0.071** (0.035)	0.054 (0.036)	0.052 (0.036)	0.106* (0.036)	0.105** (0.047)
Log of age	-0.183*** (0.066)	-0.181*** (0.067)	0.059 (0.074)	0.098 (0.074)	0.664* (0.368)	-0.039 (0.094)
R&D	0.696*** (0.110)	0.649*** (0.112)	0.604*** (0.113)	0.578*** (0.112)	0.602*** (0.113)	0.684*** (0.134)
Internal liquidity	0.004** (0.001)	0.003** (0.001)	0.004** (0.001)	0.003** (0.001)	0.003** (0.001)	0.005*** (0.002)
Localization in an industrial zone			1.001*** (0.108)	0.932*** (0.109)	0.977*** (0.108)	0.999*** (0.135)
Log of employment (squared)				-0.072*** (0.016)		
Log of age (squared)					-0.108* (0.064)	
Constant	-3.585*** (0.274)	-3.392*** (0.294)	-4.286*** (0.324)	-5.950*** (0.502)	-5.097*** (0.588)	-5.224*** (0.414)
Industry-Fixed Effects	NO	YES	YES	YES	YES	YES
Number of obs.	2831	2831	2828	2828	2828	2092
Pseudo R2	0.153	0.158	0.186	0.193	0.187	0.253

Notes: Standard errors are presented in parentheses. All of the explanatory variables are lagged one period.

The propensity score is estimated using a Logit model to limit the problem of disproportionate sampling.¹⁸ Most estimated coefficients show the expected signs. As anticipated, we find that firms with higher levels of employment and higher wages are likely to be exporters. It is worth noting, however, that the level of employment can affect the likelihood of exporting in opposite directions. On the one hand, since we are in a less developed setting, firms with a relatively high number of employees can exploit the comparative advantage in labor and export in countries with higher levels of unit labor cost. This leads to a positive association between the level of employment and the probability to export. On the other hand, firms with a high number of employees can perform poorly due to diminishing returns to labor in production, potentially leading to a negative association between the employment level and the likelihood of exporting.

The coefficient on firm age is negative and statistically significant, possibly reflecting the nonmonotonic association between firm age and the export decision. Indeed, as for the level of employment, the effect of firm age on the probability of exporting may be, *a priori*, ambiguous. In effect, although firm age can increase the likelihood of exporting at the lowest levels of age, it can also negatively affect it as the firm becomes older and do not innovate. This is particularly the case in developing economies. To control for this, we include the log of firm age along with its squared term in Specification 6 (column 6).

Furthermore, the internal financial health positively influences the probability to export, signaling the importance of a link between financial factors and firm export behavior (see for instance [Blalock & Roy, 2007](#); [Manova, 2008](#); [Bellone et al., 2010](#); [Minetti & Zhu, 2011](#)). Consistent with [Wagner \(2007\)](#), firms with a department specialized in research & development tend to sell abroad. While the baseline specification accounts for the main factors explaining the probability to export (Column 1), we nevertheless check the robustness of these results to a number of sensitivity tests. We first control for industry-level heterogeneity to allow for productivity differentials across industries in the matching (Column 2). We then account for the localization in an industrial zone (Column 3), the squared values of employment and firm age (Columns 4-5). Also, the results are not sensitive to dropping the most influential firms (Column 6). These firms are those for which the Cook's distance is greater than the conventional cut-off point $4/N$, with N the number of observations. The Cook's distance is derived from a regression of a log-linear Cobb-Douglas production function.

We further test the sensitivity of these results by using the two and three-nearest-neighbor matching estimators. This does not alter the statistical significance of the treatment effect and the magnitude of the export premium.¹⁹

¹⁸ Unlike of the Probit model, the estimation of the coefficients of the regressor variables using a Logit model is not affected by the unequal sampling rates for exporters and non-exporters ([Maddala, 1992](#)). This problem is frequent in large firm-level datasets, particularly when the number of observation in one groups is much larger than the number of in the other group. In our case, as it is mostly the case in developing economies, the number of exporters appears to be much smaller than the number of non-exporters.

¹⁹ Results are not presented but available upon request.

5.2. Are exporters more productive than non-exporters?

The results on productivity differentials between exporters and non-exporters are reported in Table 5. We present the ATT and the related export premium. In the baseline specification, the results strongly support the idea that exporting firms are more productive than their domestically-oriented counterparts. LP is almost 43% greater for exporters than their more insulated domestic counterparts. Similarly, TFP is about 61% higher for exporters than for domestically-oriented firms. These results are consistent with the picture of earlier studies on the export-productivity link. The exporter premium is robust to augmenting the baseline specification of the propensity score estimates with additional covariates. All these additional factors do not alter the statistical significance of the treatment effect.

Another result is that the export premium is far larger for TFP than for LP. This signals that export-market participation is proportionately more associated with capital productivity than with labor productivity. For the self-selection hypothesis, this suggests that future exporters need to increase relatively more the productivity of their capital than that of their labor. In contrast, if the export premium is driven by the learning hypothesis, this would suggest that exporting firms improve relatively more capital productivity than labor productivity after they enter foreign markets. In both hypotheses, this picture is quite consistent with the situation of developing countries where capital is less abundant than labor and where exporting requires relatively capital-intensive technology.

In line with the spirit of [Greenaway and Kneller \(2007\)](#), we control for industry differences in the export premium by including industry dummies. This decreases the export premium by 4.4 percentage points for LP. However, the export premium for total factor productivity increased by 5.6 percentage points. These results may be due to the fact that exporters are concentrated in different industries than non-exporters and reflects the difference of productivity differentials between industries, but this does not alter the statistical significance of the treatment effect. In contrast, taking into account firm localization in an industrial zone leads to an increase in export premia, signaling the fact that exporting firms locating in an industrial zone tend to be on average more productive.

Controlling for the localization in an industrial zone also makes the treatment effect less clear-cut, but leaves its significance unchanged. The export premium decreases labor productivity by 1.6 percentage points, suggesting that the export premium is lower for firms located in industrial zones than for others. This is quite intuitive because, as mentioned above, the localization in an industrial zone can be regarded as a factor generating positive externalities from exporters to non-exporters. This time, the premium for total factor productivity increased by only 0.51 percentage point.

Similarly, accounting for the squared terms of employment and firm age reduces the export premium, relative to the specification (4), but does not alter its significance. Interestingly, this reveals the nonmonotone nature of the relation between firm employment and age and the propensity to export. Employment has a positive and significant effect on the likelihood to

export, but at a decreasing rate. At lower levels, employment increases the probability to export but no longer beyond a certain threshold level of employment (Table 4, column 5).

Table 5: Export premium

	Average treatment effect on the treated		Export premium (%)		
	LP	TFP	LP	TFP	Number of observations
Baseline specification (1)					
Exporter dummy	0.360*** (0.123)	0.480*** (0.157)	43.422	61.715	Treated= 285 Untreated=752
(1) and controlling for the industry-level differences (2)					
Exporter dummy	0.329*** (0.164)	0.514*** (0.146)	39.022	67.335	Treated= 285 Untreated=752
(2) and controlling for the localization in an industrial zone (3)					
Exporter dummy	0.317** (0.134)	0.517*** (0.136)	37.376	67.854	Treated= 285 Untreated= 751
(2) and controlling for the squared term of employment (4)					
Exporter dummy	0.288** (0.138)	0.446*** (0.160)	33.447	56.248	Treated= 285 Untreated= 751
(2) and controlling for the squared term of firm age (5)					
Exporter dummy	0.313** (0.120)	0.462*** (0.143)	36.802	58.775	Treated= 285 Untreated= 751
(2) and controlling for potential outliers (6)					
Exporter dummy	0.248*** (0.138)	0.430*** (0.134)	28.204	53.739	Treated=585 Untreated=1497

Notes: Bootstrapped standard errors for the ATT, using 50 replications are reported in parenthesis. Standard errors are presented in parentheses. Industry-level differences are controlled for by adding dummy variables for the following industries: garments, textiles, machinery & equipment, chemicals, electronics, metal industries, nonmetal industries, agro industries, and other industries.

This result was also found by [Wagner \(2007\)](#) in a comparable study for 14 countries. The likelihood of exporting is also increasing with firm age up to a threshold level beyond which the sign of this association changes (Table 4, column 5). Finally, we control for the potential effect of outliers by running a regression of a log-linear Cobb-Douglas production function and dropping firms for which the Cook's distance is greater than the conventional cut-off point $4/N$, with N the number of observations. This also reduces the export premium, compared with that of the Specification (4). But, once again, the main result remains statistically significant at the 1 percent level. The result on the relative importance of the export premium for TFP compared to LP also continues to hold after applying these robustness checks. Summing up, the bottom line is that Egyptian exporting firms perform better than their domestically-oriented counterparts.

6 Do firms self-select into foreign markets or/and learn from exporting?

In this section, we want to explain the exporter productivity premium found in the previous subsection. In so doing, we differentiate between export-starters and export-continuers to test the self-selection hypothesis against the learning-by-exporting idea. The selection hypothesis is tested by comparing the productivity performance of export-starters and non-exporters in the period just before the export-starter enters the export market (pre-entry premium). For the hypothesis of learning from exporting, we compare the performance of export-continuers and

non-exporters one year after continuers start to export (post-entry premium). The results are presented in Table 6. For each specification, we report both the pre- and post-entry premia, using productivity (LP or TFP) growth as the outcome variable.

The results in the baseline specification clearly suggest that the self-selection idea, productivity increases prior to exporting, is not statistically significant. In contrast, the leaning effect is supported by the data. The treatment effect is much larger for the post-entry premium than for the pre-entry premium. The former is also statistically significant at any level of significance, while the latter is always insignificant. This implies that the export premium found in Table 5 is driven by the learning-by-exporting hypothesis.

The coefficients on the post-entry treatment effect indicate that LP grew 85.42% faster for exporter-continuers one year after entering the export market as compared with non-exporters. Similarly, exporting significantly and importantly increases TFP. TFP growth is almost 188.11% higher for export-continuers than for non-exporters. Once again, however, TFP growth is not statistically different between export-starters and non-exporters. After controlling for the industry-level heterogeneity, the same picture remains, though the post-entry premium decreases by 5.38 percentage points and 93 percentage points, respectively for LP and TFP (Specification 2).

Also, the post-entry treatment effect becomes weaker after controlling for the localization in an industrial zone, but its statistical significance remains unchanged (Specification 3). More interestingly, this learning effect continues to be significant and economically large, even after further controlling for the squared terms of employment and firm age and potential outliers (Specifications 4, 5, and 6). The post-entry premium becomes insignificant only when we include the square term of employment. Nevertheless, we do not regard this as a rejection of the learning hypothesis because in such a case, we control for the nonmonotone association between employment and the likelihood to export. The focus is therefore more on the significance of the coefficients on employment and its squared term in the equation of the probability to export.

On average, the learning effect in Egypt is much larger than that commonly found in other developing (but more advanced) countries. This definitely suggests that the more the economy is developed, the weaker will be the leaning effect. The extreme case is the situation of OECD countries for which there might be no evidence of learning from exporting. This strong evidence of the learning from exporting hypothesis may be the result of the technical assistance of Egyptian exporters by foreign buyers. It can also be the reflection of the more intensive competition in international markets.

In contrast, the pre-entry treatment effect remains statistically insignificant, even after augmenting the baseline specification with additional conditioning information. A possible explanation of this insignificant export premium is that future exporters tend to hire more and export the relatively abundant production factor, which is labor. In short, the big picture is that in Egypt, the export premium is clearly driven by a process of leaning from exporting rather than by a selection of more productive firms into export markets.

These results do not necessarily call into question the idea of the importance of sunk costs in developing countries. One plausible explanation is that future exporters overcome the sunk costs of entering into exporting by benefiting from technology and knowledge transfers from foreign buyers. The immediate implication is that the technical assistance of overseas buyers solves the problem of the sunk costs, which is at the origin of the self-selection hypothesis.

Table 6: Export premium: Pre-entry vs. Post entry

	Average treatment effect on the treated		Export premium (%)		Number of observations	
	LP	TFP	LP	TFP	LP	TFP
Baseline specification (1)						
Pre-entry	0.164 (0.245)	0.411 (0.266)	-	-	Treated=120 Untreated=622	
Post-entry	0.617*** (0.222)	1.058*** (0.263)	85.424	188.115	Treated=165 Untreated=622	
(1) and controlling for the industry-level differences (2)						
Pre-entry	0.061 (0.269)	0.221 (0.285)	-	-	Treated=120 Untreated=607	
Post-entry	0.588** (0.275)	0.668*** (0.243)	80.043	95.108	Treated=165 Untreated=622	
(2) and controlling for the localization in an industrial zone (3)						
Pre-entry	0.140 (0.252)	0.356 (0.313)	-	-	Treated=120 Untreated=607	
Post-entry	0.468* (0.266)	0.702** (0.305)	59.714	101.943	Treated=165 Untreated=622	
(3) and controlling for the square term of employment (4)						
Pre-entry	-0.049 (0.269)	0.301 (0.268)	-	-	Treated= 120 Untreated= 607	
Post-entry	0.397* (0.204)	0.816** (0.319)	48.846	126.292	Treated=165 Untreated=622	
(4) and controlling for the square term of firm age (5)						
Pre-entry	0.125 (0.261)	0.231 (0.213)	-	-	Treated= 120 Untreated= 607	
Post-entry	0.440* (0.231)	0.685*** (0.226)	55.413	98.431	Treated=165 Untreated=622	
(4) and controlling for potential outliers (6)						
Pre-entry	-0.126 (0.199)	0.199 (0.259)	-	-	Treated=117 Untreated=584	
Post-entry	0.468* (0.257)	0.529** (0.232)	59.696	69.760	Treated=157 Untreated=596	

Notes: Bootstrapped standard errors for the ATT, using 50 replications are reported in parenthesis. Standard errors are presented in parentheses. Industry-level differences is controlled for by adding dummy variables for the following industries: garments, textiles, machinery & equipment, chemicals, electronics, metal industries, nonmetal industries, agro industries, and other industries.

5.4. Does export destination matter for the selection process

In the previous subsection, we found strong evidence for learning-by-exporting and little evidence of self-selection into export markets. In this subsection, we explain why the pre-entry premium is not significant by differentiating the destinations between OECD countries and Non-OECD countries.

The underlying idea is that whereas exporters need to increase their productivity to be able to export to Non-OECD countries, they do not necessarily self-select. The reason is that they benefit from technical expertise of OECD importers. This technology transfer is likely to overcome the sunk costs of entry into export markets, thereby making unnecessary the self-selection. In contrast, in lesser developed countries future exporters do need to self-select into Non-OECD countries because they do not benefit from substantial technical assistance from these countries.

Table 7: Export destinations and the self-selection process

	Average treatment effect on the treated		Export premium (%)		Number of observations	
	LP	TFP	LP	TFP	LP	TFP
Baseline specification (1)						
Pre-entry in OECD countries	-0.317 (0.473)	0.283 (0.477)	-	-	Treated=37 Untreated=1000	
Pre-entry in Non-OECD countries	0.493*** (0.157)	0.349* (0.185)	63.847	41.859	Treated=83 Untreated=954	
(1) and controlling for the industry-level differences (2)						
Pre-entry in OECD countries	0.483 (0.446)	0.300 (0.470)	-	-	Treated=37 Untreated=944	
Pre-entry in Non-OECD countries	0.272 (0.210)	0.450** (0.203)	51.901	56.937	Treated=83 Untreated=856	
(1) and controlling for the localization in an industrial zone (3)						
Pre-entry in OECD countries	0.414 (0.467)	-7.48e-04 (0.416)	-	-	Treated=37 Untreated=943	
Pre-entry in Non-OECD countries	0.362** (0.158)	0.348* (0.184)	43.748	41.749	Treated=83 Untreated=856	
(1) and controlling for the square term of employment (4)						
Pre-entry in OECD countries	0.151 (0.525)	0.559 (0.405)	-	-	Treated=37 Untreated=943	
Pre-entry in Non-OECD countries	0.427** (0.179)	0.513*** (0.207)	53.304	67.188	Treated=83 Untreated=856	
(1) and controlling for the square term of firm age (5)						
Pre-entry in OECD countries	0.485 (0.437)	0.466 (0.371)	-	-	Treated=37 Untreated=943	
Pre-entry in Non-OECD countries	0.182 (0.174)	0.349* (0.191)	-	41.869	Treated=83 Untreated=856	
(1) and controlling for potential outliers (6)						
Pre-entry in OECD countries	-0.164 (0.503)	0.065 (0.461)	-	-	Treated=37 Untreated=941	
Pre-entry in Non-OECD countries	0.422** (0.183)	0.569*** (0.202)	52.572	76.814	Treated=82 Untreated=855	

Notes: Bootstrapped standard errors for the ATT, using 50 replications are reported in parenthesis. Standard errors are presented in parentheses. Industry-level differences are controlled for by adding dummy variables for the following industries: garments, textiles, machinery & equipment, chemicals, electronics, metal industries, nonmetal industries, agro industries, and other industries.

The results are presented in Table 7, which reports the same specifications as in Tables 5 and 6. The results strongly support our presumption. In the baseline specification, as anticipated, the ATT is statistically significant for the pre-entry in Non-OECD countries but insignificant

for the pre-entry in OECD countries. The value of the ATT suggests an economically substantial pre-entry premium in Non-OECD countries, even if this premium remains lower than the post-entry premium found in the baseline specification of Table 6. Future export-starters in Non-OECD markets increase their productivity relative to non-exporters by 63.84% and 41.85%, respectively for LP and TFP (Specification 1).

With few exceptions, this picture remains unchanged, even after controlling for additional factors. The export premium for the pre-entry in OECD countries remains insignificant even after controlling for industry differences, the localization in an industrial zone, the square terms of employment and age, and potential outliers (Specifications 2, 3, 4, 5, and 6). As for the pre-entry in Non-OECD countries, the self-selection effect is important in most cases. When controlling for industry differences, the pre-entry premium increases by 11.94 percentage points and 15 percentage points, respectively for LP and TFP. However, after accounting for the localization in an industrial zone, the export pre-entry premium decreased by 8.15 percentage points and 15.18 percentage points for LP and TFP respectively.

Similarly, taking account of the square term of employment and potential outliers increases the pre-entry premium, even if controlling for the square term of age reduces it. These results, therefore, clearly point to the role of economic development in shaping the export-productivity relationship.

6. Concluding remarks

Despite many previous studies of exporters' productivity premia, as compared with non-exporters, there is still a hotly debated research issue on the reason for this productivity differential. Whereas most studies on advanced countries point to the self-selection process as the source of the export premium, more recent studies using samples from the poorest economies find evidence for the learning effect. We re-examine this relationship using data from the Egyptian manufacturing industry and propensity score matching methods. We find that exporters are much more productive than their domestically-oriented counterparts. The export-premium is about 35.12% for LP and 33.50% for TFP. When we differentiate between pre-entry and post-entry differences in productivity, the results indicate that exporter premia are mainly driven by a learning effect.

These findings suggest that unlike in developed countries, firms in developing and emerging countries learn much from exporting. Hence, barriers to international trade can strongly constrain firm productivity and growth in developing countries. Export-oriented strategies that meet market rules could have strong beneficial effects on private sector productivity.

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Appendix

Table A1: Logit estimates of the propensity score, export starter dummy

Dependent variable	=1 if export-starter					
	(1)	(2)	(3)	(4)	(5)	(6)
Log of employment	0.306*** (0.053)	0.339*** (0.055)	0.303*** (0.056)	0.452 (0.281)	0.319*** (0.057)	0.594*** (0.089)
Log of average wage	-0.047 (0.065)	-0.038 (0.067)	-0.066 (0.070)	-0.064 (0.070)	-0.056 (0.070)	0.215** (0.101)
Log of age	-0.039 (0.109)	-0.052 (0.110)	0.205* (0.124)	0.212* (0.124)	1.667** (0.789)	-0.032 (0.195)
R&D	0.151 (0.224)	0.111 (0.230)	-0.019 (0.232)	-0.020 (0.231)	-0.010 (0.233)	0.181 (0.321)
Internal liquidity	8.44e-04 (0.002)	-0.001 (0.002)	8.05e-04 (0.002)	8.85e-04 (0.002)	8.39e-04 (0.002)	7.84e-04 (0.004)
Localization in an industrial zone			1.134*** (0.180)	1.118*** (0.182)	1.088*** (0.181)	0.807*** (0.290)
Log of employment (squared)				-0.015 (0.029)		
Log of age (squared)					-0.257* (0.135)	
Constant	-3.363*** (0.434)	-3.215*** (0.470)	-4.154 (0.525)	-4.472*** (0.788)	-6.166*** (1.223)	-5.707*** (0.803)
Sector-Fixed Effects	NO	YES	YES	YES	YES	YES
Number of obs.	2065	2029	2027	2827	2027	1474
Pseudo R2	0.035	0.051	0.085	0.085	0.089	0.157

Notes: Standard errors are presented in parentheses. All of the explanatory variables are lagged one period.

Table A2: Logit estimates of the propensity score

Dependent variable	=1 if export-continuer					
	(1)	(2)	(3)	(4)	(5)	(6)
Log of employment	0.793*** (0.044)	0.810*** (0.045)	0.784*** (0.045)	2.108*** (0.235)	0.797*** (0.046)	0.823*** (0.054)
Log of average wage	0.117*** (0.042)	0.117*** (0.042)	0.095** (0.044)	0.093** (0.044)	0.100** (0.044)	0.104** (0.052)
Log of age	-0.349*** (0.082)	-0.346*** (0.083)	-0.078 (0.092)	-0.014 (0.093)	0.785* (0.429)	-0.145 (0.108)
R&D	1.193*** (0.132)	1.152*** (0.135)	1.123*** (0.137)	1.086*** (0.136)	1.127*** (0.137)	1.140*** (0.156)
Internal liquidity	0.007*** (0.002)	0.007** (0.002)	0.007*** (0.002)	0.007*** (0.002)	0.007*** (0.002)	0.008*** (0.002)
Localization in an industrial zone			1.094*** (0.138)	0.980*** (0.138)	1.050*** (0.139)	1.097*** (0.159)
Log of employment				-0.129*** (0.021)		
Log of age					-0.157** (0.075)	
Constant	-5.071*** (0.350)	-4.773*** (0.373)	-5.785*** (0.415)	-8.925*** (0.713)	-6.922*** (0.703)	-5.922*** (0.486)
Sector-Fixed Effects	NO	YES	YES	YES	YES	YES
Number of obs.	2407	2407	2405	2405	2405	1838
Pseudo R2	0.301	0.308	0.334	0.348	0.336	0.357

Notes: Standard errors are presented in parentheses. All of the explanatory variables are lagged one period.