Parra, María Dolores; Martínez-Zarzoso, Inmaculada

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Imported Inputs and Egyptian Exports: Exploring the Links

María Dolores Parra and Inmaculada Martínez-Zarzoso

Abstract
This paper is the first to explore the links between exporting and importing activities of Egyptian firms using panel data over the period from 2003 to 2007. The main aim is twofold. Firstly, the authors report regression results indicating that firms that both export and import are the most productive, followed by importing-, exporting-only firms and nontraders. Secondly, the authors estimate the determinants of the extensive and intensive margins of exports and imports using dynamic panel-Probit and panel-Tobit models in combination with the method proposed by Hesketh and Skrondal (2013) to tackle the initial conditions problem. Their results show that both activities present a high degree of hysteresis, which is higher for imports than for exports pointing to the existence of sunk costs in both activities. Moreover, past productivity does affect the extensive margin of imports, but not of exports and the initial condition status is also only relevant for the import side. Similar outcomes are obtained for the intensive margin of trade.

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Keywords Firm level data; Egypt; internationalization; imports; exports; intermediates

Authors
María Dolores Parra, ✉ Research Group of Industry and Territory, Department of Economics – CREIP, Universitat Rovira I Virgili, 43204 Reus, Catalonia, Spain, and Institute of International Economics, Universitat Jaume I, Castellón, 12071, Spain, mparra@eco.uji.es
Inmaculada Martínez-Zarzoso, Department of Economics, University of Göttingen, 37001 Göttingen, Germany, and Institute of International Economics, Universitat Jaume I, Castellón, 12071, Spain

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1. Introduction

In recent years, there has been a growing interest in the study of the internationalization strategies of small- and medium-size firms in developing countries. According to the related trade literature, a high proportion of trading firms are engaged in both importing and exporting activities. Kasahara and Lapham (2013) show that this is due to the presence of cost complementarities in both activities. Once one of the activities is carried out, the second becomes easier. These cost complementarities have motivated a new strand of research that further investigates the relationship between import and export activities at the firm level, especially those focused on the use of imported intermediates and their role in enhancing exports (Muûls and Pisu 2009; Bas 2012; Aristei et al. 2013; Kasahara and Lapham 2013; Lo Turco and Maggioni 2013).

While most of the existent literature on the relationship between productivity and import and export activities has focused on developed countries, the literature concerning developing countries is still scarce. In particular, a relevant question is whether importing intermediates generates productivity gains that add to the gains arising from learning-by-exporting. It is yet to be established to what extent this is also a source of gains for developing countries, which may profit more than others from having access to intermediates from abroad. Therefore, we aim to extend the existing evidence by investigating export and import activities of firms located in Egypt, a developing country that to the best of our knowledge has not yet been investigated[1].

Atiyas (2011) summarizes the research that uses firm-level data in MENA countries to analyse productivity and its relation to trade, trade policy and financial constraints. The author emphasizes the fact that researchers have scarcely utilized the recently available

[1] There is only a working paper, Kiendrebeogo (2014), investigating the learning by exporting and selecting into exporting hypotheses for the Egyptian case, but importing activities are disregarded.

firm-level data covering MENA countries provided by the World Bank Enterprise Survey (WBES) to investigate the relationship between trade and productivity. We focus our analysis on Egypt because is one of the most important countries in the MENA (Middle East and North African) region in terms of population and gross domestic product (GDP), and it is a developing country. According to Smeets and Warzynski (2010) and Bas and Strauss-Kahn (2011), developing countries are able to profit more than developed countries from the benefits of importing intermediate inputs, which they cannot always produce due to the existence of supply side restrictions.

In this paper, we estimate the determinants of the decision to export/import by using a dynamic panel-Probit model applied to data from approximately 500 Egyptian industrial companies. To analyse the extensive margin of trade, we employ a novel technique based on Rabe-Hesketh and Skrondal (2013) that is able to deal with the endogeneity problem of the lagged dependent variable and that controls for initial conditions in dynamic models. We also test whether the same determinants are important in determining the intensive margin of trade; in this case a tobit procedure is employed.

The period analysed spans the years from 2003 to 2007, during which the country experienced reductions in tariff barriers and important changes in trade policy. More specifically, the bilateral interim agreement between the EU and Egypt, signed in 2004, will gradually eliminate tariffs on imported products from the EU and eventually increase competition, thus forcing some firms to exit the market. Simultaneously, decreases in trade costs generated by more flexible rules of origin (RoO) for products traded with the EU had a positive effect on Egyptian exports (Bensassi et al. 2011).

The main results show that export and import activities have common sunk costs and that those are higher for import than for export activities. Past Total Factor Productivity (TFP) levels explain the decision to import, but not the decision to export and firms with

foreign ownership are more prone to export. Our results also show that past experience in both exporting and importing activities are the most important factors determining internationalization strategies and similar outcomes are found for the extensive and intensive margins of trade.

This paper is organized as follows: Section 2 describes the theoretical framework and related empirical literature. Section 3 presents the data and some descriptive statistics. Section 4 reports the importer and exporter premia. Section 5 includes the empirical strategy and outlines the main results, and Section 6 concludes.

2. Theoretical framework and literature review

With the introduction of firm heterogeneity in models of international trade by the seminal paper of Melitz (2003), the empirical literature studying the link between trade and productivity has dynamically evolved over time. According to Melitz model there is a fixed cost of exporting and firms can enter in a foreign market by paying it. They then select their level of productivity and if it is too low to be profitable, they are forced to leave the market. This seminal theory has been extended in several directions, one of this works is Kashara and Lapham (2013) that introduces the importance of importing activities in the internationalization process of the firm. These authors extended Melitz (2003) model introducing imported inputs and showed the existence of some productivity gains stemming from importing inputs, which allow importers to start exporting. As a result, a cost complementarity effect emerges between import and export activities. In order to produce final goods, firms can use imported inputs, domestic inputs or a combination of both, and their decision to import/export is linked to the associated import/export fixed costs in which they have to incur. The model is based in an open economy with heterogeneous final goods producers, where the firm makes simultaneously the decision to export their output and the decision to use imported

intermediates and firms have to pay a fixed cost to enter into the foreign market in order to import and export. The authors also introduce firm's productivity, transport costs for importing intermediates and for exporting final goods, and take into account the trade status of the firm in order to capture the observed changes in the firm's trade status over time. In particular, they consider whether a firm is import-only, export-only, both or only sells in the domestic market. They assume that two-way traders necessarily face higher trade costs, and for this reason only the most productive firms are able to operate as such. The model predict that if there is a common fixed cost for both activities, the firms that are one-way traders are more likely to start exporting and, in due course, become two-way traders.

The empirical investigations focused on explaining the links between productivity and international trade are rich, where they find evidence confirming the self-selection hypothesis (only firms with high productivity levels become exporters), others support the learning-by-exporting hypothesis (firm productivity increases after they start exporting). Although most investigations focus on the export side, a few recent papers also consider an import perspective[2].

Among the studies that focus on the export side, Bernard and Jensen (1999), Delgado et al. (2002), Arnold and Hussinger (2005) and Aw et al. (2000) find support for the self-selection hypothesis for exports, finding that only the most productive firms are able to start exporting, whereas De Loecker (2007), Bustos (2011), Van Biesebroeck (2005), Rizov and Walsh (2009) and Clerides et al. (1998) find evidence of learning-by-exporting. Nevertheless, the results remain mixed and mainly depend on the characteristics of the countries considered in the analysis.

[2] See Silva et al., (2012) for a survey of the learning-by exporting literature and Singh (2010) for a detailed literature review about the effects of international trade on productivity and economic growth at the macro- and micro-levels.

A few authors have investigated the self-selection and learning hypotheses from an import perspective and have analysed the role played by intermediate imports in increasing productivity. On the one hand, Halpern et al. (2011), Amiti and Konings (2007) and Kasahara and Rodrigue (2008) find support for a learning-by-importing effect. On the other hand, Wagner (2007) analyses both hypotheses, and only finds evidence to support the self-selection hypothesis.

Most of the studies focusing on foreign intermediates find different channels through which imported inputs affect firm productivity. Some authors find that firms that import have access to a wider variety of inputs than firms that only use domestic providers; this in turn leads to firms easily adapting their products to the foreign market. Indeed, Kugler and Verhoogen (2009) show that access to imports increases the availability of different types of inputs. They find that plants which are more productive purchase higher-quality inputs, and that despite import prices being higher than domestic prices for the same input category in the same plant and year, firms still use foreign inputs due mainly to their higher quality. Halpern et al. (2011) find that firms that import all of their inputs have a 12 percent higher productivity in comparison to firms that import only part of them. Access to foreign inputs also means that firms are able to use inputs that are cheaper and of higher quality than domestic inputs, especially in developing countries. Goldberg et al. (2010) show how the combined use of foreign and domestic inputs increases the product scope of Indian firms, and that better access to foreign inputs after trade liberalization is more important than the price reduction effect produced by the decrease in trade costs.

Another important aspect worth mentioning is that the diffusion of modern technologies through the use of foreign intermediate goods appears especially beneficial for developing countries, which benefit the most from these technological spillovers.

Meanwhile, the origin of the imported inputs and their impact on productivity have also been analysed in order to understand the technology transfer linked to imported intermediates. In their analysis, Smeets and Warzynski (2010) distinguish between inputs from the OCDE and those from low-income economies, analysing their impact on total factor productivity (TFP). The authors find that both affect productivity in a similar way. However, Bas and Strauss-Kahn (2011), compare imported inputs from developed and developing countries for French firms, and find that foreign intermediates from developed countries increase TFP 20 percent more than inputs from developing countries. They also find that importing more varieties of intermediate inputs increases TFP and also the number of exported varieties of French firms.

Other authors have focused their attention on analysing how trade liberalization in intermediate inputs affects productivity. Amiti and Konings (2007) was one of the first studies to estimate the relationship between productivity and the effects of trade liberalization on imported inputs. Using Indonesian data, they analyse the productivity gains that result from reducing tariffs on final goods and on intermediate inputs separately, showing that a ten percent reduction in input tariffs led to a productivity gain of 12 per cent for firms that use imported inputs, and that this gain was twice as large as gains from reducing tariffs on final goods. Bas (2012) studies the impact of input-trade liberalization on Argentinian firms' export decisions, finding that a reduction in input-tariff on foreign intermediates enhances Argentinian firms' performance in the export market and also increases the percentage of exports. Goldberg et al. (2010) provide evidence indicating that trade liberalization increases productivity not only due to the access to cheap inputs but also due to the opportunity to access new intermediate inputs that allow firms to create new varieties in the domestic market.

The literature that directly links both international activities is scarce. Bernard et al. (2007) were the first authors to consider jointly both activities and they find that two-way traders are more productive than only exporters or importers. Altomonte and Békés (2009) highlight that the previous literature that analyses the export-productivity link without taking import decisions into account overestimates the export gains.

There are a few papers that focus in particular on how imports affect exports. For example, Sjöholm (2003) estimates a static panel model using data for Indonesian manufacturing firms and finds, that the probability to export in the current year are positively affected by the past firm import status. Sjöholm and Takii (2008) estimate instead a dynamic binary model using the approach proposed by Wooldridge (2005). The authors obtain a high degree of hysteresis on the export activity, where past import status does not increase the probability to export. Lo Turco and Maggioni (2013) analyse how imports affect the probability to export for Italian manufacturing firms. They find that importing form low-income countries affects the probability to export and that past export status positively affects the probability to continue with this activity.

To our knowledge, only two recent papers analyse the link between both activities in a dynamic framework. Firstly, Muûls and Pisu (2009) test the existence of sunk costs of imports in addition to sunk cost of exports using a dynamic panel probit and taking the coefficient of the lagged dependent variable as a measure of sunk costs. Their results show that exports and imports show a high degree of hysteresis, meaning that past status explain the current status. Also they find that sunk costs decrease when the complementary activity was carried out the past year, meaning that common fixed costs exist, and obtain a higher sunk cost for imports than for exports. Secondly, Aristei et al. (2013) using data for Eastern European and Central Asian firms obtain a high degree of

hysteresis for both activities, but higher for exports than for imports and find that past imports affect the probability to export in the current year but not the other way around.

The numbers of studies focused on MENA countries are few. Related to the role that imported intermediates could play in technological diffusion, Brach (2010) assesses the role of technological readiness in the MENA region and the implications for Egypt. The author takes a closer look at the technological progress and innovative activities in the MENA region and within this context investigates the implications for economic development and job creation, as well as the main economic policy recommendations. She finds that one of the major constraints to improving economic performance and sustainable job creation is a general lack of technological capabilities of the MENA countries. Innovation in these countries is mainly linked to the adaptation and modification of existing technologies and the low level of technological readiness negatively impacts innovation and productivity. Hence, the use of foreign intermediates can be a good way to transfer modern technologies from foreign markets to MENA countries. To the best of our knowledge, only Kiendrebeogo (2014) analyses the Egyptian manufacturing sector and how Egyptian firms perform depending on their export activity using WBES. He finds that exporter firms are larger, more capital-intensive and more productive than domestic-only firms. He examines the self-selection and learning-by-exporting hypotheses, showing that although exporting has a positive impact on firm productivity, supporting the learning by exporting hypothesis of Egyptian firms, the pre-entry differences in productivity do not explain firms' export decisions. However, the author does not consider importing activities in his analysis. For this reason, in our paper we want to extend this analysis by considering exporting and importing activities, taking advantage of the raw data characteristics. By focusing on the relationship between exporting and importing activities in Egyptian firms, we aim at producing some policy recommendations for this country concerning their participation

in regional integration processes and their industrial policies after the Arab Spring revolution.

3. Data and descriptive statistics

Data on Egyptian firms are obtained from the World Bank Enterprise Survey dataset[3]. The dataset includes 3,129 firms for the years 2004, 2005 and 2007. For some variables, namely sales, exporting and importing status we are able to use information for an additional year per questionnaire, since each firm is asked in the questionnaire about the current year of the questionnaire and the previous year. Some firms are only included in one or two years, whereas 554 firms are included in the three questionnaires. Therefore, using the available information for these firms and after data cleaning, we build a panel dataset from 2003 to 2007 keeping 519 firms obtaining around 1,890 observations.

Table 1 shows the evolution over time of the exporting and importing status of Egyptian firms in our sample, distinguishing between firms that only sell products in the country (*domestic firms),* firms that sell in the domestic market and only carry out one international activity (*export-only) (import-only)* and firms that sell in the domestic market and are involve in both international activities, (*two-way traders*). The results show that the majority of Egyptian manufacturing firms are focused on the domestic market, results are in line with the empirical literature which highlight that international-trading firms are fairly scarce (Bernard et al 2007). The percentages of export-only and import-only firms remain quite stable over time, around 8 and 11 percent on average, respectively. We observe that only 7 percent of all firms in our sample are involved in both importing and

[3] The data comes from a firm-level survey based on a representative sample of manufacturing Egyptian firms classified using ISIC codes 15-37, 45, 50-52, 55, 60-64, and 72 (ISIC Rev.3.1). Formal (registered) companies with 5 or more employees are targeted for interviews and firms with 100% government/state ownership are not eligible to participate in the Enterprise Survey. Business owners and top managers answer the Enterprise Survey from the World Bank. Sometimes the survey respondent calls company accountants and human resource managers into the interview to answer questions concerning the sales and labour sections of the survey, which covers a broad range of business environment topics including access to finance, corruption, infrastructure, crime, competition, and performance measures. Typically, 1200-1800 interviews are conducted in larger economies, 360 interviews in medium-sized economies, and only 150 interviews in small economies. See World Bank (2012) for more details.

exporting activities in 2003. This number has increased over time and has reached 16 per cent of the number of total firms in 2007. The last rows of Table 1 show the percentage of imported inputs used by import-only firms and two-way traders, showing that on average, more than half of the inputs used in production are imported. In addition, the share has not increased over time and it is relatively stable for both types of firms.

Table 1. Sample composition by trade status and percentage of imported input

Year	Import-only	Export-only	Two-way traders	Domestic
2003	13%	7%	7%	73%
2004	12%	7%	13%	68%
2005	10%	6%	15%	69%
2006	9%	10%	10%	71%
2007	11%	9%	16%	64%
Average	11%	8%	12%	69%
Industries	Import-only	Export-only	Two-way traders	Domestic
Agro industries	16%	11%	13%	60%
Chemicals	22%	9%	26%	43%
Electronics	36%	0%	0%	64%
Garments	5%	7%	8%	80%
Machinery and equipment	22%	11%	20%	47%
Metal industries	13%	8%	11%	68%
Non-metal industries	9%	7%	8%	76%
Other industries	8%	8%	13%	71%
Textiles	12%	7%	13%	68%

% imported intermediates	Import-only	Two-way traders
2003	54%	49%
2004	57%	48%
2005	50%	46%
2006	48%	49%
2007	51%	48%
Average	52%	48%

Note: Authors' elaboration using data from the World Bank Enterprise Survey. *Export-only firms* denotes firms that sell in the local market and also export, *Import-only firms* denotes firms that sell into domestic market and also import, *Two-way traders* refers to firms that sell into the domestic market and also export and import and *Domestic* indicate firms that only sell in the local market and are not engaged in international activities.

The second part of Table 1 displays the relative importance of each industry by status. Firms are classified into nine industrial categories, of which Garments, Non-metal industries and Other industries mainly sell their products in the domestic market, whereas almost half of the two-way traders belong to the Chemical and Machinery and equipment industries. Despite the fact that Egyptian firms are mainly focused on the domestic market, those that are involved in international activities tend to engage in both import and export activities, rather than in only one of them. There are only a few exceptions in some industries in which one of the international activities is more

important than the other. This is the case in the electronics industry, where import of intermediate goods is the only international activity. It seems that firms in this industry import intermediate goods to produce products for the local market; especially the majority are larger factories assembling products for international brands. Also, the chemical and machinery and equipment industries show a higher share of importers than exporters. This descriptive analysis shows that the nature of the different industries might influence the decision to import/export; indeed, some industries are more likely to participate in international markets. For this reason, we need to take industry effects into account in our analysis.

Table 2. Descriptive statistics by trade status

Variable	Obs	Mean	Std.	Min	Max
Export-only firms					
$TFP_{i,t}$	182	7.12	1.68	0.95	10.35
$work_{i,t}$	188	251.45	478.84	8.00	2800
$foreignowner_{i,t}$	191	3.00	15.38	0.00	100
$px_{i,t}$	191	39.92	32.91	0.50	100
$pm_{i,t}$	191	0.00	0.00	0.00	0.00
$capital_{i,t}$	180	20229.64	53644.10	50.00	531419
$investment_{i,t}$	185	129047.50	1601345	0.00	2.18e+07
Import-only firms					
$TFP_{i,t}$	258	6.98	1.61	0.95	11.39
$work_{i,t}$	281	250.75	907.84	8.00	13,695
$foreignowner_{i,t}$	281	0.06	0.23	0.00	1.00
$px_{i,t}$	281	0.00	0.00	0.00	0.00
$pm_{i,t}$	281	50.84	31.19	1.00	100
$capital_{i,t}$	253	192808.40	1446639.00	0.00	1.57e+07
$investment_{i,t}$	262	128012.50	1323347.00	0.00	1.52e+07
Two-way traders					
$TFP_{i,t}$	297	7.83	1.76	0.98	14.37
$work_{i,t}$	314	634.40	1206.94	0.00	13,15
$foreignowner_{i,t}$	316	0.11	0.31	0.00	1.00
$px_{i,t}$	316	39.02	33.81	0.90	100
$pm_{i,t}$	316	47.25	29.08	2.00	100
$capital_{i,t}$	298	129055.70	698418.30	5.00	9,800,000
investment i,t	297	175131.00	1902239	0.00	2.99e+07
Domestic firms					
$TFP_{i,t}$	1646	5.44	1.48	1.41	12.93
$work_{i,t}$	1770	69.11	427.99	0.00	10,500
$foreignowner_{i,t}$	1783	0.02	0.12	0.00	1.00
$px_{i,t}$	1783	0.00	0.00	0.00	0.00
$pm_{i,t}$	1783	0.00	0.00	0.00	0.00
$capital_{i,t}$	1639	33258.00	476477.50	0.00	1.22e+07
investment i,t	1686	9237.41	165149.10	0.00	6550000

Notes: Obs denotes number of observations; Std. Dev denotes standard deviation and Min and Max are the minimum and maximum value of each variable. TFP i,t is total factor productivity, obtained using the Levinsohn-Petrin (2003) procedure. We explain the choice of this methodology and the estimation in Appendix A.2; work i,t is the average number of workers; foreignowneri,t is a dummy variable that takes the value of 1 if the firm is owned by foreigners and 0 otherwise; pxi,t is the share of exports over total sales and pmi,t is the share of imports over total sales; capital i,t is the total fixed tangible assets value of machinery and investment i,t is the net book value of machinery.

Table 2 presents summary statistics of the main variables used in the analysis The figures show that firms involved in international activities perform better than domestic-only firms in terms of total factor productivity (*TFP*)[4] and size (measured with number of workers: *work*). Among the three types of international firms, we observe that firms with higher productivity are more often two-way traders than export-only firms or import-only firms, and domestic firms have the lowest average productivity. It is also worth noting that two-way traders are not only bigger in size than import-only and export-only firms but also invest more. We also observe that firms owned by foreigners are more focused on international activities.

4. How different are Egyptian traders? Firm-level characteristics of traders vs. Non-traders

Following studies that analyse how firm trade status affects firm characteristics (Bernard et al. 2007; Muuls and Pisu 2009; Castellani et al. 2010; Seker 2012; Sharma and Mishra 2015), we start this section by computing the exporter and importer premia for Egyptian firms. Exporter/importer premia are conventionally determined estimated by regressing the dependent firm-performance variable indicators, usually expressed as TFP, labour productivity, wages, number of workers or capital, among others, on an exporter/importer dummy and other a number of control variables as explanatory variables using OLS estimations. The estimated coefficients of the dummy trade variables show the exporter/importer premia meaning or simple correlations between the dependent variable and the trade dummy variables used. At this point, a causal interpretation of the results is not possible. Clearly the results cannot be interpreted as causal effects. The main idea aim is to confirm whether an export/import premium for Egyptian international firms is present, which will be in accordance with the related

[4] TFP has been obtained using the Levinsohn-Petrin (2003) methodology. See Appendix A.2.

empirical literature. Since some exporters are also importers —as in Bernard et al (2007), Altomonte and Bekés (2010), Muûls and Pisu (2009)—we distinguish between import-only firms, export-only firms and two-way traders to better understand the characteristics of international Egyptian firms compared with domestic-only firms.

The estimated equation is:

$$lnF_{i,t} = \alpha_0 + \alpha_1 d_{i,t}^{xo} + \alpha_2 d_{i,t}^{mo} + \alpha_3 d_{i,t}^{xm} + \beta 1 \text{foreignowner}_{i,t} + \beta 2 lnwork_{i,t} + \gamma_k + \delta_t + \varepsilon_{i,t} \quad (1)$$

Where ln denotes natural logs; $F_{i,t}$ denotes a given firm performance indicator[5] (TFP, size, sales, capital and investment) used as dependent variable. $TFP_{i,t}$ is obtained using the Levinsohn-Petrin (2003) methodology, $work_{i,t}$ denotes firm size proxied by the average number of workers, $sales_{i,t}$ denotes the total sales of the firm, $capital_{i,t}$ is the total fixed tangible assets deflated using the production price index for manufactures and $investment_{i,t}$ is the net book value of machinery and equipment, all variables are in natural logs. As explanatory variables we include $d_{i,t}^{xo}$, a dummy variable taking the value of 1 if the firm only exports and zero otherwise. $d_{i,t}^{mo}$ takes the value of 1 if the firm only imports and $d_{i,t}^{xm}$ takes the value of 1 if the firms are two-way traders, zero otherwise. As control variables, we include the percentage of the firm owned by a foreigner and when the dependent variable is not employment, we include also firm size. We also include industry dummies and year dummies to take into account any unobserved effects that are industry specific and time invariant and those that are common across industries and time variant. The former could be a proxy of specific comparative advantages and the later controls for the business cycle. Both type of effects also control for potential measurement errors.

Table 3 presents the estimated trade-status premia obtained from estimating equation (1).

[5]See Appendix A.1.

Table 3. Exporter and importer premia

Dependent Variable	(1) $lnTFP_{i,t}$	(2) $lnwork_{i,t}$	(3) $lnsales_{i,t}$	(4) $lncapital_{i,t}$	(6) $lninvestment_{i,t}$
Export-only firms	1.088***	0.978***	1.272***	1.306***	1.209***
	(0.159)	(0.129)	(0.175)	(0.184)	(0.210)
Import-only firms	0.944***	1.016***	1.111***	1.146***	1.161***
	(0.123)	(0.107)	(0.134)	(0.183)	(0.189)
Two-way traders	1.342***	1.901***	1.697***	1.647***	1.628***
	(0.159)	(0.126)	(0.174)	(0.186)	(0.203)
$foreignowner_{i,t}$	0.615***	0.672*	0.561**	0.460*	0.429
	(0.223)	(0.245)	(0.236)	(0.250)	(0.279)
$lnwork_{i,t}$	0.441***		0.643***	0.549***	0.586***
	(0.0279)		(0.0317)	(0.0377)	(0.0401)
Constant	5.111***	3.377***	5.468***	5.485***	3.780***
	(0.379)	(0.466)	(0.426)	(0.425)	(0.587)
Observations	1,978	2,547	1,985	1,963	1,968
Number of firms	518	519	518	519	519
Year dummies	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes
Rho	0.168	0.522	0.150	0.212	0.238
Wald test: Chi2	1126	345.62	1818	841.9	941.3
p-value	0	0	0	0	0

Note: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

We observe that firms involved in international trade, irrespective of their trade pattern, are more productive, are larger in size, sell more, own more capital, and invest more than domestic-only firms. In particular, two-way traders are the best performers in all cases, and only exporters have higher premia than only importers. These results are in line with those obtained by Bernard et al (2007), Muûls and Pisu (2009), Castellani et al (2010) Seker (2012) and Sharma and Mishra (2015) for other countries. . Some recent studies for other developing countries, for example, Seker (2012) using data for 43 developing countries obtain that two-traders are best performers in all measures, followed by only exporters and only importers in comparison to domestic-only firms. Also Sharma and Kumar (2015) using data for Indian manufacturing firms over the period 1994–2006 finds the same pattern.

5. Empirical strategy

5.1 Modelling the decision to export and import

5.1.1 Extensive margin of trade

In order to estimate the determinants of export and import decisions and analyse how both activities are related, we model the probability of exporting/importing as a function of TFP, size of the firm and ownership structure. In order to account for correlations between exporting and importing activities, we include in the models past import-status in the export equation and past export-status in the import equation. We also add the lagged left hand side variables as explanatory variables. In this dynamic framework we will be able to investigate the existence of state dependence, also termed hysteresis, in export and import activities. In other words, we assume that there is some sort of persistence affecting the decision to export final outputs and import intermediates, and we would like to disentangle the effect of past status from the firm's initial condition as exporter/importer. The inclusion in the model of the lagged values of the dependent variables has been considered by several authors as a way to introduce a measure of the sunk costs (Bernard and Jensen, 2004; Muûls and Pisu, 2009; and Roberts and Tybout, 1997).

The proposed equations for exports and imports are given by,

$$\Pr(x_{i,t}=1) = \Pr(\beta_0 + \beta_1 x_{i,t-1} + \beta_2 m_{i,t-1} + \beta_3 \ln(work_{i,t-1}) + \beta_4 foreignowner_{i,t} + \beta_5 \ln(TFP_{i,t-1}) + \gamma_k + \delta_t + u_{i,t} > 0) \quad (2)$$

$$\Pr(m=1) = \Pr(\beta_0 + \beta_1 m_{i,t-1} + \beta_2 x_{i,t-1} + \beta_3 \ln(work_{i,t-1}) + \beta_4 foreignowner_{i,t} + \beta_5 \ln(TFP_{i,t-1}) + \gamma_k + \delta_t + u_{i,t} > 0) \quad (3)$$

where ln denotes natural logarithms, the subscript *i* indexes firms; *t*, indexes time. The dependent variable in equation (2), $\Pr(x_{i,t}=1)$, denotes the probability of exports and is a dummy variable that takes the value of 1 if firm *i* exports in year *t*, and 0 otherwise and the dependent variable in equation (3), $\Pr(m_{i,t}=1)$, is the probability of importing, which

takes the value of 1 if firm *i* imports in year *t*, and 0 otherwise. As explanatory variables we include $m_{i,t-1}$ is a dummy variable reflecting the import status of the firm in year t-1 and $x_{i,t-1}$ is a dummy variable indicating the exporting status of the firm in year t-1, TFP_{t-1} is total factor productivity of the firm obtained by using the Levinsohn-Petrin (2003) methodology. $work_{it-1}$ denotes the average number of workers in t-1, and $foreigowner_{i,t}$ is a dummy variable that takes the value of 1 if the firm is owned by foreigners and 0 otherwise[6]. $\overline{lnTFP_i}$ *and* $\overline{workt_i}$ are respectively the average of each variable. Industry (γ_k) and time dummies (δ_t) have also been included in the model to proxy for factors that are industry specific and time-invariant and for those that vary over time and are common to all firms. These variables have been commonly included as control variables in models used to estimate the determinants of the decision to export; see for example Greenaway et al (2007) and Muûls and Pisu (2009).

The main difficulty of explicitly allowing for lagged effects is that the correlation between the unobserved heterogeneity and the lagged dependent variable in the dynamic binary choice model makes the lagged dependent variable endogenous. Hence, the estimators used before will not be consistent. A familiar alternative approach is based on Wooldridge (2005), which builds on the random effects specification and basically adds the initial condition and the averages over time of the time-variant variables as additional regressors. The solution proposed by Wooldridge (2005) has been improved by Rabe-Hesketh and Skrondal (2013), who exclude the first period when calculating the averages over time of the regressors.

Therefore, we follow a similar strategy to Aristei et al (2013) and Muûls and Pisu (2009) but use instead a more reliable estimation technique that will enable us to disentangle the

[6] We also used alternatively the percentage of the firm owned by a foreigner, but since high and a low percentage of foreign ownership have approximately the same effect, we decided to create a 1/0 dummy.

effect of the initial conditions from the effect of the past export/import status of the firm on the decision to export/import.

To deal with the so-called "initial condition" problem (basically, we cannot observe the first dependent observation in the data-generating process, hence we cannot treat the stochastic process from its starting point and consequently we cannot treat it as fixed) previous literature used Wooldridge's auxiliary model. However, as stated by Rabe-Hesketh and Skrondal (2013), Wooldridge's (2005) method performs poorly for short panels, mainly because if the means are based on all periods, the initial conditions are also used to compute those means, and this induces endogeneity. The authors suggest including the initial-period as explanatory variable and calculate the mean only using the remaining periods, which is t+1 until n.

As in Wooldridge (2005), we assume that $u_i, (\varepsilon_i)$, the firm specific effects are determined by,

$$u_i = \beta_0 + \beta_1 x|m_{i0} + \beta_2 \overline{ltfp_i} + \beta_3 \overline{lworkt_i} + \mu_{i,t} \quad (4)$$

where μ_i is an independently and normally distributed error term and the control variables are now the firm-level average of each variable over time. However, as Rabe-Hesketh and Skrondal (2013) suggest, the firm-level average must be obtained excluding the initial period and then adding a dummy in the regression capturing whether the firm exports (ie_i)/imports (ii_i) in the first period of the sample. If we now substitute equation (4) into equations (2) and (3) we obtain:

$$\Pr(x_{i,t} = 1) = \Pr(\beta_0 + \beta_1 x_{i,t-1} + \beta_2 m_{i,t-1} + \beta_3 \ln(work_{i,t-1}) + \beta_4 foreignowner_{i,t} +$$

$$\beta_5 lTFP_i + \beta_6 \overline{lTFP_i} + \beta_7 \overline{workt_i} + \mu_i + ie_i + ii_i + \gamma_k + \delta_t + u_{i,t} > 0) \quad (5)$$

$$\Pr(m_{i,t} = 1) = \Pr(\beta_0 + \beta_1 m_{i,t-1} + \beta_2 x_{i,t-1} + \beta_3 \ln(work_{i,t-1}) + \beta_4 foreignowner_{i,t} +$$

$$\beta_5 lTFP_i + \beta_6 \overline{lTFP_i} + \beta_7 \overline{workt_i} + \mu_i + ie_i + ii_i + \gamma_k + \delta_t + u_{i,t} > 0) \quad (6)$$

to test the existence of sunk costs in import and export activity and to measure the importance of these sunk costs, we estimate the parameters of equations (5) and (6) using a panel-Probit model with random effects[7] based on maximum likelihood estimation techniques for the period 2003-2007, and we interpret the estimated coefficients for the dependent lagged variable as a measure of the importance of sunk costs, as the authors cited above. We argue that sunk costs generate hysteresis in the export and import market participation. The results from estimating equations (5) and (6) are shown in Table 4.

Columns (1) and (2) of Table 4 include only the lagged value of the dependent variable. A high degree of hysteresis is obtained for both activities, indicating that past trade status increase the probability to continue with the same activity. We obtain that the sunk costs that firms face to import intermediates are higher than those needed to export. Indeed, liberalization of imports with the EU started in 2004 with the entry into force of the FTA and imports from EU were progressively liberalised during a period of 10 years, whereas exports were already liberalized in 1972 with the bilateral cooperation agreements.

Results in columns (3) and (4) in Table 4 show that the combination of both export and import activities affect the probability of importing/exporting. It can be observed that past export and import participation have a high degree of hysteresis, and firms face higher sunk costs for imports than for exports. The results are similar to those obtained in Muûls and Pisu (2009), in that exporter/importer status in the previous year has a positive effect on the probability of exporting/importing in the current year and the magnitude of the effect is also higher for imports than for exports.

[7] Results are obtained using *xtprobit* command in Stata11.

Contrary to Aristei et al (2013) we obtain that foreign ownership affects positively both the export and import status of the firm, remaining only significant for exports when the imports variable dummy is included in the regression. However, past TFP affects the probability of importing but not of exporting, and the size of the firm affects only the probability to export when the import dummy variable is not included. Both, Aristei et al. (2013) and Muûls and Pisu (2009) find that past TFP influences i export and import activities, however in our case, the results show that past TFP only affect the extensive and intensive margin of imports only, but not of exports. There is also a different effect of the variable firm size on the probability of exporting and importing. Firm size has a positive effect only on the decision to start exporting. This could be explained by the fact that larger firms are able to serve the domestic and the foreign market because they have a higher production capacity than smaller firms. However, firm size does not affect the probability of importing indicating that firms import intermediates probably because these are not available in the domestic market, independently of the scale of production.

Table 4. Dynamic panel-Probit model controlling for initial conditions (Exports and Imports)

	(1) $P(x_{it}=1)$	(2) $P(m_{it}=1)$	(3) $P(x_{it}=1)$	(4) $P(m_{it}=1)$
$x_{i,t-1}$	1.489***		1.408***	1.342***
	(0.112)		(0.136)	(0.140)
$m_{i,t-1}$		1.591***	1.219***	1.427***
		(0.114)	(0.135)	(0.140)
Ln work $_{i,t-t}$	0.130**	0.057	0.071	-0.003
	(0.056)	(0.055)	(0.062)	(0.064)
Foreign owner $_{i,t}$	0.625***	0.319*	0.600***	0.047
	(0.175)	(0.177)	(0.202)	(0.218)
Ln TFP $_{i,t-1}$	0.041	0.063*	0.034	0.059
	(0.036)	(0.036)	(0.039)	(0.041)
Ln TFP mean $_{i,t-1}$	0.097	0.094	0.012	0.067
	(0.060)	(0.061)	(0.069)	(0.075)
Ln work mean $_{i,t-t}$	0.072	0.070	0.096	0.046
	(0.073)	(0.074)	(0.083)	(0.088)
ie_i	-0.060		0.162	
	(0.122)		(0.157)	
ii_i		0.029		0.347**
		(0.118)		(0.170)
Year dummies	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes
Number of observations	1889	1867	1882	1863

Notes: The dependent variable P(x=1) is a dummy variable for the exporter status and P(m=1) for the importer status. t-1 denotes lagged values of these variables. ie_i denotes initial exporter dummy. ii_i means initial importer dummy. Standard errors are in brackets, where *** p<0.01, **p<0.05, * p<0.1. Industrial and year dummies included. TFP $_{i,t}$ denotes total factor productivity, it is obtained using the Levinsohn-Petrin (2003) procedure; TFP $_{i,t-1}$ are lagged values of $TFP_{i,t}$; $work_{i,t}$ denotes the average number of workers and work $_{i,t-1}$ are aged value of the variable; $x_{t,i}$ are a dummy variable that takes value 1 if the firm is exporting and 0 otherwise, $x_{t,i-1}$ are the corresponding lagged value and foreign $owner_{i,t}$ is a dummy variable that takes the value of 1 if the firm is owned by foreigners and 0 otherwise.

5.1.2 Intensive margin of trade

In this section we check if results still similar for the impact on the intensive margin of trade. The estimated model is given by equations (7) and (8), similar to equations (2) and (3) used for the extensive margin; the difference is that the dependent variable is proxied by the percentage of exports over total sales of firm *i* in year t, and by the percentage of total purchases of materials inputs imported from firm *i* in year t. Similar to equations (2) and (3), we propose a dynamic model following the treatment proposed by Rabe-Hesketh and Skrondal (2013).

$$exp_{i,t} = \beta_0 + \beta_1 exp_{i,t-1} + \beta_2 imp_{i,t-1} + \beta_3 \ln(work_{i,t-1}) + \beta_4 foreignowner_{i,t} +$$

$$\beta_5 \ln(tfp_{i,t-1}) + \beta_6 \overline{ltfp_i} + \beta_7 \overline{workt_i} + \mu_i + ie_i + ii_i + \gamma_k + \delta_t + u_i \quad (7)$$

$$imp_{i,t} = \beta_0 + \beta_1 imp_{i,t-1} + \beta_2 exp_{i,t-1} + \beta_3 \ln(work_{i,t-1}) + \beta_4 foreignowner_{i,t} +$$

$$\beta_5 \ln(tfp_{i,t-1}) + \beta_6 \overline{ltfp_i} + \beta_7 \overline{workt_i} + \mu_i + ie_i + ii_i + \gamma_k + \delta_t + u_i \quad (8)$$

In this case, the parameters of the model are estimated using a panel-Tobit procedure. The election of this estimation technique is justified by the fact that our dependent variable is continuous and positively distributed, taking censored values from 0 to 100. As stated in Wooldridge (2010), the use of linear models is not recommended in this case where corner solutions are present, and a censored regression model is more recommended in this setting. In our sample approximately 80 percent of the observations in the dependent variable take the value of 0.

The results are presented in Table 5, and they are similar to those obtained for the extensive margin of trade. Aristei et al. (2013) also used a Tobit model to analyse the relationship between both activities, nevertheless the authors find that only past imports are positively correlated with current exports, but not the other way round. As we can observe in columns (1) and (2) we find a high degree of hysteresis, since the past percentage of exports and imported intermediates explains the current levels of each activity, been more important for imports. When both activities are included in the estimation, sunk costs decrease for both activities, the reduction being more important for imports than for exports (20 percent versus 15 percent), showing the existence of common costs in both activities.

Table 5. Dynamic panel-Tobit model controlling for initial conditions (Exports and Imports)[8]

	(1) $exp_{i,t}$	(2) $imp_{i,t}$	(3) $exp_{i,t}$	(4) $imp_{i,t}$
exp_{i,t_1}	0.493***		0.430***	0.306***
	(0.025)		(0.031)	(0.021)
$imp_{i,t-1}$		0.525***	0.286***	0.436***
		(0.026)	(0.020)	(0.032)
Ln work $_{i,t-t}$	0.035***	0.019	0.018	0.002
	(0.011)	(0.012)	(0.011)	(0.011)
Foreign owner $_{i,t}$	0.179***	0.080**	0.153***	0.013
	(0.039)	(0.039)	(0.038)	(0.039)
Ln TFP $_{i,t-1}$	0.011	0.016**	0.007	0.010
	(0.007)	(0.007)	(0.007)	(0.007)
Ln TFP mean $_{i,t-1}$	0.011	0.012	-0.005	0.006
	(0.011)	(0.012)	(0.011)	(0.012)
Ln work mean $_{i,t-t}$	0.016	0.012	0.016	0.004
	(0.015)		(0.014)	
ie_i	-0.015		0.022	
	(0.026)	(0.015)	(0.028)	(0.015)
ii_i		0.018		0.061**
		(0.026)		(0.028)
Year dummies	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes
Observations	1889	1867	1882	1863

Notes: The dependent variables are the natural logs of the percentage of exports over total sales of a firm and the percentage of material purchases imported. t-1 means lagged values of these variables. Standard errors are in brackets, where *** p<0.01, **p<0.05, * p<0.1. ie_i denotes initial exporter dummy. ii_i means initial importer dummy. Industrial and year dummies included. TFP $_{i,t}$ denotes total factor productivity, it is obtained using the Levinsohn-Petrin (2003) procedure; TFP $_{i,t-1}$ are lagged values of TFP $_{i,t}$; work $_{i,t}$ denotes the average number of workers and work $_{i,t-1}$ are aged value of the variable; $x_{t,i}$ are a dummy variable that takes value 1 if the firm is exporting and 0 otherwise, $x_{t,i-1}$ are the corresponding lagged value and foreignowner $_{i,t}$ is a dummy variable that takes the value of 1 if the firm is owned by foreigners and 0 otherwise.

6. Conclusions

According to the recent literature investigating the relationship between productivity and international trade, firms involved in international activities are larger and more productive than domestic-only firms. The bulk of the literature has mainly focused on the export side, disregarding the importance of importing activity. It has been only recently that more attention has been paid to the import side of internationalization strategies (Muûls and Pisu 2009; Bas 2012; Aristei et al. 2013; Kasahara and Lapham 2013; Lo Turco and Maggioni 2013). These studies show the presence of cost complementarities in both activities, indicating that importing intermediates is crucial to

[8] Results including lagged values of $exp_{,t}$ and $imp_{,t}$ where the dependent variable is $exp_{i,t-1}$ and $imp_{i,t-1}$, are available upon request.

start exporting and to stay in foreign markets. These cost complementarities have motivated a new strand of research that further investigates the relationship between firm's import and export activities, especially those focused on the use of imported intermediates and their role in enhancing exports. In this paper we contribute to this research by providing new evidence for Egypt. More specifically, using firm-level data for 519 manufacturing companies in Egypt, we first estimate the two-way traders and importer- and exporter-only premia with respect to non-traders. Our findings show that firms involved in international activities have higher productivity, are larger, own more capital and invest more than domestic-only firms. In particular, two-way traders are the best performers in terms of all outcome variables, followed by exporter-, importer-only and non-traders. Secondly, we investigate the relationship between exporting and importing activities by estimating dynamic panel-Probit models for the extensive margin of exports (imports) and panel-Tobit models for the intensive margin of exports (imports). We use the solution proposed by Rabe-Hesketh and Skrondal (2013) that improve Wooldridge (2005) for initial condition problem in dynamic models.

The results indicate that both activities are significantly interrelated and that sunk costs are higher for import than for export activities, with both activities showing a high degree of hysteresis. Moreover, past productivity does affect the extensive and intensive margin of imports, but not the export side and the initial condition status is also only relevant for the import side.

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Appendix

Table A.1 Variables description

	Variable	Description
Dependent Variables	$x_{i,t}$	Dummy variable that take value 1 if firm export in year t
	$m_{i,t}$	Dummy variable that take value 1 if firm import inputs in year t
	$exp_{i,t}$	Percentage of total sales exported in t
	$pm_{i,t-1}$	Percentage of purchases of materials inputs imported
Firm characteristics	**Work** $_{i,t}$	Average number of workers in t
	Foreign owner$_{i,t}$	Percentage of the firm owned by a foreign Arabic owner and by other foreign owner
	Capital$_{i,t}$	Total fixed tangible assets
	Sales$_{i,t}$	Total sales in t. Value in thousands of Egyptian pounds. Not defalted
	Investment$_{i,t}$	Net book value of machinery and equipment
	Tfp$_{i,t}$	Levinsohn and Petrin (2003) TFP
Total Factor Productivity	**Capitaldef**$_{i,t}$	Total fixed tangible assets deflated by the Production price index for manufactures
	Materialsde $_{i,t}$	Total purchases of raw material and intermediate goods deflated by the Production price index for manufactures
	Salesdef$_{i,t}$	Total sales in t. Value in thousands of Egyptian pounds. We deflate sales using the Production price index for manufactures using 2005 year as a base years.

A.2 Total Factor Productivity (TFP) Estimation

To calculate TFP estimates of a traditional Cobb-Douglas production are obtained. The Cobb-Douglas production function is given by:

$$\text{lnsales}_{i,t} = \beta_0 + \beta_l \ln \text{work}_{i,t} + \beta_m \text{lnmaterialsdef}_{i,t} + \beta_k \text{lncapitaldef}_{i,t} + \omega_{i,t} + \eta_{i,t} \quad (9)$$

where all the variables are in natural logarithms, $\text{sales}_{i,t}$ is total sales of firm in year t, in thousands of Egyptian pounds. As independent variables we include $\text{work}_{i,t}$ defined as the average number of workers, $\text{materials}_{i,t}$ denotes the total purchases of raw material and intermediates goods, $\text{capital}_{i,t}$ denotes the total fixed tangible assets of the firm and the error term id discomposed into $\omega_{i,t}$, which indicates productivity socks and an i.i.d. error term given by $\eta_{i,t}$. We deflate firm level sales and input expenditures using the industry level production price index for manufactures using 2005 as a base year, the data comes from the International Financial Statistics (IFS and UN) for manufacturing.

When researchers estimate TFP using firm level data they have to deal with different bias associated with input and output firm level data. The existing literature proposes a number of avenues to overcome these problems. The first bias is caused by simultaneity between firm inputs choice and the unobserved productivity level. A second bias emerge when the firm makes its input choice conditional on its survival, which means that there is a correlation between the unobserved productivity and the firm's capital, conditional to being in the dataset. A third bias appears because industry-level price data are used to deflate output and inputs and to proxy these variables as quantities. The problem is that under imperfect competition in input or output markets, inputs and output prices used as deflators must be correlated with firm level deviations of inputs or outputs. The literature has not yet provided a formal solution to deal with this bias. Finally, a fourth bias is related to the fact that firms can produce different products with different in production technologies, to deal with this aspect Bernard et al (2009) propose use the number and type of products of the firm and use them to allow for varying technology parameters in the production function. An alternative solution is to estimate different regressions for firms that produce a single product and for multi-product firms. Also a measurement problem arises because the true value of the capital stock is difficult to mesure, in particular due to the fact that the depreciation rate and the initial stock of the firm are unknown. Given that the available methodologies deal with different biases, in what follows we present a number of alternative estimates of the coefficients of the

production function used to obtain TFP, as proposed by Van Beveren (2012). Table A.2 shows several estimates that overcome the abovementioned biases.

Column 1 in Table A.2 shows the classical OLS estimates that are subject to endogeneity and selection biases. In column 2 the model is estimated with firm fixed effects, controlling for time-invariant unobserved heterogeneity which is firm-specific. The third alternative, (column 3), was proposed by Levinsohn and Petrin (2003), who proposed to estimate the production function using inputs as control. Finally, column 4 shows the coefficients estimated by using Olley and Pakes (1996) method. Olley and Pakes (1996) propose a three steep procedure. In the first steep the unobserved productivity is obtained for each firm using their level of investment, in the second step we obtain the survival probability of the firm and the last steep employs the outcomes of the previous two steps to control for simultaneity and selection biases. Consistent and unbiased estimates of the production function are used to obtain unbiased estimates of TFP, which is computed as the residual of the estimated production function. We decide to use TFP estimated using the Levinsohn and Petrin (2003) as independent variable in the export and import models because this methodology control for two important biases, namely, simultaneity and self-selection and our data availability do not allow use obtain accurate values of the firm investments.

Table. A.2. Product function estimates

	OLS	FE	LP reg	OP reg
$lncapitaldef_{i.t}$	0.085***	0.081***	0.055***	0.081***
	(0.011)	(0.012)	0.010	(0.029)
$lnwork_{I,t}$	0.350***	0.372***	0.363***	0.606***
	(0.020)	(0.025)	0.019	(0.042)
$lnmaterialsdef_{i,t}$	0.603***	0.611***	0.608***	0.315***
	(0.012)	(0.014)	0.012	(0.043)
Number of observations	2429	2429	2429	2480

Note: where OLS denotes Ordinary Least Squares, FE denotes OLS fixed effects, LP denotes, Levinsohn and Petrin, and OP denotes Olley and Pakes. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.