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Imported intermediate inputs and Egyptian exports: Exploring the links

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Castellón (Spain)

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Abstract

This paper aims at exploring the links between firms' exporting and importing activities in Egyptian firms. With this aim, a panel dataset of 554 Egyptian manufacturing firms that contains yearly data over the period from 2003 to 2007 is used to estimate the probability of exporting /importing. According to the related literature a complementarity gain is generated when firms are involved in both activities because then they are able to internalize the common fixed costs to access a given foreign market (e.g. Kashara and Lapham, 2013). Stylized facts indicate that firms that start exporting or importing are more likely to become two-traders. The purpose of our research is to better understand this relationship in Egypt, which is the most populated and economically influential country in the Middle East. The main results show a high degree of hysteresis on past international activity, where past experience still most important to determine the continuance in the same activity and we achieve that Egyptian firm's face to higher sunk cost of imported intermediates than sunk cost faced to sell their products in foreign markets.

Keywords: Imported intermediates, exporting activity, internationalization, Egypt

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Imported intermediates inputs and Egyptian exports: Exploring the links

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 it is due to the presence of cost complementarities in both activities where once one of the both activities is carried out the second became easier. These costs complementarities have motivated a new strand of research that further investigates the relationship between imports and export activities of the firm, especially those focus in the use of imported intermediates and their role in enhancing exports. e.g. Muûls and Pisu (2009) analysed Belgium firms, Bas (2012) for only Argentinian firms, Aristei et al (2013) for firms in Eastern European and Central Asian countries, Kasahara and Lapham (2013) focus on Chilean firms, Lo Turco and Maggioni (2013) for Italian manufactured firms

Most of the existent literature has been focused on developed countries and the literature concerning developing countries is still scarce. In particular, it is still unclear whether importing intermediates generates productivity gains that add to the gains coming from learning by exporting and to what extent this is a more importance 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 evidence by investigating export and import activities of firms located in Egypt, country that to our knowledge has not been yet investigated.

In this paper we aim at exploring the links between firms' exporting and importing activities of Egyptian firms using panel data over a period of six year. With this aim we estimate the determinants of the decision to export/import using and static and dynamic panel-Probit models. 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. We also test if the same determinants are important in determining the trade intensity. We focus our study on Egypt for two reasons. Firstly, it is one of the most important countries on the MENA (Middle East and North African Countries) region in terms of population and gross domestic product (GDP) and secondly, it is a developing country and 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 restriction.

The period analyzed goes from 2003 to 2007, during which the country experienced reductions in tariff barriers and important changes in trade policy. Bensassi et al. (2011) obtained that a decrease in trade costs induced by more flexible rules of origin (RoO) for products traded with the EU, had a positive effect on Egyptian exports. This is partly because with the new RoO firms will have access to cheaper imported inputs from the EU. Simultaneously, the bilateral interim agreement between the EU and Egypt, signed in 2004 will gradually eliminate tariffs of imported products from the EU and eventually increase competition and force some firms to exit the market.

The works is organized as follows. Section 2 describes the related literature. Section 3 presents the sample used in the analysis and some descriptive data, Section 4 introduce the theoretical background and the empirical strategy and show the main results are outlined in Section 4 and Sections 5 concludes.

2. LITERATURE REVIEW

With the introduction of firm heterogeneity in models of international trade by the seminal paper of Melitz (2003), the empirical trade literature studying the link between trade and productivity has dynamically evolved over time. According to Melitz's model there is a fixed cost of exporting and firms can enter an industry by paying it, they then learn their productivity and if it is too low to be profitable are forced to leave. Hence, trade liberalization results in an increase in average productivity. The seminal theory has been extended in several directions, one of which is closely related to our research and introduces the importance of importing activities in the internationalization process of the firm.

In this section we focus on a number of papers that consider importing as a factor explaining also exporting activities and closely related to productivity of the firm. From a theoretical perspective, Kasahara and Lapham (2013) extended Melitz (2003) model with imported inputs and show the existence of some productivity gains stemming from importing inputs that allow importers to start exporting. As a result, a cost complementary effect emerges between import and export activities.

Moving to the related empirical literature, most studies that focus on foreign intermediates use different ways to explain the role that imports play in determining firm productivity and consequently in its export decision. In what follows, we classify and summarize these works. Firms can decide to use imported-inputs, use domestic-

inputs or combine both to produce final goods, and their decision to import/export are linked to the import/export fixed costs faced.

Whereas some empirical investigations find evidence confirming the self-selection hypothesis (only firms with high productivity levels become exporters), others support the learning by exporting hypothesis (firms' productivity increases after they start exporting). Most investigations focus on the export side although most recent papers also consider an import perspective[3].

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 results remain mixed and mainly depend on the characteristics of the countries considered in the analysis.

A few authors have investigated the selection and learning hypotheses from an import perspective and have analyzed 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 hypothesis finding only support for the self-selection hypothesis.

Surprisingly, only a few papers analyze the self-selection and learning hypotheses for both, importing and exporting activities. Among the empirical applications, Altomonte and Bekes (2009), Castellani et al. (2010), Bernard et al. (2007) and Muûls and Pisu (2009) provide mixed results, each of them focusing on particular aspects of the exports-imports-productivity link. On the one side, Altomonte and Bekes (2009) finds that the previous literature that analyzes the export-productivity link without taking into account the import decision overestimate the export gains. On the other side, Bernard et al. (2007) obtain that two-way traders are better performers along all firm characteristics, Finally, Muûls and Pisu (2009) find that firms that only import have higher labour productivity than those than only export.

The abovementioned literature finds different channels trough, 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

[3] 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.

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 more-productive plants 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 its higher quality. Halpern et al. (2011) find that firms that import all its 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 have a higher quality than domestic inputs, especially in developing countries. Goldberg et al. (2010) show how the combined use of foreign and domestic inputs increase the product scope of Indian firms and that a better access to foreign inputs after trade liberalization is more important than the price reduction effect induced by the decrease in trade costs.

Another important aspect that is 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 has also been analyzed to understand the technology transfer linked to the imported intermediates. Smeets and Warzynski (2010) distinguish in their analysis between inputs from the OCDE and from low-income economies and analyze their impact on total factor productivity (TFP). The authors find that both affect productivity in a similar way. However, Bas and Strauss-Kahn (2011), which compare imported inputs form developed and developing countries for French firms, find that foreign intermediates from developed countries increase TFP a 20 percent more than inputs from less developed countries. They also find that importing more varieties of intermediate inputs increase TFP and also the number of exported varieties of French firms.

Other authors have focused their attention on analyzing how trade liberalization in intermediate inputs affects productivity. Amiti and Konings (2007) was one of the first authors to estimate the relationship between trade liberalization affecting imported inputs and productivity. They analyze, using Indonesian data, the productivity gains coming from reducing tariffs on final goods and on intermediate inputs separately, showing that a ten percent reduction in input tariffs lead to a productivity gain of 12 percent for firms that use imported inputs and that this gain is twice as large as gains from reducing tariffs in final goods. Bas (2012) studies the impact of input-trade liberalization and the firms export decision for Argentinean firms, finding that a reduction in input-tariff from foreign intermediates enhances Argentinean firms' performance in the export market and also increase 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 to the opportunity to have access to new intermediate inputs that allow firms to create new varieties in the domestic market.

Despite the increasing number of studies that investigate the relationship between trade and imported intermediates using micro data, only a few of them focus on firms located in MENA countries. 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 investigates the implications for economic development and job creation, as well as the main economic policy recommendations in this context. She finds that one of the major constraints to improve 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. In another study, Atiyas (2011) summarizes the research that uses firm-level data in MENA countries to analyze productivity and its relation to trade, trade policy and financial constraints. He also identifies the main research questions that could be addressed in the near future using the firm-level data available from the World Bank. He emphasizes the fact that the recently available firm-level data covering MENA countries provided by the World Bank Enterprise Survey (WBES) have not yet been utilized by researchers to investigate the relationship between trade and productivity, for these reason we want exploit the availability of this dataset to run our analysis profiting of the raw data characteristics. Our work aims to analyze the relationship between exporting and importing activities in Egyptian firms and how both are linked to extract 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

3.1. Database

Data on Egyptian firms are obtained from the World Bank Enterprise Survey dataset[4]. The dataset includes 3,129 firms for the years 2004, 2005 and 2007. For some variables, namely sales, exporting and importing status

[4] 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 labor sections of the survey, which covers a broad range of business environment topics including access to finance, corruption, infrastructure, crime, competition, and performance measures.

we are able to use information for an additional year per questionnaire, since each firm is asked in the questionnaire for the value of sales and the export/import status in the current and the previous year. Some firms are only included in one or two years, whereas 554 firms are included in the three questionnaires. Hence using the available information for these firms we build a panel dataset from 2003 to 2007 obtaining 2,770 observations. Table 1 show that firms involve in international activities perform better than only domestic firms. If we distinguish between the three types of international firms, we observe that firms with higher productivity are more often two-way traders than only exporters or only importers and domestic firms have the lower average productivity. It is also worth to notice that two-way traders are bigger in size than only importer and only exporter firms and investment more. We also observe that firms that are owned by foreigners are more focused on international activities.

Table 1.Descriptive statistics by trade status

Variable	Obs	Mean	Std.	Min	Max
Exporters only					
$TFPlp_{i,t}$	182	7.11	1.68	0.95	10.35
$llabp_{i,t}$	200	4.11	1.67	-2.68	11.49
$work_{i,t}$	188	251.45	478.84	8	2,800
$foreignowner_{i,t}$	191	0.10	0.31	0	1
$px_{i,t}$	191	39.92	32.91	0.5	100
$pm_{i,t}$	191	0	0	0	0
$capital_{i,t}$	180	20,229.64	53,644.1	50	531,419
$investment_{i,t}$	185	124,822.60	1,541,717	0	2.10e+07
Importes only					
$TFPlp_{i,t}$	258	6.98	1.61	-0.95	11.39
$llabp_{i,t}$	281	4.12	1.55	-3.48	10.68
$work_{i,t}$	281	250.75	907.84	8	13,695
$foreignowner_{i,t}$	281	0.06	0.23	0	1
$px_{i,t}$	281	0	0	0	0
$pm_{i,t}$	281	50.84	31.19	1	100
$capital_{i,t}$	253	192,808.40	1,446,639	0	1.57e+07
$investment_{i,t}$	262	119,439.10	1,228,527	0	1.46e+07
Two-way traders					
$TFPlp_{i,t}$	297	7.83	1.76	0.98	14.37
$llabp_{i,t}$	317	4.11	1.60	-2.84	10.44
$work_{i,t}$	314	634.40	1206.94	0	13,15
$foreignowner_{i,t}$	316	0.11	0.31	0	1
$px_{i,t}$	316	39.02	33.81	0.9	100
$pm_{i,t}$	316	47.25	29.08	2	100
$capital_{i,t}$	298	129,055.70	698,418.30	5	9,800,000
$investment_{i,t}$	297	163,132.00	1,734,164	0	2.67e+07
Domestic					
$TFPlp_{i,t}$	1646	5.44	1.48	1.41	12.93
$llabp_{i,t}$	1745	3.33	1.31	-2.74	11.14
$work_{i,t}$	1770	69.11	427.99	0	10,500
$foreignowner_{i,t}$	1783	0.02	0.12	0	1
$px_{i,t}$	1783	0	0	0	0
$pm_{i,t}$	1783	0	0	0	0
$capital_{i,t}$	1639	33,258	476,477.50	0	1.22e+07
$investment_{i,t}$	1686	9014.56	159,121.50	0	6,305,686

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, it is obtained Levinsohn and 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; $foreignowner_{i,t}$ is a dummy variable that take the value of 1 if the firm is owned by foreigners and 0 otherwise; $px_{i,t}$ is the percentage of total exports by sales and $pm_{i,t}$ is the percentage of total imports by sales

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.

3.2. Trade status description

Table 2 shows the evolution over time of exporting and importing status of Egyptian firms. The percent of only-exporters and only-importers remain rather stable over time around 8 and 11 percent on average respectively. We observe that only 7 percent of all firms in our sample were involved in both importing and exporting activities in 2003. This number has increased over time, and has reached 16 percent of the number of total firms in 2007. Last part of Table 2 shows the percentage of the imported inputs used by only- importers and two-way traders, showing that on average more than half of the inputs used in production are imported and the share has not increased over time and it is rather stable for both type of firms.

Table 2. Sample composition by trade status and percentage of imported inputs

	Percentage of firms that are:				% of imported intermediate goods	
Year	Exporters	Importers	Both	Domestic	Importers	Both
2003	7%	13%	7%	73%	54%	49%
2004	7%	12%	13%	68%	57%	48%
2005	6%	10%	15%	69%	50%	46%
2006	10%	9%	10%	71%	48%	49%
2007	9%	11%	16%	64%	51%	48%
Average	8%	11%	12%	69%	52%	48%

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

Table 3 displays the relative importance of each industry in the sample. Firms are classified into nine industrial categories, of which three of them comprise the 66 percent of the interviewed firms, namely, other industries, metal industries and textiles. The majority of them are focused on the domestic market. In particular, garments, non-metal industries and other industries, for which around 70-80 percent of their activity is domestic, followed by textiles and metal industries also close to 70 percent of domestic activity.

Despite the fact that Egyptian firms are very focused on the domestic market, when they are involved in

Table 3. Number of firms by industry and trade patterns

	Agro industries	Chemicals	Electronics	Garments	Machinery & Equipments	Metal industries	Non metal industries	Other industries	Textiles	Total
Num. firms	45	185	35	325	65	520	280	835	480	2,770
% of total	2%	7%	1%	12%	2%	19%	10%	30%	17%	100%
Importers	16%	22%	36%	5%	22%	13%	9%	8%	12%	
Exporters	11%	9%	0%	7%	11%	8%	7%	8%	7%	
Both	13%	26%	0%	8%	20%	11%	8%	13%	13%	
Domestic	60%	43%	64%	80%	48%	68%	76%	71%	68%	
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Note: Authors elaboration.

international activities they are mostly engaged in both activities, rather than in only one of them. There are only a few exceptions for some industries in which one of the international activity is more important than the other. This is the case for electronics, for which import of intermediate goods represents a higher share than exports. It seems that firms in this industry import intermediate goods mainly to produce products for the local market, also the chemical industry shows 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 into account industry effects in our analysis.

3.3. How different are Egyptian traders?

Empirical literature shows that international firms differ from only domestic firms in different aspects. After Bernard and Jensen (1999) seminal work, many authors has been interested in analyse the relationship between export activity and firms' characteristics. Some of them have been focus in study the causality between firm export activity and firm productivity and trying to link both activities. Two basic hypotheses serve to explain this relationship. The first is the self-selection hypothesis and it assume that only the most productive firms can start to export due to the presence of different export costs and the second hypothesis, namely learning by exporting hypothesis, suggest that firms involved in international trade need to deal with more competition than domestic firms and that they have access to new knowledge driven by customers, competitors or technology and these increase their firm productivity. Initially, authors were focus only in better understand exporting activity negligent their analysis from an importing perspective due to the limitation of imports data availability. Bernard et al (2007) highlight that, and using data from United States they compare the characteristics of exporters and importers firms obtaining an importer and exporter premia, higher for firms than only import. After Bernard et al (2007) paper the interest of analyse the role of imports and firm behaviour boost, specially the links between importing activity and firm productivity, in this line also self-selection hypothesis and learning by importing are used to explain the relationship of imports and firms productivity.

Following works that analyse how firm trade status affects firm characteristics; we obtain the exporter and importer premia for Egyptian firms. Exporter/importer premia are conventionally obtained by regressing the dependent variable, traditionally expressed as TFP, labour productivity, wages, number of workers or capital among others, on a exporter/impoter dummy and other control variables as explanatory variables using OLS estimations. The estimated coefficients of the dummy trade variable show the exporter/impoter premia meaning simple correlations between the dependent variable and the trade dummy variables used. In this point a causal

interpretation of the results must be use carefully. The main idea is to confirm the existence of an export/import premium for Egyptian international firms that will be in accordance with the related empirical literature and better understand the international Egyptian firms behaviour. To our knowledge only Kiendrebeogo (2012) analyse the Egyptian manufactured sector and how Egyptian firms perform better depending their export activity. He obtains that exporter firms are larger, more capital intensive and more productive than only domestic firms. He also examine the self-selection and learning by exporting hypothesis obtaining than exports have a positive impact on firm productivity for Egyptian firms and that pre-entry differences in productivity do not explain firm export decision.

Our aim is test if this results still robust when we include also import activity. Both activities may be taking place jointly, and some exporters are also importers, and conversely, for this reason similar to Altomonte and Bekés (2010), Muûls and Pisu (2009), we distinguish between only importers, only exporters and two-way traders to better understand the characteristic of international Egyptian firms compared with only domestic firms.

We obtain the importer and exporter premia estimating an equation where the dependent variable are different measures of firm performance and we include as explanatory variables their import and export status and other control variables explained below. The estimated equation is:

$$\ln F_{i,t} = \alpha_0 + \alpha_1 d_{i,t}^{xo} + \alpha_2 d_{i,t}^{mo} + \alpha_3 d_{i,t}^{xm} + lwork_{i,t}\beta + \gamma_k, \delta_t + \varepsilon_i \quad (1)$$

where $\ln F_{i,t}$ is a vector of firm characteristics using as dependent variables the TFP (Log TFP $_{i,t}$)[5], labour productivity measured as average number of sales by worker (Log labp $_{i,t}$), the firm size proxied by the average number of workers (Log work $_{i,t}$), also we analyse capital (Log capital $_{i,t}$) and the investment (Log investment$_{i,t}$). As explanatory variables we include $d_{i,t}^{xo}$ that is a dummy variable taking value one if firm only export, $d_{i,t}^{mo}$ takes value one if the firm only import and $d_{i,t}^{xm}$ takes value one if firm are two-way trader. As a control variable when the dependent variable is not employment we include the size of the firm $lnwork_{i,t}$ measured as the average number of works. We also include industry dummies and year dummies to take into account for any fixed effects common across industries and to control for potential measurement errors and also to control for business cycles. We estimate simple OLS fixed effects regressions.

Table 4 presents the estimates trade status premia obtained from a pooled OLS regression for all industries.

[5] TFP has been obtained using Levinsohn and Petrin (2003) methodology and it is obtained using *levpet* command in Stata13.

Table 4. Exporter and importer premia

Dependent Variable	Log labp $_{i,t}$		Log TFP $_{i,t}$		Log work $_{i,t}$	Log capital i,t	Log investment$_{i,t}$
Only Exporters	0.619***	0.624***	1.383***	0.624***	1.011***	0.575***	0.793***
	0.130	0.138	0.161	0.138	0.132	0.192	0.185
Only Importers	0.507***	0.512***	1.233***	0.512***	1.037***	0.823***	0.603***
	0.113	0.116	0.134	0.116	0.108	0.176	0.161
Both	0.611***	0.620***	2.033***	0.620***	1.943***	0.794***	0.740***
	0.125	0.142	0.147	0.142	0.125	0.200	0.186
Log work $_{i,t}$		-0.004		0.683***		0.535***	0.859***
		0.034		0.034		0.051	0.045
Year Dummies	yes	yes	yes	yes	yes	yes	yes
Industry Dummies	yes	yes	yes	yes	yes	yes	yes
Observations	2383	2383	2383	2383	2547	1850	2372
R2	0.20	0.20	0.27	0.20	0.51	0.19	0.27

OLS fixed effect regression, robust and standard errors reported below each coefficient. *** denotes statistical significance at the 0.01 level. TFP $_{i,t}$ is total factor productivity, obtained using Levinsohn and Petrin (2003) procedure using *levpet* command in Stata13. *Only Exporters* denotes firms that sell into the domestic market and only export; *Importers* denotes firms that sell into the domestic market and only import; *Both* refers to firms that are two-way traders and also sell in the local market and *Domestic* indicate firms that only sell in the local market and are not engaged in international activities.

Results show similar estimated coefficients for labour productivity and TFP, when we control for firm size. In general we observe as Bekés et al (2011) and Altomonte and Bekés (2010), that firms involve in international trade independently of their pattern have higher productivity, are largest and own more capital and investment more than only domestic firms. If we analyse what firms perform better in function of their international trade pattern we observe that only exporters and two-way traders have similar estimated coefficients being only exporters the most productive with a 87 per cent[6] of higher productivity than only domestic firms and a 86 per cent of higher productivity for two-way traders compared with only domestic. Only importers show to be the less productivity compared with the other international firms but still a 67 per cent above compared with domestic firms.

4. THEORETICAL BACKGROUND AND EMPIRICAL STRATEGY

4.1. THEORETICAL BACKGROUND IMPORTS AND EXPORTS COMPLEMENTARITIES

Kashara and Lapham (2013) develop a model for an open economy with heterogeneous final goods producers, in which the firm takes simultaneously the decision to export their output and to use imported intermediates. The authors extend Melitz (2003) model by incorporating importing costs into it and use it to test the relationships between plant productivity and export and import status of Chilean firms.

The model is based in an open economy in which the final goods sector is composed by monopolistically competitive firms producing horizontally differentiated goods using labour and an intermediate good. Firms have

[6] Percentages obtained as ((e^cof)-1)*100)

to pay a fixed cost to entry into the foreign market in order to import and export. They also introduce the productivity of the firm, transport costs for importing intermediates and for exporting final goods and take into account the different trade status of the firm to capture observed changes in the firm's trade status over time in the data. That is, they consider whether a firm is only importer, only exporter, 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 productivity firms are able to operate as such, although if it exist some common fixed cost for both activities the firms that are one trader are more likely to start exporting and after a while become two-way traders.

4.2. MODELLING THE DECISION TO EXPORT AND IMPORT

4.2.1. EXTENSIVE MARGIN OF TRADE

In order to estimate the determinants of export and import decisions, 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 extend the models by introducing past import-status in the exporting equation and past export-status in the import equation. The estimated equations for exports and imports are given by,

$$\Pr(x_{i,t} = 1) = f[\mathrm{m_{i,t-n}}, \ln(TFP_{i,t-n}), \ln(work_{i,t-n}),\ foreignowner_{i,t}, \gamma_k, \delta_t, \varepsilon_i] \quad (1)$$

$$\Pr(m_{i,t} = 1) = f[\mathrm{x_{i,t-n}}, \ln(TFP_{i,t-n}), \ln(work_{i,t-n}),\ foreignowner_{i,t}, \gamma_k, \delta_t, \epsilon_i] \quad (2)$$

where ln denotes natural logarithms, the subscript *i* indexes firms; *t*, indexes time and *n* takes value 0 when the value of the variable are used in the current year and takes value of 1 if the first lag of the variable is included. The dependent variable in equation (1), Pr($xt_{i,t}$=1), denotes the probability of exports and it 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 (2), PR($mt_{i,t}$=1), is the probability of importing, which takes the value of 1 if firm *i* imports in year *t*, and 0 otherwise. $m_{i,t-n}$ is a dummy variable reflecting the import status of the firm in year t-n and $x_{i,t-n}$ is a dummy variable indicating the exporting status of the firm in year t-n, TFP_{it-n} is total factor productivity of the firm. It has been obtained using Levinsohn and Petrin (2003) methodology[7], $work_{it-n}$ denotes the average number of workers in t-n, and $foreigowner_{i.t}$ is a dummy variable that takes the value of 1 if the firm is owned by foreigners and 0

7 The TFP variable used in our empirical analysis is based on Levinsohn and Petrin (2003) procedure. We explain the choice of this methodology and the estimation, as well as the alternative ways to calculate TFP in Appendix A.2.

otherwise[8]. 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).

Industry (λ_k) and time dummies (δ_t) have been also 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. The parameters of equations (1) and (2) are estimated using a panel-Probit model[9] based on maximum likelihood estimation techniques for the period 2003-2007.

Tables 5 show the results of estimating equations (1) and (2). Two sets of results are presented for the extensive margin of exports (columns 1-2) and imports (columns 3-4). The first specification for both models includes the first lag of the independent variables and the results indicate that the use of imported intermediates increase the probability to start exporting (column 1, Table 5) and export in the past year also increase the probability to import in the current year (column 2, Table 5) Size, TFP and be owned by foreigners also increase the probability to be involve in international trade, where he importance of be owner by foreigner is more important to explain the exports activity than for import and also the use of intermediates is more important to export than export to explain imports. Industry and time dummies are included in the regression and we observe that firms in chemicals, garments, machinery and equipment's and other industries show a higher probability to export in comparison to the default category (Agro-industries and electronic industry). In addition, firms have less probability of importing intermediates in 2006 in comparison to 2003 and 2004, which could be related to the entry into force in 2004 of the free trade agreement (FTA) with the European Union and according to which imports from Europe have been progressively liberalized and that in 2007 Egypt liberalize also with Turkey and EFTA countries, where firms postpone their importations.

Despite the fact that current productivity can lead to some endogeneity problems, we introduce the current and past TFP with the aim of identifying the channel through which imports affect exports. When we control for current productivity and we also include the lagged values of the independent variables. We observe that for exports (column 2) the past import status is not significant, this imply that past status is correlated with past productivity and that only imports in the current year affect the probability to export in this year. In the otherwise we observe in column 4 that when we control in the import model for past productivity, we obtain that past and current productivity increase the probability to import, so productivity are explaining that Egyptian firms decide

[8] We also used alternatively the percentage of the firm owned by a foreigner, but since a high or low percentage of foreign ownership have approximately the same effect, for this reason we decide to create a 1/0 dummy.

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

to import in the current year and we observe that past productivity are correlated with past export status but not for the current exports. In this line, firms might be importing intermediates in the current year in order to produce a final good that could be exported in the following year, otherwise, firms might import intermediate goods because they profited from exporting in the previous year and through exporting are able to achieve higher productivity levels.

Table 5. Probit baseline results (Intensive margin for exports and imports)

	$x_{i,t}$	$x_{i,t}$	$m_{i,t}$	$m_{i,t}$
$lwork_{i,t-t}$	0.390***	0.080	0.373***	0.006
	(0.050)	(0.071)	(0.050)	(0.072)
$lwork_{i,t}$		0.441***		0.516***
		(0.071)		(0.078)
$ltfp_{i,t-1}$	0.134***	0.043	0.163***	0.134***
	(0.035)	(0.043)	(0.036)	(0.045)
$ltfp_{i,t}$		0.172***		0.089*
		(0.044)		(0.047)
$m_{i,t-1}$	0.378***	-0.014		
	(0.124)	(0.159)		
$m_{i,t}$		1.308***		
		(0.165)		
$x_{i,t-1}$			0.288**	-0.182
			(0.128)	(0.171)
$x_{i,t}$				1.488***
				(0.179)
$foreignowner_{i,t}$	0.893***	0.492*	0.440*	-0.306
	(0.241)	(0.293)	(0.252)	(0.319)
chemicals	1.119**	1.250**	0.554	0.480
	(0.464)	(0.576)	(0.431)	(0.561)
garments	0.851*	1.233**	-0.489	-0.869
	(0.452)	(0.567)	(0.425)	(0.565)
machinery & equipments	1.047*	1.133*	0.205	-0.248
	(0.543)	(0.685)	(0.541)	(0.723)
metal industries	0.704	0.833	-0.096	-0.262
	(0.431)	(0.537)	(0.394)	(0.513)
non metal industries	0.598	0.839	-0.676	-1.028*
	(0.454)	(0.566)	(0.430)	(0.563)
other industries	0.707*	0.901*	-0.410	-0.774
	(0.424)	(0.527)	(0.386)	(0.505)
textiles	0.638	0.772	-0.158	-0.410
	(0.434)	(0.541)	(0.397)	(0.519)
2005	-0.062	0.007	-0.047	-0.006
	(0.127)	(0.152)	(0.124)	(0.151)
2006	-0.133	-0.214	-0.372***	-0.592***
	(0.126)	(0.160)	(0.126)	(0.163)
2007	-0.089	-0.099	-0.185	-0.244
	(0.130)	(0.153)	(0.127)	(0.154)
cons	-4.255***	-6.028***	-3.186***	-4.374***
	(0.490)	(0.666)	(0.441)	(0.617)
obs	1883.000	1850.000	1885.000	1852.000
aic	1448.464	1164.991	1531.713	1256.998
bic	1537.114	1269.927	1620.38	1361.954

Notes: Dependent variables are dummy variables for the exporter and importer status. t-1 means lagged values of these variables. Standard error in brackets where *** p<0.001, **p<0.05, * p<0.01. Industrial and year dummies included. $tfp_{i,t}$ means total factor productivity, it is obtained using Levinsohn and Petrin (2003) procedure; $tfp_{i,t-1}$ are lagged value of ; $tfp_{i,t}$; $work_{i,t}$ means the average number of workers and $work_{i,t-1}$ are aged value of the variable; $x_{t,i}$ are a dummy variable that take value 1 if the firm is exporting and 0 otherwise, $x_{t,i-1}$ are the lagged value and $foreignowner_{i,t}$ are a dummy variable that take value 1 if the firm is owned by foreigners and 0 otherwise

To further investigate the dynamics of models (1) and (2) we add as explanatory variables the lagged left hand side variables. In this way we will be able to investigate the existence of state dependence, also named hysteresis in the export and import status. 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 initial condition as exporter/importer of the firm. 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 main complication 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 variable variables as additional regressors. This technique has been improved by Rabe-Hesketh an Skrondal (2013).

Therefore we follow a similar strategy as Aristei et al (2013) and Muûls and Pisu (2009) but use instead a more reliable estimation technique that will able us to disentangle the effect of the initial conditions from the effect of the past export/import status of the firm on the decision to export/import.

We use the approach proposed by Rabe-Hesketh an Skrondal (2013) 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 related literature used Wooldridge's auxiliary model to deal with the problem. However, as stated by Rabe-Hesketh an Skrondal (2013), Wooldridge's (2005) method performs poorly for shorts panels, mainly because if the means are based on all periods, the initial conditions are also used to compute those means and this induce endogeneity. The authors suggest including the initial-period as explanatory variable and calculate the mean only using the remaining periods, that is t+1 until n. We follow this strategy and estimate the following models:

$$\Pr(x_{i,t}=1) = f[\,(\mathrm{x_{i,t-1}}), (\mathrm{m_{i,t-1}}), \ln(tfp_{i,t-n}), \ln(work_{i,t-n}),\ \ (foreignowner_{i,t}), \gamma_k, \delta_t, u_i] \quad (3)$$

$$\Pr(m_{i,t}=1) = f[,(\mathrm{m_{i,t-n}})\,(\mathrm{x_{i,t-n}}), \ln(tfp_{i,t-n}), \ln(work_{i,t-n}),\ \ (foreignowner_{i,t}), \gamma_k, \delta_t, u_i] \quad (4)$$

where the dependent variables are binary variables that take value one when a firm export (import) and zero otherwise. As independent variables we include the lagged dependent variable and the lagged importer (exporter) status. As control variables we include the same control variables as in models (1) and (2); TFP, size of the firm and a dummy variable indicating whether a firm is owned by foreigners, all the control variables apart from $foreignowner_{i,t}$ are in logs. We also include industrial and time dummies (γ_k, δ_t) and those other firm-level specific effects that are unobserved are captured by u_i, ε_i. As in Wooldridge (2005) we assume that u_i, (ε_i), the firm specific effects are determined by,

$$u_i\,(\varepsilon_i) = \beta_0 + \beta_1 x|m_{i0} + \beta_2 \overline{ltfp_i} + \beta_3 \overline{lworkt_i} + \mu_i \quad (5)$$

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 (calculated by excluding the initial period). However as Rabe-Hesketh and Skrondal (2013) suggest the firm-level average much be obtained excluding the initial period and then adding a dummy in the regression (ie_i), (ii_i) capturing whether firm import/export in the first period of the sample. If we include now equation (5) in equations (3) and (4) we obtain:

$$\Pr(x_{i,t} = 1) = \gamma_{0+}\,\beta_0 x_{i,t-1} + \beta_1 \ln(tfp_{i,t-1}) + \beta_2 \ln(work_{i,t-1}) + \beta_3 foreignowner_{i,t} +$$

$$\beta_4 m_{i,t-1} + \beta_5 \overline{ltfp_i} + \beta_6 \overline{workt_i} + \mu_i + ie_i + ii_i + \gamma_k + \delta_t + u_i \quad (6)$$

$$\Pr(m_{i,t} = 1) = \gamma_{0+}\,\beta_0 m_{i,t-1} + \beta_1 \ln(tfp_{i,t-1}) + \beta_2 \ln(work_{i,t-1}) + \beta_3 foreignowner_{i,t} +$$

$$\beta_4 x_{i,t-1} + \beta_5 \overline{ltfp_i} + \beta_6 \overline{workt_i} + \mu_i + ie_i + ii_i + \gamma_k + \delta_t + u_i \quad (7)$$

As Muûls and Pisu (2009) and Aristei et al (2012) we test the existence of sunk cost to import and export activity. To measure the importance of these sunk cost we estimate the parameters of the two dynamic probit models from equations (6) and (7) individually and we interpret the estimated coefficients for the dependent lagged variable as a measure of the importance of sunk costs following the authors cited above, arguing that sunk cost generate hysteresis in the export, import market participation. Results from equation (6) are showed in Table 7 and from equation (7) are showed in Table 8.

The first columns of Tables7 and 8 include only the lagged value of the dependent variable. It shows that the past import/export status does indeed explain the current import/export status. Similarly, as we obtained in the previous estimations foreign ownership are also affecting both the export and import status of the firm. However,

TFP affect the probability to import but not to export and the size of the firm are important to export but not to import.

Next, in order to analyse how the combination of both export and import activities affect the probability to import/export, we include in columns (2) in Table 7 and (2) in Table 8 both activities.

According to the results, we obtain that previous export and import status affects current export and import status positively, whereas past exports does not affect current imports and past imports does not affect current exports. However we observe the lagged dependent variable wefind that past export and import participation has a high degree of hysteresis, where firms face to sunk cost to import that are larger than those face to export. Results are similar than those obtained from Muûls and Pisu (2009) where last year exporter/importer status has a positive effect on the probability to also export/import in the current year and higher for importing activity. Contrary we do not find that past imports affect the probability to export in the current year and that past exports do not affect the probability to import in the present year due that the lagged variable of import and export activity has not statistical significance, the effect appears when we include the current importer and exporter status, results are shown in column 3 of Table 7 an 8, meaning that actual import status affect positively the probability to export and that export in the current year also affect the possibility to import, nevertheless past experience in the same activity still most important to determine the continuance in the same activity.

Table 7. Probit Dynamic Panel Model controlling for initial conditions (Exports)

	$x_{i,t-1}$	$x_{i,t-1}$	$x_{i,t-1}$
$x_{i,t-1}$	1.489***	1.492***	1.408***
	(0.112)	(0.117)	(0.136)
$m_{i,t-1}$		-0.027	
		(0.106)	
$m_{i,t}$			1.219***
			(0.135)
$lwork_{i,t-t}$	0.130**	0.134**	0.071
	(0.056)	(0.057)	(0.062)
$foreignowner_{i,t}$	0.625***	0.621***	0.600***
	(0.175)	(0.175)	(0.202)
$ltfp_{i,t-1}$	0.041	0.041	0.034
	(0.036)	(0.036)	(0.039)
ltfp $mean_{i,t-1}$	0.097	0.102*	0.012
	(0.060)	(0.060)	(0.069)
lwork $mean_{i,t-t}$	0.072	0.068	0.096
	(0.073)	(0.074)	(0.083)
baseExp	-0.060	-0.065	0.162
	(0.122)	(0.122)	(0.157)
chemicals	0.782**	0.786**	0.696*
	(0.325)	(0.327)	(0.366)
garments	0.760**	0.754**	0.856**
	(0.323)	(0.324)	(0.365)
machinery & equipments	0.761**	0.756**	0.793*
	(0.368)	(0.370)	(0.418)
metal industries	0.675**	0.672**	0.711**
	(0.309)	(0.310)	(0.345)
non metal industries	0.596*	0.591*	0.785**
	(0.323)	(0.324)	(0.364)
other industries	0.648**	0.641**	0.759**
	(0.304)	(0.306)	(0.341)
textiles	0.610**	0.609*	0.649*
	(0.311)	(0.312)	(0.348)
2005	-0.182	-0.192	-0.150
	(0.121)	(0.121)	(0.135)
2006	-0.180	-0.191*	-0.042
	(0.115)	(0.116)	(0.128)
2007	-0.033	-0.045	0.059
	(0.119)	(0.120)	(0.133)
cons	-3.424***	-3.432***	-3.352***
	(0.381)	(0.387)	(0.478)
obs	1889	1880	1882
aic	1293.017	1292.134	1148.389
bic	1398.349	1402.915	1259.191

Notes: Dependent variables are dummy variables for the exporter and importer status. t-1 means lagged values of these variables. Standard error in brackets where *** p<0.001, **p<0.05, * p<0.010. baseImp means initial importer dummy. $tfp_{i,t}$ means the lagged value of the total factor productivity, it is obtained using using Levinsohn and Petrin (2003) procedure; $work_{i,t-1}$ are the lagged value of the average number of workers; $m_{t,i}$ are a dummy variable that take value 1 if the firm is importing and 0 otherwise, $m_{t,i-1}$ are the lagged value; $x_{t,i}$ are a dummy variable that take value 1 if the firm is exporting and 0 otherwise and $foreignowner_{i,t}$ are a dummy variable that take value 1 if the firm is owned by foreigners and 0 otherwise.

Table 8. Probit Dynamic Panel Model controlling for initial conditions (Imports)

	$m_{i,t-1}$	$m_{i,t-1}$	$m_{i,t-1}$
$m_{i,t-1}$	1.591***	1.622***	1.427***
	(0.114)	(0.118)	(0.140)
$x_{i,t-1}$		-0.124	
		(0.106)	
$x_{i,t}$			1.342***
			(0.140)
$lwork_{i,t-t}$	0.057	0.068	-0.003
	(0.055)	(0.056)	(0.064)
$foreignowner_{i,t}$	0.319*	0.324*	0.047
	(0.177)	(0.178)	(0.218)
$ltfp_{i,t-1}$	0.063*	0.065*	0.059
	(0.036)	(0.036)	(0.041)
ltfp $mean_{i,t-1}$	0.094	0.100	0.067
	(0.061)	(0.061)	(0.075)
lwork $mean_{i,t-t}$	0.070	0.066	0.046
	(0.074)	(0.074)	(0.088)
baseImp	0.029	0.017	0.347**
	(0.118)	(0.118)	(0.170)
chemicals	0.092	0.114	-0.202
	(0.249)	(0.250)	(0.315)
garments	-0.296	-0.277	-0.683**
	(0.249)	(0.250)	(0.317)
machinery & equipments	-0.201	-0.188	-0.574
	(0.322)	(0.323)	(0.409)
metal industries	-0.189	-0.182	-0.447
	(0.227)	(0.228)	(0.285)
non metal industries	-0.456*	-0.452*	-0.775**
	(0.249)	(0.249)	(0.318)
other industries	-0.281	-0.272	-0.601**
	(0.222)	(0.222)	(0.279)
textiles	-0.214	-0.204	-0.454
	(0.230)	(0.230)	(0.288)
2005	-0.205*	-0.199*	-0.203
	(0.118)	(0.119)	(0.134)
2006	-0.406***	-0.395***	-0.445***
	(0.116)	(0.116)	(0.133)
2007	-0.006	-0.004	-0.043
	(0.117)	(0.117)	(0.134)
cons	-2.290***	-2.358***	-1.972***
	(0.316)	(0.321)	(0.418)
obs	1867	1863	1863
aic	1322.391	1321.338	1175.859
bic	1427.501	1431.937	1286.458

Notes: Dependent variables are dummy variables for the exporter and importer status. t-1 means lagged values of these variables. Standard error in brackets where *** p<0.001, **p<0.05, * p<0.010. baseImp means initial importer dummy. $tfp_{i,t}$ means the lagged value of the total factor productivity, it is obtained using Levinsohn and Petrin (2003) procedure; $work_{i,t-1}$ are the lagged value of the average number of workers; $m_{t,i}$ are a dummy variable that take value 1 if the firm is importing and 0 otherwise, $m_{t,i-1}$ are the lagged value; $x_{t,i}$ are a dummy variable that take value 1 if the firm is exporting and 0 otherwise and $foreignowner_{i,t}$ are a dummy variable that take value 1 if the firm is owned by foreigners and 0 otherwise

4.2.2. INTENSIVE MARGIN OF TRADE (static and dynamic approach)

In order to extend our analysis and provide greater robustness to our results, we analyze the impact on the intensive margin of trade measured as the log of the percentage of exports on total sales of firm and the percentage of material purchases imported. The estimated model is given by equations (8) and (9), similar than equations (1) and (2) used to the extensive margin, the only difference is that the dependent variable is $pxt_{i,t}$ proxy by the intensive margin of trade in Egypt, as the percentage of exports on total sales of firm *i* in year t, and $pmt_{i,t}$ proxy by the intensive margin of trade in Egypt, as the percentage of total purchases of materials inputs imported from firm *i* in year t. The methodology used to the estimation, in this case the parameters of the model are estimated using a Tobit procedure.

$$\Pr(px_{i,t} = 1) = f[\ln(p\mathrm{m}_{\mathrm{i,t-n}}), \ln(lTFP_{i,t-n}), \ln(work_{i,t-n}),\ foreignowner_{i,t}, \gamma_k, \delta_t, \varepsilon_i] \quad (8)$$

$$\Pr(pm_{i,t} = 1) = f[\ln(p\mathrm{x}_{\mathrm{i,t-n}}), \ln(lTFP_{i,t-n}), \ln(work_{i,t-n}),\ foreignowner_{i,t}, \gamma_k, \delta_t, \epsilon_i] \quad (9)$$

and similar than in equation (1) and (2) we propose two alternative specifications; one including only lagged values of the explanatory variables and the second including current and lagged values. Results are presented in Table 9 for the intensive margin of exports and imports, where we can observe in columns 1 and 2, that when we include the lagged values of the independent variables, we obtain that the percentage of past imports and export affect the percentage of the other activity positively and also the size, ownership and TFP are correlated with the dependent variable. Nevertheless, when we include their current values, columns 2 and 4, we highlight a causality problem. Only past and current TFP are significant for the percentage of imported intermediates, but not for the percentage exported, underlining the importance of TFP on the import activity of firms in comparison. In general results still similar than for the extensive margin.

Table 9. Tobit baseline results (Intensive margin for exports and imports)

	$px_{i,t}$	$px_{i,t}$	$pm_{i,t}$	$pm_{i,t}$
$lwork_{i,t-t}$	12.653***	-0.642	13.922***	-0.462
	(1.823)	(1.932)	(1.862)	(2.141)
$lwork_{i,t}$		16.620***		17.545***
		(2.029)		(2.254)
$ltfp_{i,t-1}$	5.715***	2.290*	7.113***	3.664***
	(1.365)	(1.261)	(1.432)	(1.393)
$ltfp_{i,t}$		4.984***		4.708***
		(1.282)		(1.418)
$pm_{i,t-1}$	0.230***	0.109		
	(0.074)	(0.071)		
$pm_{i,t}$		0.359***		
		(0.069)		
$px_{i,t-1}$			0.256***	-0.006
			(0.089)	(0.096)
$px_{i,t}$				0.527***
				(0.093)
$foreignowner_{i,t}$	30.886***	30.693	21.344**	18.175
	(9.030)	(19.894)	(9.845)	(18.018)
Chemicals	34.083*	31.406	19.018	-30.757*
	(20.043)	(19.409)	(18.088)	(18.199)
Garments	32.145*	26.342	-23.676	-5.309
	(19.447)	(23.801)	(17.959)	(23.063)
Machinery & Equipments	36.384	14.585	1.765	-11.762
	(23.617)	(18.592)	(22.654)	(16.619)
Metal industries	18.631	16.374	-9.871	-37.250**
	(18.666)	(19.533)	(16.648)	(18.182)
Non metal industries	18.005	18.536	-34.717*	-24.496
	(19.637)	(18.215)	(18.220)	(16.307)
Other industries	21.365	22.654	-20.995	-15.498
	(18.305)	(18.645)	(16.323)	(16.803)
Textiles	26.130	-1.108	-8.268	-1.501
	(18.725)	(4.099)	(16.773)	(4.426)
2005	-1.788	-8.972**	-3.683	-19.651***
	(4.666)	(4.434)	(4.828)	(4.828)
2006	-2.779	-4.435	-13.753***	-9.583**
	(4.689)	(4.208)	(4.960)	(4.525)
2007	-5.133	-181.266***	-10.615**	-145.231***
	(4.797)	(20.781)	(4.935)	(18.826)
obs	1883	1850	1885	1852
aic	5206.462	4893.465	5901.713	5601.873
bic	5300.653	5003.924	5995.922	5712.353

Notes: Dependent variables are dummy variables for the exporter and importer status. t-1 means lagged values of these variables. Standard error in brackets where *** p<0.001, **p<0.05, * p<0.01. Industrial and year dummies included. $tfp_{i,t}$ means total factor productivity, it is obtained using Levinsohn and Petrin (2003) procedure; $tfp_{i,t-1}$ are lagged value of ; $tfp_{i,t}$; $work_{i,t}$ means the average number of workers and $work_{i,t-1}$ are aged value of the variable; $x_{t,i}$ are a dummy variable that take value 1 if the firm is exporting and 0 otherwise, $x_{t,i-1}$ are the lagged value and $foreignowner_{i,t}$ are a dummy variable that take value 1 if the firm is owned by foreigners and 0 otherwise

Following the strategy from the extensive margin of trade we also obtain a dynamic model for the extensive margin, using a Tobit procedure. Equation (10) and (11) are similar than equation (6) and (7) with the only difference than dependent variables are now the percentage of the sales exported (10) and imported (11).

$$\Pr(px_{i,t} = 1) = \gamma_{0+}\, \beta_0 px|pm_{i,t-1} + \beta_1 \ln(tfp_{i,t-1}) + \beta_2 \ln(work_{i,t-1}) + \beta_3 foreignowner_{i,t} + \beta_1 px|pm_{i0} + \beta_2 \overline{ltfp_i} + \beta_3 \overline{workt_i} + \mu_i + ie_i + ii_i + \gamma_k + \delta_t + u_i \quad (6)$$

$$\Pr(pm_{i,t} = 1) = \gamma_{0+}\, \beta_0 px|pm_{i,t-1} + \beta_1 \ln(tfp_{i,t-1}) + \beta_2 \ln(work_{i,t-1}) + \beta_3 foreignowner_{i,t} + \beta_1 px|pm_{i0} + \beta_2 \overline{ltfp_i} + \beta_3 \overline{workt_i} + \mu_i + ie_i + ii_i + \gamma_k + \delta_t + u_i \quad (7)$$

Results are presented in Table 10 and 11 obtaining similar results than for the extensive margin of trade. We find a high degree of hysteresis, where the past percentage of exports and imported intermediates explain the current levels of each activity. Past TFP still important to explain the level of the use of imported intermediates by Egyptian firms and foreign ownership still important for exports.

Table 10. Tobit Dynamic Panel Model controlling for initial conditions (Exports)

	px_{i,t_1}	px_{i,t_1}	px_{i,t_1}
px_{i,t_1}	0.493***	0.491***	0.430***
	(0.025)	(0.026)	(0.031)
$pm_{i,t-1}$		-0.001	
		(0.022)	
$px_{i,t}$			
$pm_{i,t}$			0.286***
			(0.020)
$lwork_{i,t-t}$	0.035***	0.035***	0.018
	(0.011)	(0.012)	(0.011)
$foreignowner_{i,t}$	0.179***	0.177***	0.153***
	(0.039)	(0.039)	(0.038)
$ltfp_{i,t-1}$	0.011	0.011	0.007
	(0.007)	(0.007)	(0.007)
$ltfp\ mean_{i,t-1}$	0.011	0.012	-0.005
	(0.011)	(0.012)	(0.011)
$lwork\ mean_{i,t-t}$	0.016	0.016	0.016
	(0.015)	(0.015)	(0.014)
baseExp	-0.015	-0.016	0.022
	(0.026)	(0.027)	(0.028)
Chemicals	0.126**	0.127**	0.100*
	(0.052)	(0.053)	(0.052)
Garments	0.121**	0.120**	0.135***
	(0.049)	(0.049)	(0.049)
Machinery & Equipments	0.112*	0.111*	0.097
	(0.065)	(0.065)	(0.064)
Metal industries	0.102**	0.101**	0.107**
	(0.047)	(0.047)	(0.047)
Non metal industries	0.085*	0.084*	0.118**
	(0.049)	(0.050)	(0.049)
Other industries	0.099**	0.098**	0.122***
	(0.046)	(0.046)	(0.046)
Textiles	0.096**	0.096**	0.105**
	(0.047)	(0.048)	(0.047)
2005	-0.035	-0.037*	-0.029
	(0.022)	(0.022)	(0.020)
2006	-0.050**	-0.053**	-0.026
	(0.021)	(0.022)	(0.020)
2007	-0.011	-0.013	-0.001
	(0.022)	(0.022)	(0.020)
cons	-0.278***	-0.279***	-0.177***
	(0.060)	(0.061)	(0.060)
obs	1889	1880	1882
aic	1047.417	1050.728	841.0867
bic	1158.293	1167.047	957.4285

Notes: Dependent variables are the percentage total sales exported. t-1 means lagged values of these variables. Standard error in brackets where *** p<0.001, **p<0.05, * p<0.010. baseExp means initial importer dummy. $tfp_{i,t}$ means the lagged value of the total factor productivity, it is obtained using Levinsohn and Petrin (2003) procedure; $work_{i,t-1}$ are the lagged value of the average number of workers; $m_{t,i}$ are a dummy variable that take value 1 if the firm is importing and 0 otherwise, $m_{t,i-1}$ are the lagged value; $x_{t,i}$ are a dummy variable that take value 1 if the firm is exporting and 0 otherwise and $foreignowner_{i,t}$ are a dummy variable that take value 1 if the firm is owned by foreigners and 0 otherwise

Table 11. Tobit Dynamic Panel Model controlling for initial conditions (Import)

	$pm_{i,t-1}$	$pm_{i,t-1}$	$pm_{i,t-1}$
$px_{i,t\ 1}$		-0.036	
		(0.023)	
$pm_{i,t-1}$	0.525***	0.533***	0.436***
	(0.026)	(0.027)	(0.032)
$px_{i,t}$			0.306***
			(0.021)
$pm_{i,t}$			
$lwork_{i,t-t}$	0.019	0.022*	0.002
	(0.012)	(0.012)	(0.011)
$foreignowner_{i,t}$	0.080**	0.081**	0.013
	(0.039)	(0.040)	(0.039)
$ltfp_{i,t-1}$	0.016**	0.016**	0.010
	(0.007)	(0.007)	(0.007)
$ltfp\ mean_{i,t-1}$	0.012	0.013	0.006
	(0.012)	(0.012)	(0.012)
$lwork\ mean_{i,t-t}$	0.012	0.012	0.004
	(0.015)	(0.015)	(0.015)
baseImp	0.018	0.015	0.061**
	(0.026)	(0.026)	(0.028)
Chemicals	0.023	0.028	-0.028
	(0.054)	(0.054)	(0.055)
Garments	-0.060	-0.056	-0.105**
	(0.051)	(0.051)	(0.051)
Machinery & Equipments	-0.042	-0.038	-0.086
	(0.067)	(0.067)	(0.068)
Metal industries	-0.048	-0.047	-0.082*
	(0.048)	(0.048)	(0.049)
Non metal industries	-0.092*	-0.092*	-0.119**
	(0.051)	(0.051)	(0.051)
Other industries	-0.063	-0.061	-0.098**
	(0.047)	(0.047)	(0.048)
Textiles	-0.051	-0.050	-0.081*
	(0.049)	(0.049)	(0.049)
2005	-0.037*	-0.036	-0.030
	(0.022)	(0.022)	(0.020)
2006	-0.095***	-0.093***	-0.083***
	(0.022)	(0.022)	(0.020)
2007	-0.005	-0.005	-0.006
	(0.022)	(0.022)	(0.021)
cons	-0.072	-0.090	0.064
	(0.063)	(0.063)	(0.064)
obs	1867	1863	1863
aic	1102.709	1102.284	897.3467
bic	1213.35	1218.413	1013.476

Notes: Dependent variables are the percentage total sales imported. t-1 means lagged values of these variables. Standard error in brackets where *** p<0.001, **p<0.05, * p<0.010. baseImp means initial importer dummy. $tfp_{i,t}$ means the lagged value of the total factor productivity, it is obtained using Levinsohn and Petrin (2003) procedure; $work_{i,t-1}$ are the lagged value of the average number of workers; $m_{t,i}$ are a dummy variable that take value 1 if the firm is importing and 0 otherwise, $m_{t,i-1}$ are the lagged value; $x_{t,i}$ are a dummy variable that take value 1 if the firm is exporting and 0 otherwise and $foreignowner_{i,t}$ are a dummy variable that take value 1 if the firm is owned by foreigners and 0 otherwise

5. CONCLUSIONS

Theoretical and empirical works highlight that firms involve in international activities are bigger, more productive and larger than only domestic firms. Using firm-level data for 554 manufactured companies in Egypt, we estimate the import and export premia obtaining that firms involve in international activities have a higher productivity, are largest and own more capital and investment more than only domestic firms. We observe that only exporters and two-way traders have similar estimated coefficients being only exporters the most productive and only importers are less productive compared with the other international firms.

The aim of the paper focus in investigates the relationship between exporting and importing activity for Egyptian firms and using a static and dynamic Probit model for the extensive margin of trade, in which both imports and exports has used as dependent variables we confirm that both activities are importantly interrelated obtaining higher sunk costs for the import activity than for export. In this case the TFP explain the decisions to import but we cannot explain the causality from productivity to export, further research is needed to deal with possible endogeneity problems. In this point our results show how past experience still most important to determine the continuance in the same activity. Results still similar for the intensive margin of trade.

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APPENDIX

Table A.1 Variables Description

	Variable	Description	Question	Question num
International Trade	$x_{i,t}$	Dummy variable that take value 1 if firm export in year t	What percent of your establishment's sales were exported directly in current year	Authors creation
	$m_{i,t}$	Dummy variable that take value 1 if firm import inputs in year t	what percent of establishment's purchases of materials inputs and supplies were purchased through direct imports in the current year?	Authors creation
	$px_{i,t}$	Percentage of total sales exported in t	What percent of your establishment's sales were exported directly in current year	q19b1
	$pm_{i,t-1}$	Percentage of purchases of materials inputs imported	What percent of establishment's purchases of materials inputs and supplies were purchased through direct imports in the current year?	q26b_1
Size of the firm	**work** $_{i,t}$	Average number of workers in t	Refers only to permanent workers of your establishment. Permanent workers are defined as all (paid) long term (i.e. for one year or more) employees with guarantee of renewal of employment contract.	q107c
Total Factor productivity (TPF)	$ltfp_{i,t}$	Levinsohn and Petrin (2003) TFP	Levinsohn and Petrin (2003)	Authors creation
	capital $_{i,t}$	Total fixed tangible assets	Value of your total assets?	q128a1 and q128a2
	capitaldef $_{i,t}$	Total fixed tangible assets deflated by the Production price index for manufactures	capital $_{i,t}$ / PPI	Authors creation
	material $_{i,t}$	Total purchases of raw material and intermediate goods	Total purchases of raw material and intermediate goods (whether used in production or not), including finished goods for resale	q122b2 and q122b1
	materialsdef $_{i,t}$	Total purchases of raw material and intermediate goods deflated by the Production price index for manufactures	material $_{i,t}$ / PPI	Authors creation
	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.	salest $_{i,t}$ / Production price index for manufactures	Authors creation

	sales$_{i,t}$	Total sales in t. Value in thousands of Egyptian pounds. Not deflated	Total sales	q122a2
	sales$_{i,t-1}$	Total sales in t. Value in thousands of Egyptian pounds. Not defalted	Total sales	q122a1
Sector	**nameindustry $_{i,t}$**	Coded value for each sector	What is the main activity of your establishment?	sector_str
Ownership	**foreignowner$_{i,t}$**	Percentage of the firm owned by a foreign Arabic owner and by other foreign owner	What is the percentage of the firm owned by a foreign Arabic owner? What is the percentage of the firm owned by other foreign owner?	q11a2+ q11a3

A.2 Total Factor Productivity (TFP) Estimation

To calculate TFP we obtain estimates of a traditional Cobb-Douglas production function [10].

The Cobb-Douglas production function estimated is given by:

$$lsalesdef_{i,t} = \beta_0 + \beta_l\, lwork_{i,t} + \beta_m lmaterialsdef_{i,t} + \beta_k\, lcapitaldef_{i,t} + \omega_{i,t} + \eta_{i,t} \quad (1)$$

where all the variables are in natural logarithms, $salesdef_{i,t}$ is total sales of firm I in year t, in thousands of Egyptian pounds. As independent variables we include $work_{i,t}$ defined as the average number of workers, $materials_{i,t}$ denotes the total purchases of raw material and intermediates goods, $capital_{i,t}$ 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. component given by $\eta_{i,t}$. We deflate firm level sales and input expenditures (salesdef, $work_{i,t}$) using the industry level production price index for manufactures with 2005 as base year, the data comes from the International Financial Statistics (IFS and UN) for manufacturing.

asure, 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 bias, in what follows we present a number of alternative

[10] In a first step we also included imported intermediates as an additional variable following De Loecker (2007) and Kasahara and Rodrigue (2008) obtaining very similar results. Indeed, the percent of imported intermediate goods and total intermediates used by firms are highly correlated. The correlation between total intermediates and imported intermediates used by firms is 0.7208. When we include both variables in the equation, the imported intermediate variable is not significant and results using TFP obtained by the traditional Cobb-Douglas production function or those proposed by Kasahara and Rodrigue (2008) lead to similar results, for this reason we obtained TFP using the traditional form. Result using TFP including imported intermediates are available from the authors upon request.

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 firm-specific effects. The third alternative, (column 3), was proposed by Levisohn and Petrin (2003), who proposed to estimate the production function using inputs to 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. Finally, we decide to use TFP estimated using the Levisohn and Petrin (2003) as independent variable for our export models because this methodology control for two important bias, namely simultaneity and our data availability do not allow use obtain accurate values of the firm investments.

Table. A.2. Product function estimates

	OLS	FE	LEV reg	OP reg
$lcapitaldef_{i,t}$	0.085***	0.081***	0.055***	0.081***
	(0.011)	(0.012)	0.010	(0.029)
$lwork_{I,t}$	0.350***	0.372***	0.363***	0.606***
	(0.020)	(0.025)	0.019	(0.042)
$lmaterialsdef_{i,t}$	0.603***	0.611***	0.608***	0.315***
	(0.012)	(0.014)	0.012	(0.043)
Nobs	2429	2429	2429	2480

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

Graph 1. Kernel Density for each TFP