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IZA DP No. 15627

Exports and Labor Demand: Evidence from Egyptian Firm-Level Data

Claudia N. Berg
Raymond Robertson
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ISSN: 2365-9793

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ABSTRACT

Exports and Labor Demand: Evidence from Egyptian Firm-Level Data

Unlike many countries, Egypt did not experience significant labor market improvements following trade liberalization. In this paper, we build upon the earlier work of Robertson et al. (2021) to investigate why increased Egyptian exports did not directly increase employment. To illustrate the relationship between firm-level exporting and employment, we present a simplified general equilibrium model inspired by Melitz (2003) with two sectors: one able to export and one "reserve" sector. This paper tests the implications of this theory using firm-level data from the World Bank's Enterprise Surveys (ES) in 2013, 2016, and 2020. Our firm-level microanalysis demonstrates that while there is a positive employment response to export expansion, this is not occurring at a large enough scale to be felt at the macro level. To seize the benefits of trade, Egypt requires deeper business environment reforms to incentivize large export, labor-intensive sector growth and integrate its economy into global value chains.

JEL Classification: F1, C1
Keywords: exports, trade, employment, labor market, econometrics, Egypt

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1. Introduction

International trade is associated with economic growth and decreased poverty (Frankel and Romer 1999, Norguer and Siscart 2005, Dollar and Kraay 2004, Engel et al. 2021, Artuc et al. 2019). Between 1990 and 2017, global poverty fell from 36 to 9 percent while developing countries increased their share of global exports from 16 to 30 percent (Engel et al. 2021). The causal effect of trade on economic growth is well established in the long run, but the short-term relationship is less clear (Zaki 2016). Surprisingly, the direct link between trade policy and micro-level labor-market outcomes is also opaque. Workers in Bangladesh, China, India, and Vietnam benefited from an apparel export boom, but workers in Sri Lanka and Morocco had a different experience (Lopez-Acevedo and Robertson 2012). Egypt is a notable example where successful trade expansion was not associated with rising local employment nor higher wages. Robertson, Vergara, Kokas, and Lopez-Acevedo (2021) establish a "broken link" between trade and labor markets in Egypt, finding that while trade policy changes did increase trade flows, any short-term labor-market response (wages, informality,[1] and female labor force participation [FLFP]) to export shocks dissipated quickly and remained statistically insignificant for most types of workers.

The "broken link" between trade and local labor market outcomes implies that rising exports are not associated with increased labor demand. Lack of a detectable relationship between exports and local labor demand is surprising because a significant positive relationship between exports and employment emerges in studies that analyze changes over time in both developed and developing countries (Fox and Oviedo 2008, Lichter, Peichl and Siegloch 2013, Pellandra 2015, Abbey et al. 2017, Artuc et al. 2019). Exporters across different countries and industries employ

[1] Where informal is defined as those who are self employed, unpaid family workers, or workers without social security coverage.

more labor, are more productive, skill- and capital-intensive, and pay higher wages than non-exporting counterparts (Bernard et al. 2007, Brambilla et al. 2015, Dutz et al. 2011, Duda-Nyczak and Viegelahn 2018).

Across countries, however, mixed results emerge. Krauss (2015) analyzes trade effects on job growth in 12 East Asian and Pacific (EAP) countries individually.[2] He finds that exporting positively and significantly correlates with firm expansion, especially in larger economies (China, Indonesia, Mongolia, the Philippines, and Vietnam). In contrast, exports do not have much relationship with job growth in small and island states (Fiji, Lao, Samoa, Timor-Leste, and Tonga). Dessing (2002) fails to support the optimistic view of trade with respect to employment creation. Examining data between 1980 and 1998 from 18 developing countries plus newly-industrialized Korea to assess the employment effects of trade, Dessing shows that estimated export-employment elasticities are never significantly different from zero. Egypt is another country that failed to experience job growth and poverty reductions despite significant growth in trade (Robertson et al. 2021).

The results from Egypt seem to suggest that it is one of the interesting exceptions to the positive export-employment link found in most countries. Although rising exports usually increase employment through increased labor demand, there are at least four reasons why it might not even when labor supply is constant. First, exporting firms may be too small of a segment in the local labor market to significantly affect aggregate employment. Second, in the presence of hiring and firing costs, firms may hold on to workers, creating a relatively idle "reserve" group of workers to fill the demand from rising exports.[3] Third, firms in capital-intensive sectors may expand

[2] China, Fiji, Indonesia, Lao PDR, Micronesia, Mongolia, the Philippines, Samoa, Timor-Leste, Tonga, Vanuatu, and Vietnam.
[3] Selwaness and Zaki (2019) demonstrate that labor market rigidities in MENA reduce the positive impact of exports on employment.

production using either new machinery or extending the run-time of existing machinery. Finally, firm-level production may simply shift from the domestic to the international market, without expanding production or employment.

To evaluate these possible explanations, we build upon Robertson et al. (2021) by turning to the World Bank Enterprise Surveys (ES) for Egypt, a small panel of firms. Specifically, this analysis will focus on a panel of 198 firms in 2013, 2016, and 2020.

The remainder of the paper is organized as follows: Section 2 will present the Egyptian context. Section 3 will discuss the conceptual framework underlying our empirical analysis. Section 4 details our data sources and discusses descriptive statistics. Section 5 lays out the empirical framework, and Section 6 discusses results. Finally, Section 7 summarizes conclusions and offers policy recommendations.

2. Egyptian Context

To better understand why rising exports did not directly increase employment in Egypt, it is informative to review recent history of the country's trade liberalization, macroeconomic stabilization, and overall structure of its export sector.

Beginning in the early 1990s, Egypt began implementing policies designed to boost trade. The first of these, the Economic Reform and Structural Adjustment Program (ERSAP), aimed at rectifying the country's macroeconomic imbalances, including its chronic balance of payment deficits and high inflation (Korayem 1997). As part of this liberalization, the country reduced its maximum tariff from 110 percent in the 1980s to 40 percent by the end of the 1990s. This was followed in 2004 by a second wave of liberalization, whereby tariff rates were simplified and further reduced. See Table 1 for a list of Egypt's Regional Trade Agreements currently in force. Reforms to improve the business environment and exchange rate accompanied these changes (Zaki

2016; Zaki et al. 2018). In November 2016, the Central Bank of Egypt announced the floatation of the Egyptian pound, which depreciated by 45 percent against the US dollar, reaching EGP 13, at the decision and reached EGP 18 soon thereafter (Zaki et al. 2018).

Following these reforms, Egypt's weighted mean applied tariffs fell from 20.0 percent to 6.6 percent between 2002 and 2016, before rebounding to 10.4 percent in 2019 (Figure 1). Egypt's trade rose significantly, almost tripling between 2000 and 2020, with exports increasing by 196 percent while imports soared 231 percent (Figure 2). The increase in trade flows coincided with the depreciation of the Egyptian Pound, which made exports relatively less expensive for foreign customers (Figure 2). Despite this increase in trade volume, the export sector remained a relatively small share of the Egyptian economy. In 2020, Egypt's export sector accounted for a mere 13 percent of its GDP, as compared to 35 percent in Morocco, 38 percent in Tunisia, 61 percent in Malaysia, and 52 percent in Thailand (World Development Indicators).

Labor market outcomes tend to be better for workers in exporting firms compared to those in non-exporting firms. Consistent with both economic theory and results from other countries, Egypt's exporting firms tend to pay higher wages, provide better jobs, demand more skilled workers, deliver higher job security, and hire more women (Saad 2020). They also tend to be few and relatively larger relative to non-exporting firms (ES data). According to the Egyptian Enterprise Census in 2017, which contains all enterprises, only 1 percent of firms export. The average size of an exporting firm and non-exporting firm is 18.9 and 3.2 employees, respectively.[4] Exporting firms are also in general more capital-intensive; in 2013, the capital-labor ratio was 322 for exporters and 22 for non-exporters (Saad 2020).

[4] The Enterprise Survey, which targets larger firms (5 employees and larger) similarly finds that exporters are on average considerably larger than non-exporters (313 versus 65, respectively, in 2020).

Following the trade liberalization, Egypt's unemployment rate initially declined before skyrocketing after the financial crisis in 2009 and Arab Spring in 2011. The unemployment rate resumed falling until the COVID-19 pandemic hit in 2020. As demonstrated in Robertson et al. (2021), despite the boom in exports following the trade reforms, Bartik (1991) analysis did not detect any significant labor market effects at sub-national levels. To better understand the dynamics at play, we turn to firm-level data to explore how export flows relate to labor demand at the firm level.

3. Conceptual Framework

3.1 Model Overview and Main Results

To illustrate the relationship between firm-level exporting and local-labor-market employment, consider a simplified general equilibrium Melitz (2003) model in which there are two sectors. The first is a "reserve" sector, like the informal or service sector, where firms are homogeneous and produce using only labor with decreasing returns-to-scale technology. The second sector is a heterogeneous sector that can export. For now, we assume that the local labor market has full employment in the sense that, lacking unemployment or other social insurance, workers must engage with the labor market to secure an income.

For simplicity, we assume two periods of time during which firms in the heterogeneous sector have the option to shut down (or not produce), produce for the domestic market, or produce for the foreign market (export). We simulate this model to illustrate how an increase in export opportunities (represented by an increase in the export market price) affect local employment. In particular, we show that an increase in the export price of 5 percent would increase employment in the heterogeneous sector by about 73 percent as workers shift from the reserve sector into it. As

such, we would expect that the increase in exports would reduce informality or employment in the "reserve" sector.

Within the heterogeneous sector, employment increases by 2,451 workers (15 percent) and is spread across three groups of firms in the sector. The first group are firms that were exporters in the first period and continue to be exporters in the second. These "always exporters" increase employment by 642 workers. We refer to this effect as the "within exporter" effect, because these firms slightly increase their average employment. The "within exporter" effect makes up about 7 percent of the total change in employment in the model.

The second group includes "never exporters," firms that never export and only produce for the domestic market in the first and second periods. The domestic firms reduce employment by nine workers (a drop in average firm size of about 0.1 worker per firm). The size of this "within-non-exporter" effect is about -0.003 percent of the total change in employment.

This third group of firms includes those that switch from domestic to exporting. We call this the "between" effect. Total employment in this group changes by about 1,819 workers or 42 percent of the total employment change. In other words, the main expected employment effect comes from firms that were producing for the domestic market and switch to exporting.

In the next section, we provide the details of the model and the simulation.

3.2 Model Details

As noted, consider an economy characterized by two sectors that produce with labor as the only input. We first describe the homogeneous sector and then the heterogeneous sector before describing general equilibrium.

a. The Homogeneous Sector

The first sector produces exclusively for the domestic market, with homogeneous technology. Assume that firms in the first sector produce using homogenous decreasing returns to scale (falling marginal product of labor) technology. These assumptions are meant to roughly emulate a "reserve" sector *a*, such as the informal sector found in many developing countries. Indexing this "reserve" sector with *a,* we represent labor demand with:

$$l_a = f(\kappa, \lambda, w). \tag{3.1}$$

The parameters κ and λ characterize the labor demand function. In practice, we assume that labor demand in sector *a* is linear so that κ and λ represent intercept and slope. Firms are assumed to be small and take the market wage *w* as given. The market wage is set in general equilibrium, which is described in more detail after we describe the second heterogeneous sector.

b. The Heterogeneous (Exporting) Sector

Following Melitz (2003), the second sector is characterized by heterogeneous firms differentiated by a firm-specific productivity parameter φ_i. After entry into the market, the firm-specific productivity parameter φ_i is first revealed (thus it is unknown prior to entry). The *ex ante* productivity parameter distribution is described by $g(\bar{\varphi}, \sigma_{\varphi}^2)$. In practice, we assume that the productivity parameter is drawn from an exponential distribution.[5] For simplicity, assume that production is a function of labor, l_j, and can be represented as $Q = \gamma l_j^{\alpha}$ in which in which $j \in (a, b)$ indicates the subsector, γ represents total factor productivity (TFP), and α restricted to be a positive value less than 1 ensures decreasing marginal productivity of labor.

[5] Note that the exponential distribution is closely related to the Pareto distribution. For example, if *X* follows a Pareto distribution with a minimum of *a* then $y = \log(x/a)$ (Halliday et al. 2018).

If firms are small, as we assumed for the first sector, they can affect neither the wage paid to labor w nor the domestic market price P_d. Any production (for either the domestic or export market) requires a fixed cost F_d.[6] By allowing the productivity parameter to enter the cost function, we can represent *ex ante* profits with the simple profit function:

$$\pi_i = P_d Q_i - \frac{w l_i}{\varphi_i} - F_d \tag{3.2}$$

Note that firm i's profit-maximizing level of l_i is uniquely defined by P_d, φ_i, w, $\boldsymbol{\gamma}$, and α. Perhaps trivially, the output price, TFP, and the individual-specific productivity parameter are positively correlated with firm-level labor demand.

Equation (3.2) also shows that profits must be at least as large as F_d for the firm to produce a positive amount of output. Otherwise, the firm will shut down and produce nothing. Since profits are higher for higher values of φ_i, the model generates a cut-off value for φ_i that separates firms that produce from those that do not. When firms leave the market, average productivity levels increase because the lowest-productivity firms chose to exit the market.

Using the asterisk to represent the optimal solution to the profit-maximization problem implied in (2), optimal labor demand is represented as:

$$l_i^* = \left(\frac{w}{P_d \alpha \gamma \varphi_i}\right)^{\frac{1}{\alpha-1}}. \tag{3.3}$$

Note that (3) shows that more productive firms (higher values of φ_i) will be larger in the sense of having higher employment, production, and profits.

[6] In other models, Bernard et al. (2007) for example, the fixed cost becomes part of labor demand. Our model simplifies this by assuming fixed costs to be a pure loss. This implies that the economy's equilibrium is characterized by a small but constant trade surplus that covers its fixed costs. The conclusions of the model would not be affected if the fixed costs were instead distributed among all the workers (Halliday et al. 2007).

3.3 Open economy

In addition to producing, firms in the second sector *b* also have the opportunity to export. Exporting, however, requires an additional fixed cost, F_x. That is, to consider exporting, firms have to be viable domestic producers first. A common assumption is that $Q\tau$ (τ>1) goods must be exported for the quantity Q to arrive (the usual "iceberg" assumption). Under these conditions, exporting firms sell their goods for a higher price abroad than they would receive in the domestic market. In practice, the international (export) price (P_x) is represented as a fixed markup over the domestic price. Specifically, $P_x = \tau P_d$. The markup is related to foreign tariffs as well (τ = premium/tariff). Foreign tariffs are negatively related to the price exporters receive and, as tariffs increase, exports fall. We model the effects of trade agreements—which decrease foreign tariffs—by raising the export price in the model. Under these conditions, firms will choose to export if:

$$P_x Q_i - \frac{wl_i}{\varphi_i} - F_d - F_x > P_d Q_i - \frac{wl}{\varphi_i} - F_d > 0 \,. \qquad (3.4)$$

A key result of the model is that exporters will be more productive, larger, and have higher profits than firms in the heterogeneous sector that produce for the domestic market. As we show in the empirical work that follows, Egypt's export sectors have the same characteristics.

3.4 General Equilibrium

In this model, general equilibrium means that wages, which are exogenous to individual firms, are determined by aggregate labor demand in the two sectors. Without social insurance, the economy is assumed to be characterized by full employment, meaning that all workers have to find work somewhere (in either of our two sectors) or they will have no income. Assuming no labor-market adjustment costs, workers move freely between sectors to earn the highest wages. Free mobility between sectors implies that, in equilibrium, (base) wages will equalize between sectors. As in the Melitz (2003) model, total labor supply (L) is perfectly inelastic. Since our

focus is mainly on trade agreements, and since the first sector is the "reserve" sector, we represent employment in the "reserve" sector to be total employment minus employment in the heterogeneous export sector:

$$l_a = L - l_b. \tag{3.5}$$

Obviously, total employment in each sector is equal to the sum of each firm's employment. Since each firm in the export sector is unique (due to a unique productivity parameter), each firm has a different level of employment. In the "reserve" sector, all firms are identical and total employment is simply the sum across all firms. Formally,

$$l_j = \sum_i l_{ij} \tag{3.6}$$

in which $j \in (a,b)$ and individual firms are indexed with *i*. Since firms are homogeneous in the "reserve" sector, aggregate labor demand can be represented by a single labor demand function and all workers receive the same labor income. Given small heterogeneous firms in the export sector, small homogenous firms in the second sector, and perfect mobility between plants and sectors, wages are determined in the aggregate labor market and equalize across sectors.

3.5 Model Simulation

To simulate the model, we first choose parameter values and describe the initial equilibrium. Note that depending on the parameter values, the model could generate four possible outcomes: (i) none of the firms produce anything, (ii) all the firms only produce for the domestic market, (iii) all the firms produce only for the international market, and (iv) a mixed solution in which some of the firms do not produce, some produce for the domestic market, and others produce for export (Halliday, Lederman, and Robertson 2018). We begin by picking initial parameter values so that the equilibrium falls into the mixed category. Note that the model is not calibrated. The point is just to illustrate the theoretically-predicted changes in employment patterns generally.

Our main variable of interest is the export price P_x. Along with other variables, the export price determines the level of employment in both sectors, which generates a feedback effect on the wage in the homogenous sector. In practice, the wage in the homogeneous sector is the worker's reservation wage; that is, the lowest wage that someone will accept for a job. The reservation wage equilibrates between the two sectors in a way that generates an equilibrium level of employment in both sectors given the export price.

Figures 3 and 4 show a typical mixed equilibrium under two scenarios. Figure 3 depicts the model under the original international price and Figure 4 shows what happens following a 5 percent increase in the international price. Starting parameters are chosen to ensure that the (aggregate) labor demand curve in the homogenous sector is elastic and to avoid corner solutions for observed export prices.[7] Figures 3 and 4 plot profits (y-axis) against its (exponentially-distributed) productivity (phi, φ_i) values under the original international price. Firms with productivity parameter less than 6.55 do not make enough profit to cover their fixed costs and so do not produce anything. Firms with productivity greater than 6.55 can produce and sell output. Producing firms fall into one of two groups depending on their level of productivity. Those with productivity between 6.55 and 68.72 cannot cover the additional fixed costs necessary to export under the original export price, and so their profits are higher in the domestic market and therefore they only sell there. The remaining firms, with productivity values higher than 68.72 find that exporting is more profitable.

Consider a new trade agreement that increases the export price by 5 percent. Comparing Figures 3 (before the change) with Figure 4 (after), the domestic profit line is unchanged while the

[7] Note that modifying parameter values changes the endogenous variable values but has little impact on the qualitative path of our variables of interest unless the export price's change drives the model into one of the two corner solutions (where all firms export, or none do).

export profit line has shifted leftward, bringing more firms into the export market. That is, the productivity cut-off for joining the export market falls from 68.72 to 38.09.

In our simulation, we fix the total number of workers at 400,000 in 281 firms. Originally, 16,552 work in the heterogeneous sector *b* and the rest work in the reserve sector *a*. The model is full-employment, general equilibrium prior to the trade agreement. In the heterogeneous sector, there are 46 firms selling to the international market that employ a total of 9,300 workers, with an average firm size of 202 workers. The remaining 235 firms in this sector produce for the domestic market, employ 2,752 workers total, with an average size of 11.7 workers.

We model an increase in the international (export) price of 5 percent (Table 4). The results show that employment in the export sector increases by 2,451 workers. This increase is broken down into three groups of firms: (i) "always exporters" increase employment by 642 workers (7 percent); (ii) "never exporters" reduce employment by 9 workers (with a drop in average firm size of about 0.1 worker per firm); and (iii) firms that switch from domestic to exporting increase employment by 1,819, an increase in average firm size of 30.8 workers. The change in employment in these three groups matches the overall increase in employment in the export sector.

In the next section, we turn to firm-level data from Egypt to estimate actual employment changes and compare them to the general results of the model simulation.

4. Data and Descriptive Analysis

4.1 Sources

Our empirical analysis relies primarily on the World Bank's Enterprise Surveys (ESs) for Egypt, a small panel of firms followed over time. The ESs are conducted across all geographic regions and cover small, medium, and large companies and are representative of firms in the non-agricultural, formal private economy. The survey—stratified by size (small, medium, and large),

industry, and region—collected data for Egypt in 2004, 2007, 2008, 2013, 2016, and 2020. Each survey year is representative of the business environment that year. Of these, this analysis will focus on a panel of 198 firms in 2013, 2016, and 2020. See Table 2 for mean values of our main variables.[8]

We supplement the ES data with information on the universe of firms captured by the 2017 Census of Establishments in Egypt and with data from the United Nations International Trade Statistics Database (UN COMTRADE), specifically information on world imports from Egypt over the period of study.

4.2 Stylized Facts of Egypt

a. Exporter Characteristics

We begin the data analysis at the aggregate level, by comparing total Egyptian exports from the ES with world imports from Egypt from UN COMTRADE. As Figure 6 shows, the ES data represent a reasonable proxy for Egypt's exports to the world. In 2020, wood manufacturing (ISIC=20) and vehicle manufacturing (ISIC = 34) stand out as the only two sectors over-represented in the ES relative to the UN COMTRADE data.

Figure 6 aggregates exports from all ES firms. Looking at the data more closely, we see that few Egyptian firms export, either directly or indirectly (Table 3).[9] In 2020, only 27 of the 198 firms in the panel exported.

[8] Appendix A reports descriptive statistics for firms that survived between 2016 and 2020 with those that did not. Overall, the firms in both groups are broadly similar except in terms of size. Larger firms are both more likely to survive.

[9] Firms exporting directly are those who sell to other countries without intermediaries. Firms exporting indirectly are those which sell to a wholesaler or other who then resells to customers in other countries.

b. Cross Section

As Figure 6 shows, exporters tend to be significantly larger than non-exporters in every year of the survey. In 2020, the average employment size for exporters is 363, statistically different from the 95 for non-exporters. Given the kernel densities in Figure 6, it is not surprising to see a strong positive correlation between employment and export sales in 2020 (Figure 7).[10] In other words, exporters are more likely to be relatively large firms, with the correlation appearing to be even stronger in 2013 and 2016.

c. Changes in Exports and Employment

Figure 8 shows the kernel density functions of changes in log export sales and log employment. Given the overlap, employment growth for exporters and non-exporters appears comparable. Figure 9 reports the correlations between changes in employment and export sales, with the correlation in 2016-2020 relatively flat, while there seems to be a positive correlation during the 2013-2016 period. When looking at the 2013-2020, we see that the positive correlation of the first period dominates.

We now focus on the change between 2016 and 2020, where the panel is slightly larger than the three-year panel (2013, 2016, and 2020). To assess whether exporting firms increased production or simply shifted production from the domestic to the foreign market, we analyze exports as a percent of total sales. Table 5 considers what happens to firm employment in four different cases: (i) sales and share exported increased, (ii) sales did not increase while export sales did, (iii) sales increased while the share going to exports did not, (iv) neither sales nor export shares increased.

[10] This finding is further supported by the cross-section regressions in Appendix A, showing a strong positive correlation between export sales and employment.

Consider case (i) where expanding exporters increase both sales and export share, and average employment increases by more than in the other three cases. Next, we turn to case (iv) where neither sales nor export shares increase, and average employment decreases, as we would expect. Now consider case (ii) where sales did not increase while export shares did; these are exporters not expanding sales, and average employment increases modestly. This group of firms can be thought of as those that sell more to the domestic market. What is interesting is that when we compare this case (ii) to the one where sales are increasing and export sales are not (iii), change in employment is almost identical.

Indeed, looking at Figure 10, which depicts the kernel densities of change in log employment for each of the four cases, we see that the density of (i) lies to the right of the pack. Interestingly, the distributions of (iii) and (iv) have a high degree of overlap, lying to the left of the pack, indicating firms with decreasing sales being likely to reduce employment. Of firms with reducing sales, those that export tend to employ more workers, and are thus more likely to increase employment. The case where sales do not increase and export shares do (ii), lies in the middle between the (iii) and (iv) pair on the left and (i) on the right. It would seem that increasing sales is a stronger predictor of employment change rather than the degree of those sales going to exports. While these results are not consistent with the theory that exporting firms are shifting sales from domestic to foreign markets, they are not conclusive enough to reject the theory outright. Overall, while some firms shift production from the domestic to the foreign market without increasing employment, it has a minor effect on the disconnect between export flows and the labor market.

Table 6 reports changes in aggregate employment between 2013 and 2020 in survey firms grouped by export status. We divide the firms into four groups: (i) “always” are firms which exported in all three years (2013, 2016, and 2020); (ii) “new” are firms that did not export in 2013

but were exporting by 2020 (starting in either 2016 or 2020); (iii) "stopped" are firms that switched from exporting to not;[11] and (iv) "never" are firms that did not export in any of the three years. What is interesting is that overall employment appears to have decreased between 2013 and 2016 before rebounding between 2016 and 2020. Even in the first period of overall employment decline, "new" exporters increased employment, but not enough to offset employment declines in the "never" exporting group. During the employment increase between 2016 and 2020, overall employment increased in the "always", "new", and "never" groups, while it decreased in those that stopped exporting. New exporters appear to be the main driver of job creation.

5. Empirical Analysis

5.1 Empirical Approach

We are interested in estimating the relationship between exports and employment. All our models are estimated using the 2013-2016-2020 firm panel data.

As a first step, we consider the characteristics which make a firm more likely to export. We begin by estimating the extensive margin to identify what the main drivers of a firm being an exporter are.

$$exporter_{it} = \alpha + X'_{it}\gamma + Z'_{it}\delta + D_t + \mu_i + \varepsilon_{it} \quad (5.1)$$

where, $exporter_{it}$ is a dummy indicating a firm i's export status in year t. We alternatively consider the determinants of being a "new" exporter (one that did not export in 2013). We control for a selection of firm characteristics (X_{it}, Z_{it}), and year dummies (D_t). Firm characteristics included in X_{it} are those that we expect would impact the firm's export sales and employment. Exclusion restrictions in Z_{it} are characteristics that we would expect to impact a firm's decision

[11] Notice this group does not appear in the simulation because under the assumptions of the model, firms would not have any incentive to switch from exporting to not.

to export but not have any direct impact on its employment levels. Our choices of control variables are guided by the empirical literature (Dixit and Pal 2010, Abbey et al. 2017, Marques 2015).

To control for firm productivity, we use as proxies the value of machinery and labor costs. The value of machinery is taken as the book value of all machinery the firm currently uses if it were to hypothetically purchase all of it. Together, the value of machinery and labor costs help proxy for a firm's capital-intensity. Including the firm's age serves as a proxy for its experience and strength of its business network.

Guided by the observation of Marques (2015) that the gender of an entrepreneur effects firm decision whether and how much to export, we include a dummy for whether the firm's owners are women. We control for whether a firm has foreign ownership, as this can be expected to influence export decisions. We control for whether the firm offers training, following Dixit and Pal (2010), who evaluated the effects of training, among others, on firm performance. We include whether the firm uses foreign technology and whether it imports inputs, as we would expect these to influence the firm's propensity to export. To proxy innovation, we include an indicator for whether the firm has introduced a new product or service in the last 3 years (Srinivasan and Archana, 2011). While the ES data are restricted to formal firms, to include a past indicator of informality we control for whether the firm was registered at the time it began operations. We include a dummy to indicate whether the firm exports directly or if it instead sells to an intermediary that then sells abroad. Finally, we include year dummies.

The other parameters are α, the overall intercept parameter, μ_i is a time-invariant unobservable effect, and ε_{it} is an unobservable time-varying error term assumed to be well behaved.

Next, we turn to the intensive margin to determine how a firm's employment relates to its export sales. For this, we consider the following model of derived labor demand of the firm:

$$\ln N_{it} = \alpha + \beta \ln E_{it} + X_{it}'\gamma + D_t + \mu_i + \varepsilon_{it} \quad (5.2)$$

where, E_{it} is export sales of firm *i* at time *t*, and the remaining variables are as above.

Finally, to evaluate the relationship between the change in employment relative to a change in exports, we estimate the following regression:

$$\Delta \ln N_{it} = \alpha + \beta \, \Delta \ln E_{it} + \Delta X_{it}'\gamma + \varepsilon_{it} \quad (5.3)$$

Where, Δ represents a change, for example: $\Delta \ln N_{it} = \ln N_{it} - \ln N_{i,t-1}$.

5.2 Estimation Issues

Estimating the above equations is challenging because of endogeneity driven by the fact that the export decision is not made at random. Reverse causation is a factor when considering the relationship between export status and employment. Indeed, firm size has been cited as an important determinate of exporting (e.g., Söderbom and Teal 2000, 2006). Conditional on exporting, unobserved factors such as bargaining conditions or technology potentially affect how much a firm exports (Abbey et al. 2017). These unobserved variables are captured in μ_i and ε_{it}. While fixed effect estimation eliminates the first, time-invariant, source of error, it does not address time-varying sources of endogeneity.

Guided by the empirical literature, we address these endogeneity issues by estimating the models by Fixed Effects—which eliminates time-invariant sources of bias—and the Heckman Correction to address sample selection bias (Heckman 1974). That is, we estimate equation (5.1) to obtain the inverse mills ratio and include it in equation (5.2) as an additional control. In the second stage, we restrict attention to those firms that export and include as controls the value of

machinery, the cost per worker, age of the firm, and the inverse mills ratio. For details of the Heckman Correction, see Appendix B.

5.3 Main Results

This section reports the results of the econometric analysis of the 2013-2016-2020 panel of 198 firms. Below, we review the findings from the extensive margin to better understand what characteristics make a firm more likely to export; and on the intensive margin, focusing on export sales as the left-hand variable of interest. Next, we explore the relationships between the change of employment and the change in exports. Finally, we report as a robustness check cross-sectional regressions to check for bias stemming from selection patterns.

a. Extensive Margin

First, we explore the determinants of a firm's decision to export. Table 7 reports the marginal effects of the probit estimation of equation (5.1). Column (1) has as the dependent variable a dummy for whether a firm exports. Column (2) has a dummy indicating new export status as the left-hand variable. That is, it takes a value of one if the firm did not export in 2013 and was an exporter in 2020 (starting in either 2016 or 2020). The main predictors of export status appear to be foreign technology use and imported inputs. Innovation and foreign ownership also appear positively correlated with export status. As for becoming a new exporter, the strongest predictors are whether the firm was registered when it began operations and whether it imports inputs.

b. Intensive Margin

We now turn our attention to the intensive margin reported in Table 8, estimating equation (5.2) by OLS and Fixed Effect with a Heckman correction. The OLS estimate in column (1) suggests a positive relationship between employment and export sales, significant at the 1 percent

level. In Column (2) we similarly find a positive and significant relationship between export sales and employment. A 10 percent increase in export sales is associated with a 2 percent increase in employment. Overall, these results suggest a positive relationship between employment and export sales, inconsistent with the theory that firms are simply using their excess capacity of idle workers to produce additional output for export.

c. First Differences

We now examine the relationship between change in employment and change in export sales, controlling for changes in the value of machinery and labor costs per worker. Here, we find that the positive relationship between export sales and employment holds, significant at the one percent level. Table 9 reports the estimated results from equation (5.4).

5.4. Robustness Checks

Our main analysis relies on the 2013-2016-2020 Enterprise Survey panel data for Egypt. It is important to recognize that these represent a subset of the universe of firms collected in each survey year. When reporting descriptive statistics for panel firms, we used panel rather than the cross-section weights. Nonetheless, one might worry that our results are driven by selection patterns. That is, surviving firms observed in three consecutive rounds are likely to be different from those that did not. To address this concern, we report descriptive statistics for firms that survived between 2016 and 2020 with those that did not (see Appendix A, Table A1). Then, we report the cross-section estimates to compare with our main panel results (Tables A2, A3).

The descriptive statistics comparing 2016 firms that survived to be eligible in 2020 with those that did not suggests that the two groups of firms are broadly comparable. The exceptions are that surviving firms are more likely to be exporters and hold a larger value in machinery

(difference is significant at the 10 percent level). While surviving firms are larger, the difference is not statistically significant.

Comparing tables A2 and A3 with the corresponding panel results in Tables 8 and 9, column 1, we find that the results are broadly consistent across the three years. This similarity reassures us that the main results do not appear to be driven by selection patterns.

6. Conclusions

This paper extends the analysis of Robertson et al. (2021) to determine why Egypt's trade liberalization and the resulting boost in trade flows did not directly increase employment. It would be misconstrued to conclude from the lack of labor market response that "trade doesn't work" because the story is much more nuanced.

As we discussed, while increasing trade often increases employment, there are at least four reasons why it may not. In the case of Egypt, we demonstrate that exporting firms are too small of a segment of the local labor market to significantly affect aggregate employment. Second, in the presence of hiring and firing costs, firms may hold on to workers, creating a relatively idle "reserve" group of workers that fill the demand from rising exports. Our microanalysis of firms demonstrates a positive employment response to export expansion, inconsistent with the idea of idle excess worker capacity. Third, we demonstrate that, as is the case for most exporters, Egyptian exporters tend to be in capital-intensive sectors and so may expand production by using either new machinery or extending the run-time of existing machinery. Finally, while some firms shift production from the domestic to the foreign market without increasing employment, these firms account for only a small share and thus cannot explain the disconnect between export flows and the labor market.

In sum, the lackluster response of Egypt's labor market following its trade liberalization is in large part because its export market remains a very small share of its economy. Our firm microanalysis demonstrates a positive employment response to export expansion, but not at large enough scale to be felt at the macro level. This calls for expanding Egypt's export market and its integration into global value chains.

For Egypt to seize the benefits of trade, it requires deeper reforms to incentivize substantial growth in the export sector, especially in favor of labor-intensive industries. It will be important, therefore, for Egypt to improve its business environment by: (i) lowering barriers to investment, especially foreign direct investment (FDI), (ii) promoting private sector attractiveness relative to the public sector in terms of wages and job security, and (iii) lower costs for firms to formalize.

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Tables

Table 1. Egypt's Free Trade Agreements

Free Trade Agreement	Year of Entry into Force	Current Partners
Agadir	2007	Jordan; Morocco; and Tunisia
Common Market for Eastern and Southern Africa (COMESA)-Accession of Egypt	1999	Angola; Burundi; Comoros; Democratic Republic of the Congo; Eritrea; Eswatini; Ethiopia; Kenya; Lesotho; Malawi; Mauritius; Rwanda; Sudan; Tanzania; Uganda; Zambia; Zimbabwe
Egypt-Turkey	2007	Turkey
European Free Trade Association (EFTA)-Egypt	2007	Iceland, Liechtenstein, Norway, and Switzerland
European Union-Egypt	2004	Austria; Belgium; Bulgaria; Croatia; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Poland; Portugal; Romania; Slovak Republic; Slovenia; Spain; Sweden;
Global System of Trade Preferences among Developing Countries (GSTP)	1989	Algeria; Argentina; Bangladesh; Benin; Bolivia, Plurinational State of; Brazil; Cameroon; Chile; Colombia; Cuba; Ecuador; Egypt; Ghana; Guinea; Guyana; India; Indonesia; Iran; Iraq; Korea, Democratic People's Republic of; Korea, Republic of; Libya; Malaysia; Mexico; Morocco; Mozambique; Myanmar;

		Nicaragua; Nigeria; Pakistan; Peru; Philippines; Singapore; Sri Lanka; Sudan; Tanzania; Thailand; Trinidad and Tobago; Tunisia; Venezuela, Bolivarian Republic of; Viet Nam; Zimbabwe
Pan-Arab Free Trade Area (PAFTA)	1998	Bahrain, Kingdom of; Egypt; Iraq; Jordan; Kuwait, the State of; Lebanese Republic; Libya; Morocco; Oman; Qatar; Saudi Arabia, Kingdom of; Sudan; Syrian Arab Republic; Tunisia; United Arab Emirates; Yemen
Pan-Arab Free Trade Area (PAFTA)	1998	Bahrain, Kingdom of; Iraq; Jordan; Kuwait, the State of; Lebanese Republic; Libya; Morocco; Oman; Qatar; Saudi Arabia, Kingdom of; Sudan; Syrian Arab Republic; Tunisia; United Arab Emirates; Yemen
Protocol on Trade Negotiations (PTN)	1973	Bangladesh; Brazil; Chile; Egypt; Israel; Korea, Republic of; Mexico; Pakistan; Paraguay; Peru; Philippines; Serbia; Tunisia; Turkey; Uruguay
Southern Common Market (MERCOSUR)-Egypt	2017	Argentina; Brazil; Paraguay; and Uruguay
United Kingdom-Egypt	2021	United Kingdom

Source: World Trade Organization Regional Trade Agreements Database

Table 2. Mean values of main variables

	2013	2016	2020
Employment (Number)	50.69	34.28	30.87
Export sales (EGP)	579,873	599,057	4,843,432
Exporter (yes=1)	0.05	0.07	0.08
Value Machinery (EGP)	1,066,584	11,700,000	2,619,007
Cost per worker (EGP/worker)	20,329	20,543	65,725
Age of firm (years)	11.71	15.48	18.97
Foreign ownership (yes =1)	0.10	0.10	0.08
Female ownership (yes=1)	0.05	0.03	0.09
Registered (yes=1)	0.98	0.97	0.84
Training (yes=1)	0.03	0.13	0.08
Foreign technology (yes=1)	0.01	0.02	0.06
Imported inputs (yes=1)	0.26	0.42	0.42
Indirect exporter (yes=1)	0.01	0.02	0.05

Notes: Number of observations equals 198. Sample is restricted to the 2013-2016-2020 panel and excludes firms missing information on number of employees. Weighted using panel weights.
Source: Author elaboration using Enterprise Survey for Egypt.

Table 3. Direct and indirect exporters

	Direct Only	Indirect Only	Both Directly and Indirectly	Total Exporters	Total Firms
2020	18	6	2	27	198
2016	25	4	1	30	198
2013	18	7	5	30	198

Notes: Sample is restricted to the 2013-2016-2020 panel and excludes firms missing information on number of employees. The above table reports the number of firms within each survey round that export (directly or indirectly). Firms exporting directly are those that sell to other countries without any intermediary. Firms exporting indirectly are those which sell to a wholesaler or other who then resells to customers in other countries.
Source: Authors' elaboration using Enterprise Survey for Egypt.

Table 4. Simulated Effects of an International Price Increase

Groups	No. of Firms	Average Firm-level Employment Change	Total Employment Change	Average Percent Employment Change
Always exporters	46	13.960	642.169	0.067
New exporters	59	30.824	1,818.644	0.353
Never exporters	176	-0.052	-9.183	-0.003

Notes: The above table reports the simulated changes to employment following a 5 percent increase in the international price. Never exporters are firms that only sold to the domestic market in periods 1 and 2. New exporters are firms that sold to the domestic market in period 1 and switched to exporting in period 2 following the international price increase. Always exporters are firms that exported in period 1 and 2.
Source: Authors' simulation.

Table 5. Changes in log Employment relative to Changes in Sales and Export Share between 2016 and 2020

Export Share \ Sales	Increase	Decrease or unchanged
Increase	(1) N= 50 Δln emp. mean =0.86 st. dev. = 0.74	(2) N= 21 Δln emp. mean = 0.17 st. dev. = 0.77
Decrease or unchanged	(3) N= 243 Δln emp. mean = 0.16 st. dev. = 0.69	(4) N= 179 Δln emp. mean = -0.26 st. dev. = 0.66

Note: This table reports the mean change in log employment, for four scenarios: (1) sales and share exported increased, (2) sales did not increase and export sales did, (3) sales increased while the share going to exports did not, (4) neither sales nor export shares increased. Excludes upper and lower one percentiles of change in log employment. The sample is limited to exporting firms. Calculated using 2016-2020 panel weights.
Source: Author calculation using Enterprise Survey

Table 6. Survey Firms' Aggregated Employment Changes by Export Status

	Survey	Average Firm Level Employment Change			Total Employment Change			Average Percent Employment Change		
		2013-2016	2016-2020	2013-2020	2013-2016	2016-2020	2013-2020	2013-2016	2016-2020	2013-2020
Always	7	-18.4	239.0	220.6	-129	1,673	1,544	-4.0	53.9	47.8
New	17	6.2	57.4	63.6	105	977	1,081	10.8	90.5	111.0
Never	141	-35.2	20.8	-14.4	-4,957	2,927	-2,026	-45.8	50.1	-18.7
Stopped	33	0.3	12.4	12.7	11	409	420	0.1	3.5	3.5
Total	198	-25.1	30.2	5.1	-4,971	5,985	1,019	-18.5	27.4	3.8

Note: The above table reports the changes in employment levels by export status that we see in the 2013-2016-2020 panel data, unweighted. Export status is defined as follows: (i) "always" are firms which exported in all three years (2013, 2016, and 2020); (ii) "new" are firms that did not export in 2013 but were exporting by 2020 (starting in either 2016 or 2020); (iii) "stopped" are firms that switched from exporting to not; and (iv) "never" are firms that did not export in any of the three years.

Table 7. Probit Marginal Effects of Extensive Margin

Dependent variable	(1) Exporter (yes = 1)	(2) New Exporter (yes = 1)
ln(value of machinery)	0.003*	0.001
	(1.94)	(0.95)
ln(cost per worker)	0.026*	0.004
	(1.82)	(0.34)
Innovation (yes = 1)	0.137**	0.068
	(2.43)	(1.47)
ln(age of firm)	0.006	0.009
	(0.38)	(0.63)
Foreign owners (yes=1)	0.133**	-0.009
	(2.19)	(-0.25)
Female owners (yes=1)	0.013	0.010
	(0.25)	(0.23)
Registered (yes=1)	0.018	0.071***
	(0.44)	(3.84)
Training (yes=1)	0.015	-0.039*
	(0.37)	(-1.72)
Foreign tech (yes=1)	0.328***	0.046
	(4.10)	(0.87)
Imported inputs (yes=1)	0.135***	0.057**
	(4.40)	(2.27)
Year dummies	Yes	Yes
Pseudo R-squared	0.2091	0.0524
Observations	594	594
No. of firms	198	198

Notes: Probit marginal effects reported. The dependent variable in column (1) is a dummy equal to one if the firm is an exporter and zero otherwise. The dependent variable in column (2) is a dummy equal to one if the firm is a "new exporter," that is a firm that did not export in 2013 but does in 2020. Unweighted. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8. Estimated results of intensive margin

Dependent variable ln(Employment)	(1) OLS	(2) FE-Heckit
ln(Export Sales)	0.075***	0.207**
	(5.99)	(2.18)
ln(value of machinery)	0.048***	0.006
	(6.03)	(0.36)
ln(cost per worker)	-0.181***	-0.478***
	(-2.95)	(-3.68)
ln(age of firm)	0.477***	0.181
	(6.80)	(0.30)
Indirect exporter (yes=1)	-0.481	0.213
	(-1.44)	(0.72)
Innovation (yes = 1)	-0.215	
	(-1.12)	
Foreign owners (yes=1)	0.229	
	(0.97)	
Female owners (yes=1)	0.216	
	(1.02)	
Registered (yes=1)	0.370**	
	(2.14)	
Training (yes=1)	0.777***	
	(4.57)	
Foreign tech (yes=1)	0.378*	
	(1.76)	
Imported inputs (yes=1)	0.590***	
	(4.70)	
2016 dummy (yes=1)	-0.397***	-0.183
	(-3.22)	(-0.64)
2020 dummy (yes=1)	-0.259*	-0.018
	(-1.78)	(-0.04)
Lambda		-0.545*
		(-1.70)
Constant	2.854***	6.288**
	(4.68)	(2.52)
Year dummies	Yes	Yes
Observations	594	594
R-squared	0.363	0.579

Notes: Column (1) reports ordinary least squares estimates, column (2) reports fixed effects estimates with lambda included as an additional control. Lambda is the inverse mills ratio from the Heckman Correction (Heckman 1974) calculated from a first stage probit from Table 7, column (1) above. In the second stage, the sample is restricted to exporters. Unweighted. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

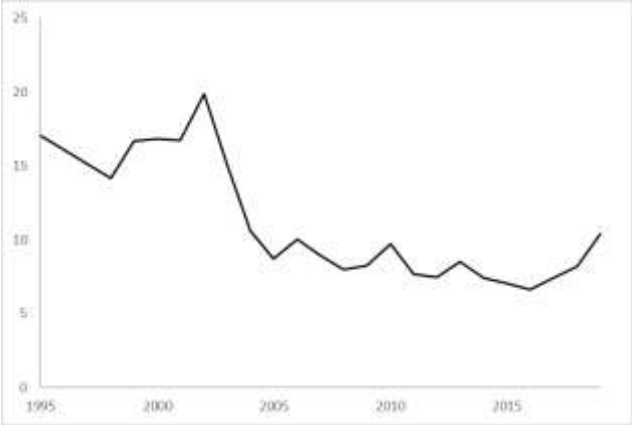
Table 9. Estimated the relationship between changes in employment and export sales

Dependent variable	(1)
Δln(Employment)	OLS
Δln(Export sales)	0.019*
	(1.69)
Δln(value of machinery)	0.026***
	(2.82)
Δln(cost of labor)	-0.213***
	(-5.52)
Constant	0.189***
	(2.61)
Year dummies	Yes
Observations	396
R-squared	0.126

Notes: Column (1) reports ordinary least squares estimates of the first differences. Unweighted. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

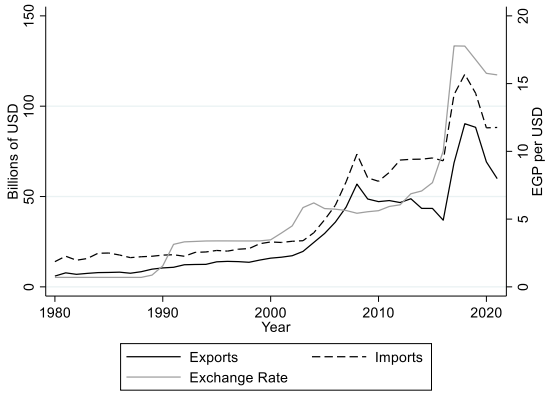
Figures

Figure 1. Egyptian tariff rate of all products, 1995-2019



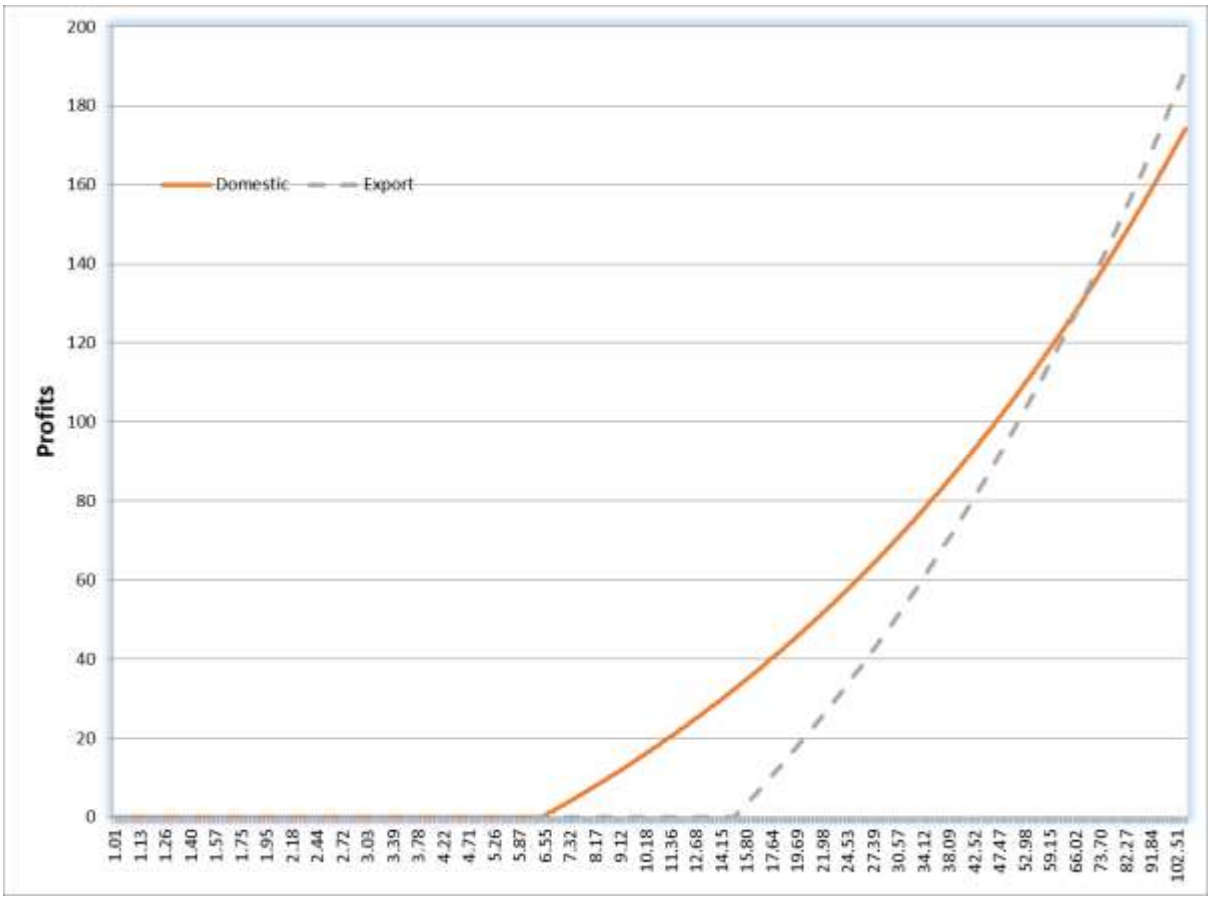
Notes: Weighted mean applied tariff is the average of effectively applied rates weighted by the product import shares corresponding to each partner country.
Source: Authors' elaboration using data from Our World in Data (https://ourworldindata.org/)

Figure 2. Exports and Imports of Goods and Services, constant 2015 US $ (left-hand axis), and Exchange Rate (right-hand axis)



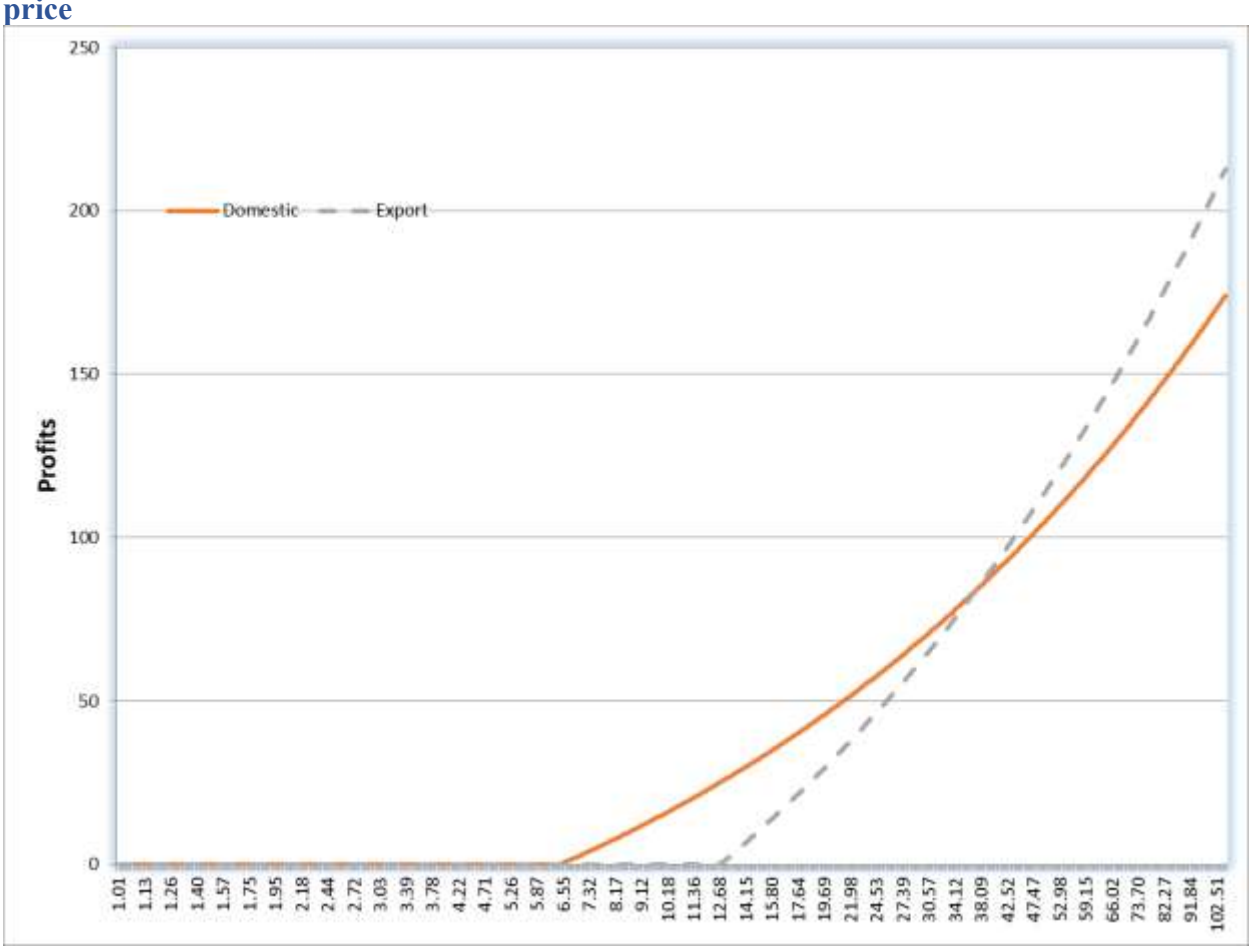
Note: Exchange rate data is annual average Egyptian pounds per USD.
Source: Authors' elaboration using data from the World Development Indicators (exports and imports) and International Financial Statistics (exchange rate).

Figure 3: Theoretic Outcome in Melitz (1993)-style model under the original international price



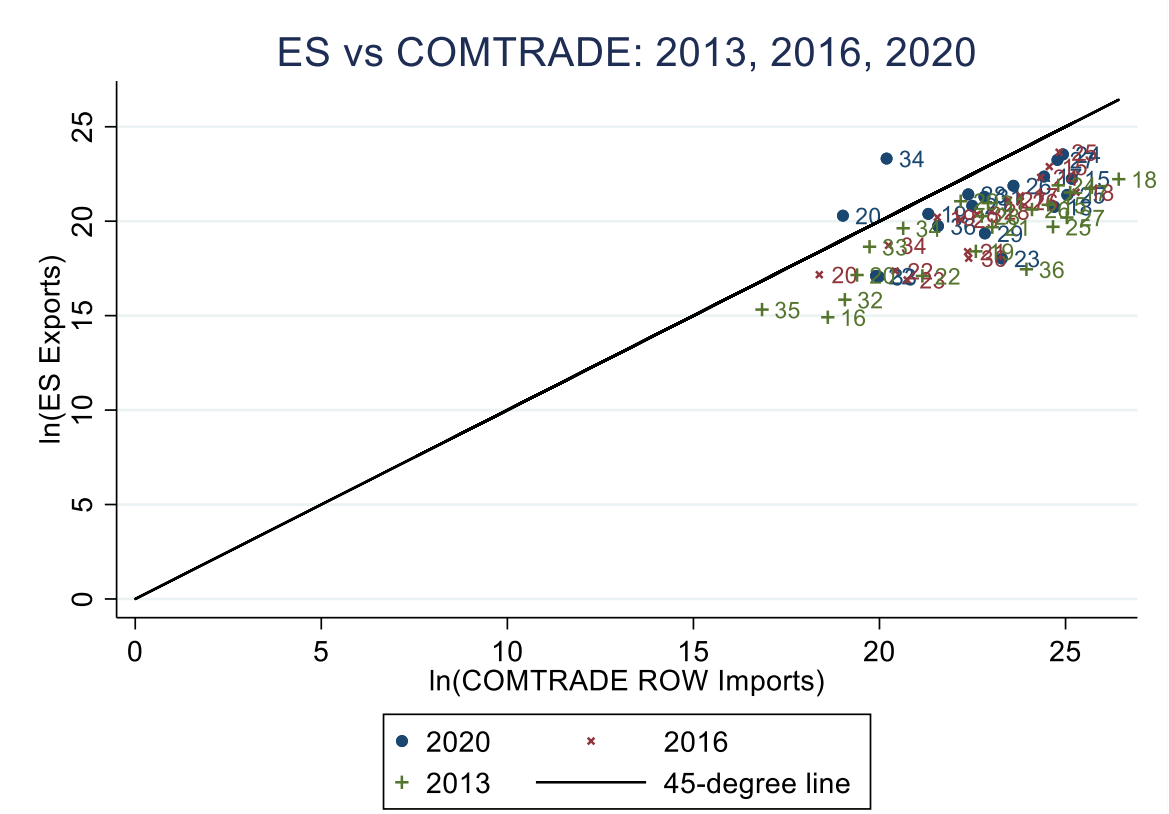
Notes: The above figure depicts the scenario under the original international price. Firms are sorted along the horizontal axis in increasing level of firm-specific productivity (phi). The solid orange line indicates firms producing for the domestic market. The dashed-grey line indicates firms producing for the international market. Firms will export or not depending on which profit line is higher. Firms with productivity less than 6.55 produce nothing. Firms with productivity above 15.18 have the *option* of producing for export. Firms with productivity between 6.55 and 68.72 produce and sell only to the domestic market at the original price.

Figure 4: Theoretic Outcome in Melitz (1993)-style model under the higher international price



Notes: The above figure depicts the scenario under the new international price following a 5 percent increase. Firms are sorted along the horizontal axis in increasing level of firm-specific productivity (phi). The solid orange line indicates firms producing for the domestic market. The dashed-grey line indicates firms producing for the international market. Firms will export or not depending on which profit line is higher. Notice that the domestic profit line is unchanged compared to Figure 5. When the international price increases by 5 percent, the export profit line shifts left relative to its position in Figure 5. Under this new price, the productivity cut-off for exporting drops from 68.72 to 38.09 thus bringing more firms into the export market.

Figure 5. Comparing Egypt's total exports from Enterprise Survey and UN COMTRADE, 2016

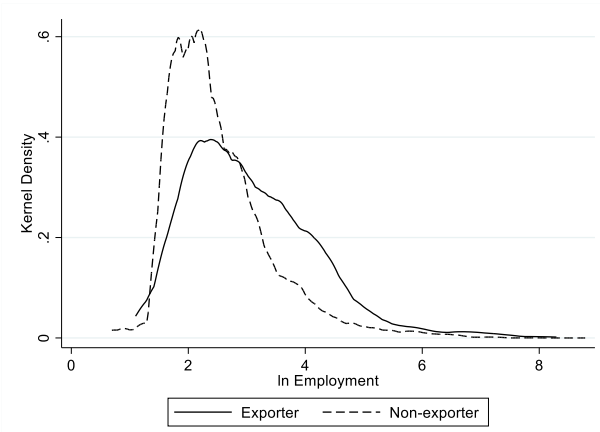


Notes: Only Manufacturing sectors are included. The vertical axis measures log export sales in value from the Enterprise Surveys while the horizontal axis measures the log imports by the rest of the world from Egypt.[12] Sectors groupings are in ISIC rev 3.1: 15 = Manufacture of food products and beverages; 16 = Manufacture of tobacco products; 17 = Manufacture of textiles; 18 = Manufacture of wearing apparel; dressing and dying of fur; 19 = Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear; 20 = Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; 21 = Manufacture of paper and paper products; 24 = Manufacture of chemicals and chemical products; 26 = Manufacture of other non-metallic mineral products; 28 = Manufacture of fabricated metal products, except machinery and equipment; 31 = Manufacture of electrical machinery and apparatus n.e.c.; 34 = Manufacture of motor vehicles, trailers and semi-trailers; 36 = Manufacture of furniture; manufacturing n.e.c.
Source: Authors' elaboration using data from the Enterprise Survey for Egypt and UN COMTRADE.

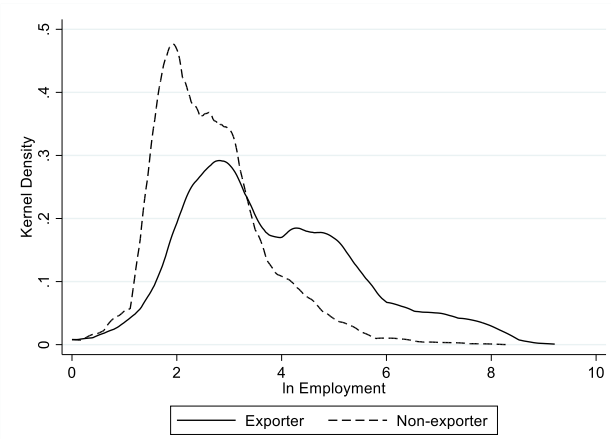
[12] We focus on total imports from Egypt rather than total exports by Egypt because imports tend to be better measured.

Figure 6. Employment Kernel Density Functions of Exporters and Non-Exporters in Egypt

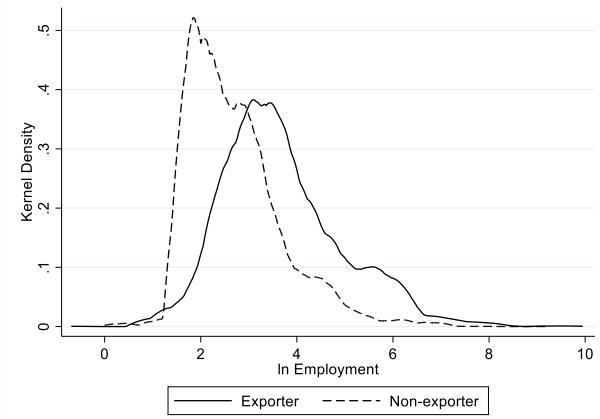
a. 2020



b. 2016



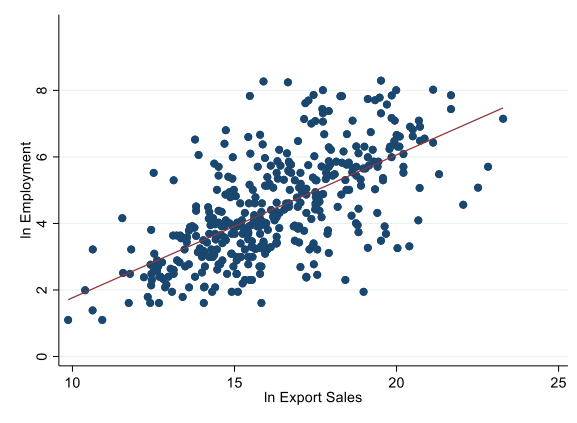
c. 2013



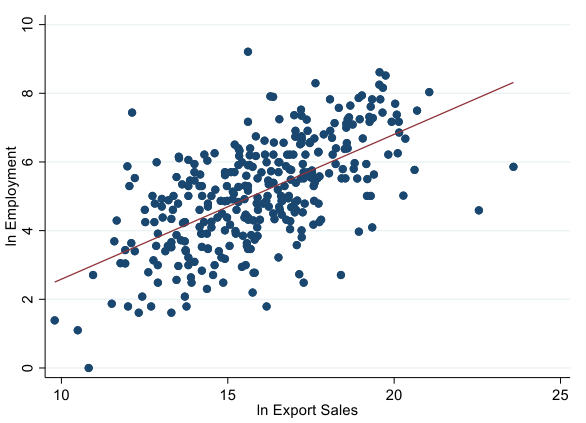
Source: Author calculations using 2013-2016-2020 panel, Enterprise Survey for Egypt.

Figure 7. Employment vs Export Sales

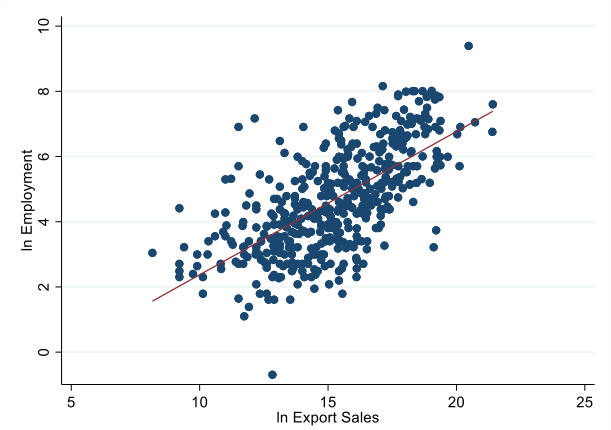
a. 2020



b. 2016



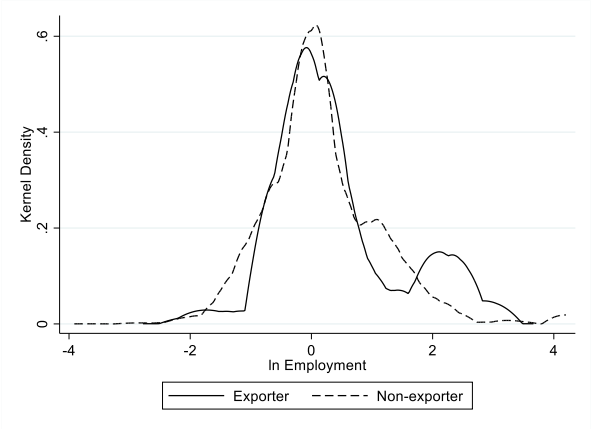
c. 2013



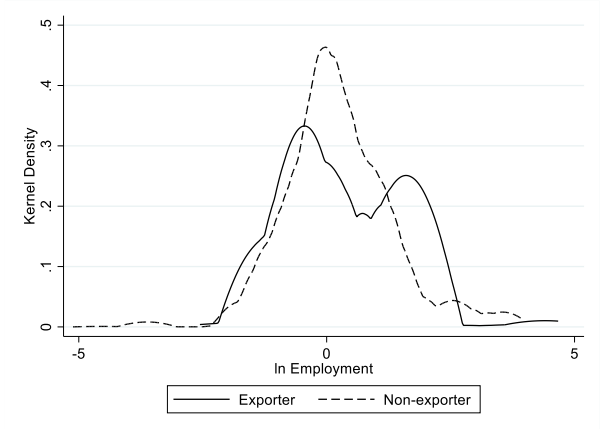
Source: Authors' elaboration using data from the Enterprise Survey for Egypt, 2013, 2016, and 2020.

Figure 8. Kernel Density Function of the change in ln Employment

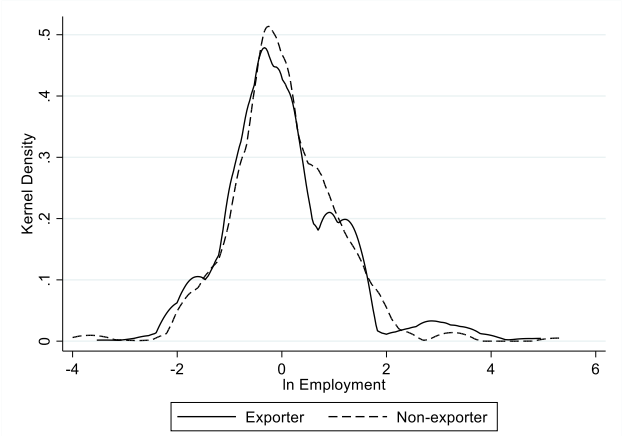
a. 2016-2020



b. 2013-2020



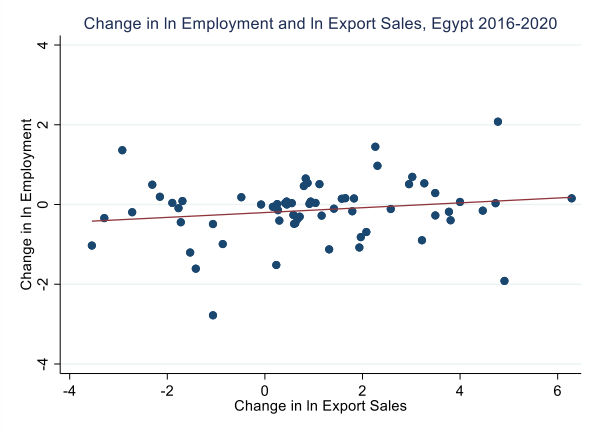
c. 2013-2016



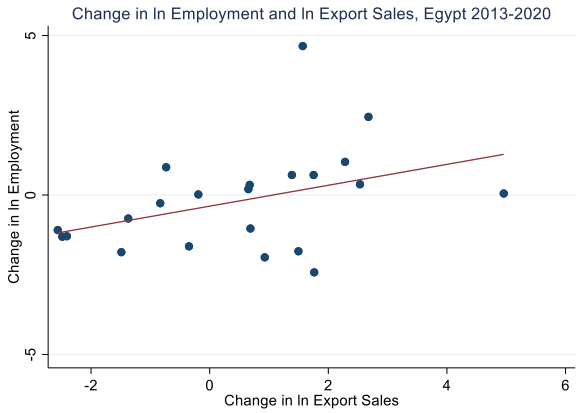
Source: Authors' elaboration using data from the Enterprise Survey for Egypt, 2013, 2016, and 2020.

Figure 9. Scatterplots of the change in ln Employment and change in Exports

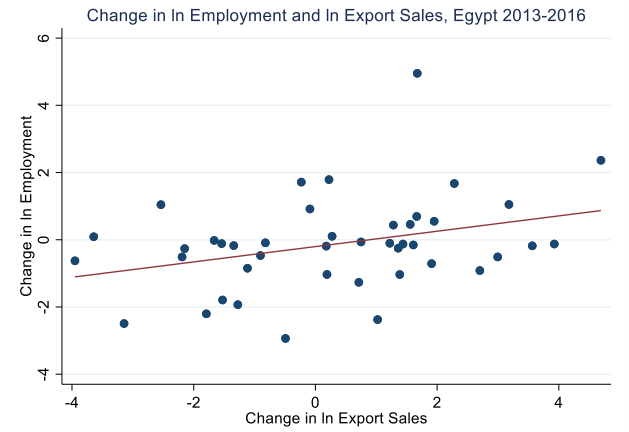
a. 2016-2020



b. 2013-2020

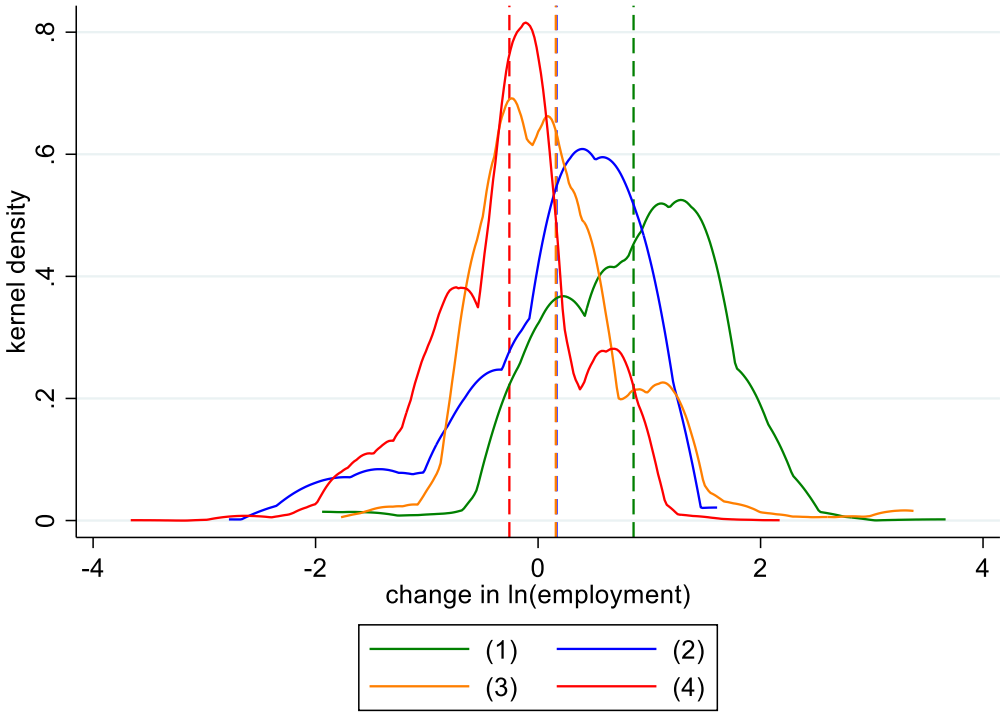


c. 2013-2016



Source: Authors' elaboration using data from the Enterprise Survey for Egypt, 2013, 2016, and 2020.

Figure 10. Kernel Density Functions of change in log employment under alternative scenarios



Notes: This figure depicts the kernel density functions for four scenarios: what happens to firm employment in four different cases: (1) sales and share exported increased, (2) sales did not increase and export sales did, (3) sales increased while the share going to exports did not, (4) neither sales nor export shares increased. Dashed vertical lines depict the mean value for change in log employment. Note that the mean for the four groups are: (1) 0.86, (2) 0.17, (3) 0.16, and (4) -0.26. Calculated using 2016-2020 panel weights. Sample excludes the upper and lower one percentile of change in log employment.
Source: Authors' elaboration using data from the Enterprise Survey for Egypt, 2013, 2016, and 2020.

Appendix A. Robustness Checks

Table A1. Descriptive Statistics for firms that survived between 2016 and 2020 as compared to those that did not

	Survivors	Non-survivors	Difference	sd	t-statistic
Employment	189.27	144.81	-44.45	533.44	-1.23
Export sales	21,300,000	5,738,930	-15,561,070	182,000,000	-1.27
Exporter (yes=1)	0.23	0.18	-0.05	0.42	-1.92*
Value Machinery	42,100,000	13,300,000	-28,800,000	241,000,000	-1.77*
Cost per worker	30,701	29,900	-801	91,009	-0.13
Age of firm	28.23	27.68	-0.54	18.12	-0.45
Foreign ownership (yes =1)	0.07	0.08	0.01	0.26	0.34
Female ownership (yes=1)	0.10	0.14	0.04	0.31	1.64
Registered (yes=1)	0.93	0.95	0.02	0.25	1.44
Training (yes=1)	0.22	0.18	-0.04	0.41	-1.50
Foreign technology (yes=1)	0.13	0.10	-0.03	0.33	-0.98
Imported inputs (yes=1)	0.50	0.45	-0.05	0.50	-1.44
Indirect exporter (yes=1)	0.04	0.04	0.00	0.21	0.00

Note: Estimates are unweighted. Survival is defined in the data based the eligibility of a 2016 firm in 2020 ("eligibility2020").

Table A2. OLS Cross Section Estimates of Employment and Export Status

Dependent variable	(1)	(2)	(3)
ln(Employment)	2013	2016	2020
Exporter (yes=1)	1.066***	1.250***	0.807***
	(0.11)	(0.13)	(0.09)
ln(value of machinery)	0.044***	0.021**	0.176***
	(0.01)	(0.01)	(0.02)
ln(cost per worker)	-0.100***	-0.006	-0.218***
	(0.04)	(0.05)	(0.04)
ln(age of firm)	0.406***	0.342***	0.141***
	(0.06)	(0.07)	(0.03)
Foreign owners (yes=1)	0.475***	0.368**	0.107
	(0.11)	(0.18)	(0.13)
Female owners (yes=1)	0.261**	0.064	0.103
	(0.11)	(0.12)	(0.08)
Registered (yes=1)	0.342***	0.312**	0.165***
	(0.09)	(0.16)	(0.06)
Training (yes=1)	-0.971***	-0.562***	-0.839***
	(0.11)	(0.11)	(0.11)
Foreign tech (yes=1)	0.306**	0.343**	0.355***
	(0.14)	(0.15)	(0.10)
Imported inputs (yes=1)	0.313***	0.633***	0.234***
	(0.07)	(0.09)	(0.05)
Indirect exporter (yes=1)	-0.396***	-0.509**	-0.271
	(0.15)	(0.22)	(0.17)
Constant	3.945***	2.510***	3.509***
	(0.47)	(0.62)	(0.50)
Sector dummies	Yes	Yes	Yes
Region Dummies	Yes	Yes	Yes
Observations	1,767	1,084	2,676
R-squared	0.389	0.443	0.394

Notes: Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A3. OLS Cross Section Estimates of Employment and Export Sales

Dependent variable	(1)	(2)	(3)
ln(Employment)	2013	2016	2020
ln(export sales)	0.082***	0.088***	0.058***
	(0.01)	(0.01)	(0.01)
ln(value of machinery)	0.043***	0.022**	0.171***
	(0.01)	(0.01)	(0.02)
ln(cost per worker)	-0.113***	-0.016	-0.224***
	(0.03)	(0.05)	(0.03)
ln(age of firm)	0.395***	0.332***	0.134***
	(0.06)	(0.07)	(0.03)
Foreign owners (yes=1)	0.434***	0.297*	0.086
	(0.11)	(0.17)	(0.13)
Female owners (yes=1)	0.233**	0.053	0.109
	(0.11)	(0.11)	(0.08)
Registered (yes=1)	0.346***	0.306*	0.164***
	(0.09)	(0.16)	(0.06)
Training (yes=1)	-0.918***	-0.520***	-0.803***
	(0.11)	(0.11)	(0.11)
Foreign tech (yes=1)	0.240*	0.243*	0.300***
	(0.14)	(0.15)	(0.10)
Imported inputs (yes=1)	0.286***	0.612***	0.224***
	(0.07)	(0.09)	(0.05)
Indirect exporter (yes=1)	-0.477***	-0.514***	-0.318**
	(0.13)	(0.20)	(0.16)
Constant	3.994***	2.534***	3.595***
	(0.46)	(0.61)	(0.50)
Sector dummies	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes
Observations	1,767	1,084	2,676
R-squared	0.410	0.462	0.405

Notes: Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix B. Heckman Correction for Selection Bias (Heckit)

To correct for selection bias, we implement a variation of the method developed by Heckman (1974). Equation (B1) is the selection equation:

$$export_{it} = \theta_0 + X_{it}\theta_1 + \epsilon_{it} \quad \text{(B1)}$$

The Heckman correction procedure is as follows:

1. Equation (B1) is consistently estimated by Probit regression. From this, we can obtain the inverse Mills ratio:

$$\hat{\lambda}_i = \frac{\hat{\phi}_i}{\hat{\Phi}_i}$$

where, ϕ_i and Φ_i are the probability density and cumulative normal distribution respectively.

2. Equation (1) is estimated with the inverse Mills ratio included as an additional control.

$$\ln N_{it} = \alpha + \hat{\lambda}_i + \beta \ln E_{it} + X'_{it}\gamma + D_t + \mu_i + \varepsilon_{it} \quad \text{(B2)}$$