

Quality and accessibility of infrastructure and manufacturing exports in Egypt: Firm-level evidence

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Abstract

This paper aims to investigate the effect that infrastructure quality and accessibility have on the extensive and intensive export margins of manufacturing firms in Egypt. Using firm-level data from the World Bank's enterprise survey for the years 2007 and 2013, we attempt to link Egyptian firms' heterogeneity in productivity and characteristics related to the access to infrastructure such as transport, telecommunication, power generation and water and sanitation, with their trade performance. Results suggest that quality and access to infrastructure have significant effects on export volumes, stronger in the case of private foreign firms. Being a large firm, increases resilience against the growth of access to power and water, as obstacles to exporting over time. Owning an electricity generator also seems to have a significant positive impact on exports. Moreover, results show discrepancies of infrastructure quality across regions, implying the importance of local authorities in maintaining and enhancing infrastructure quality and accessibility.

Keywords

Infrastructure, exports, heterogeneity, productivity, Egypt

1. INTRODUCTION

The Manufacturing sector has always played a key role in driving the growth of the Egyptian economy contributing to the value added, creating jobs and exporting. Between 2000 and 2016, the value added of the sector has contributed on average to 17 per cent of the GDP. After the uprisings of 2011 and the political instability that resulted from the situation – diving a low level of 15.9 in 2012 but and gradually recovering. The government plans to increase its share to 25 per cent of GDP by 2020. Manufacturing sector fosters over 25 per cent of Jobs in the Egyptian market and contributes largely exports.

Egyptian exports, including manufacturing exports, faced different headwinds in the past decade starting with the global economic crisis, through the political turmoil between 2011 and 2013 that disrupted the expansion of Egypt's electricity generation capacity, causing it to lag behind rising demand. The power shortfall has been exacerbated by declining natural gas production and a foreign currency crisis which has restricted the government's ability to pay for fuel, whether imported or produced locally by international oil companies. Moreover, the Central bank's decision in November 2016 to float the Egyptian pound, resulting in a sever devaluation of the EGP, has contributed to the dollar crisis and the government's ability to subsidise imported power supply.

This power shortage inspired this paper to look at different variables that represent infrastructure services at a firm level, and attempt to link these variables to firms' export performances and the probability to enter foreign markets. This paper aims to investigate the effect that infrastructure quality and accessibility have on the extensive and intensive export margins of manufacturing firms in Egypt. Empirical literature often focuses on infrastructure variables from a macro-level approach using static and dynamic panel data models, spatial econometrics, as well as bilateral trade flow and gravity models to measure the impact that infrastructure has on export performance.

Two main problems occur when attempting to use the macro-level analysis. On one hand, few countries have macro-data that are reliable enough to produce solid and robust results. In the case of Egypt, infrastructure indicators are available; however, variation over time is very limited for the majority of them; which leaves no room for panel analysis justification. On the other hand, macroeconomic indicators do not count for regional variations; neglecting the role of local governance and assuming that infrastructure quality is indifferent across regions.

Using firm-level data from the World Bank's enterprise survey for the years 2007 and 2013, we attempt to link Egyptian firms' heterogeneity in productivity and characteristics related to the access to infrastructure such as transport, telecommunication, power generation and water and sanitation, with their trade performance. Doing so, we focus on two types of variables: external and internal. External variables represent water and electricity supply, water and power outages and the losses occurring due these outages. Internal variables are related to firm's infrastructure such as owning a power generator, having a website and communicating through emails.

First, the paper estimates the effect of infrastructure on sales. In a second step, the paper evaluates how the heterogeneity in characteristics and infrastructure accessibility translates into different export performances.

The paper will start with an introduction followed by a review of theoretical and empirical literature. Section three presents stylized facts and section four discusses data, methodology and econometric issues. Findings from different estimations are in section five and lastly, section six concludes with recommendations.

2. LITERATURE REVIEW

Infrastructure quality has a pervasive influence on all sectors of an economy. Low-quality infrastructure and limited transport and power services increase logistical and production cost; rendering products uncompetitive, and limiting production optimization and firms' access to markets. The part of the literature linking firm productivity and export performance is based on the firm heterogeneity model developed by Melitz (2003). His model proposes that for a given country, in each industry, there are a number of firms differentiated in terms of product varieties, as well as in terms of productivity level.

By entering the domestic market, each firm discovers its level of productivity and only those with a level of productivity allowing them to cover the fixed costs of production remain on the market. Alternatively, firms with a low level of productivity withdraw. Similarly, there are fixed costs associated with export activities, additional to the fixed costs of production in the domestic market.

The decision of a firm to export comes after the discovery of its level of productivity. As a result, a firm decides to export if and only if, its net profits from its export activities to another country are sufficient to cover its fixed export costs. In other words, the profit thresholds in the domestic market and the export market respectively determine the input productivity thresholds of a firm in the domestic market and in the export market. In fact, the fixed and variable costs of exporting require a productivity threshold to export always higher than that required to produce on the domestic market. Finally, we observe that only a small fraction of the small percentage of firms with a high level of productivity engage in export activities.

The literature on the relationship between infrastructure and export performance is fairly limited. The available literature investigates the impact of infrastructure and firms' production. In India, poor access to electricity and Internet seems to explain 25% of the total factor productivity gap in these firms (Dollar et al, 2002). Dollar et al (2004) show that power outages are one of the important impediments for firms in Pakistan, Bangladesh and India, and lower for Chinese firms. Subramanian et al (2005) find that utility services interruptions negatively affect firms' performance in China and Brazil. On the contrary, Hallward-Driemeier et al (2006) and Bastos and Nasir (2004) find no evidence on the impact of physical infrastructure on firms' productivity. Şeker (2011) suggests that improvements in regulation, access to finance, and physical infrastructure significantly increase export volumes across countries with different income levels.

3. DATA AND METHODOLOGY

To assess the effect that infrastructure quality and accessibility has on exports in Egypt, we use data of the Enterprise Survey gathered by the World Bank for the years 2007 and 2013. Our dataset is formed of 882 firms (441 firms in two years 2007 and 2013), operating in the manufacturing sector.

Business surveys, gathered through interviews with firms in the manufacturing and service sectors, capture data on the greatest barriers to business growth, the relative importance of different constraints to employment and productivity, and the effects of a country's business environment on its international competitiveness. They are used to create statistically significant indicators of the business environment that are comparable across countries. Business surveys are also used to build a business data plan that will track changes in the business environment over time and allow assessments of the impact of reforms.

These enterprise level surveys have been conducted since the 1990s by different units within the World Bank. Since 2005-06, most data collection efforts have been centralized within the Enterprise Analysis Unit. All surveys have country-specific questions; therefore the aggregate data set between countries does not include these country-specific issues. In our study, we will use the survey of firms in Egypt for the years 2007 and 2013 and 2016.

Due to the sensitive questions of the investigation concerning the relations between enterprises and government and subjects related to corruption, private entrepreneurs carry out the surveys of the companies on behalf of the World Bank. The survey is answered by business owners and senior managers. Sometimes the respondent calls the company's accounting and human resources managers in the interview to answer questions regarding the sales and work items of the survey. Manufacturing and service sectors are the main areas of activity of interest.

The Unit conducting the survey uses two instruments: the Manufacturing Questionnaire and the Service Questionnaire. The basic subjects of the Enterprise Survey include company characteristics, women's participation, access to financing, annual sales, input / labour costs, workforce composition, corruption, licensing, infrastructure, trade, crime, competition.

Based on the new trade theories (Melitz (2004) and following the empirical literature (see for instance Yoshino (2008) and Redding and Venables (2003)), we derive a firm-level base model as follows:

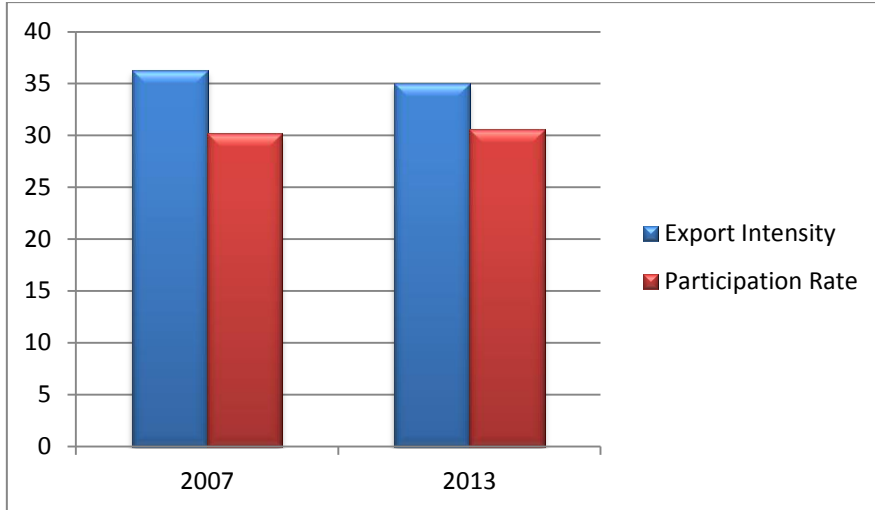
$$Y_{it} = \alpha_0 + \sum_h \alpha_{1h} \delta_{ih} + \sum_c \alpha_{2c} \phi_{ict} + \varepsilon_{it}$$

Where Y is the export probability of firm i in year t , δ_{ih} are the different infrastructure variables ϕ_{ict} represents firm-level controls as sector, percentage of the firm owned by foreign private and public owners and size. Finally, ε_{it} is a random error term. In a second step, we use the maximum-likelihood techniques through a base Tobit model to estimate export intensity, using the same instrumental and control variables as the previous model.

4. STYLIZED FACTS

A- Export Intensity and Export Participation Rate

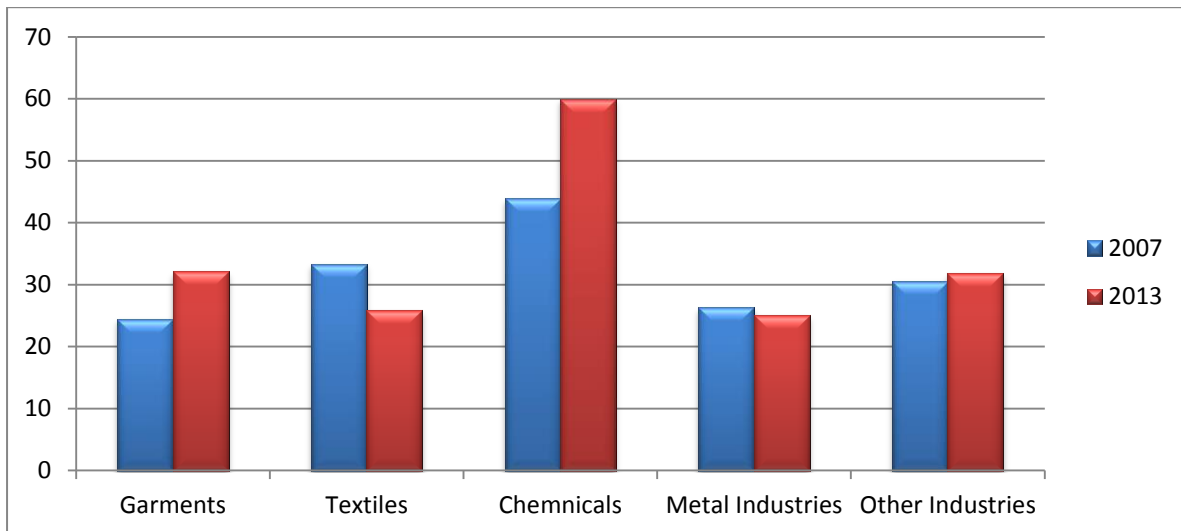
Figure 1. Export Intensity and Export Participation rate by Year



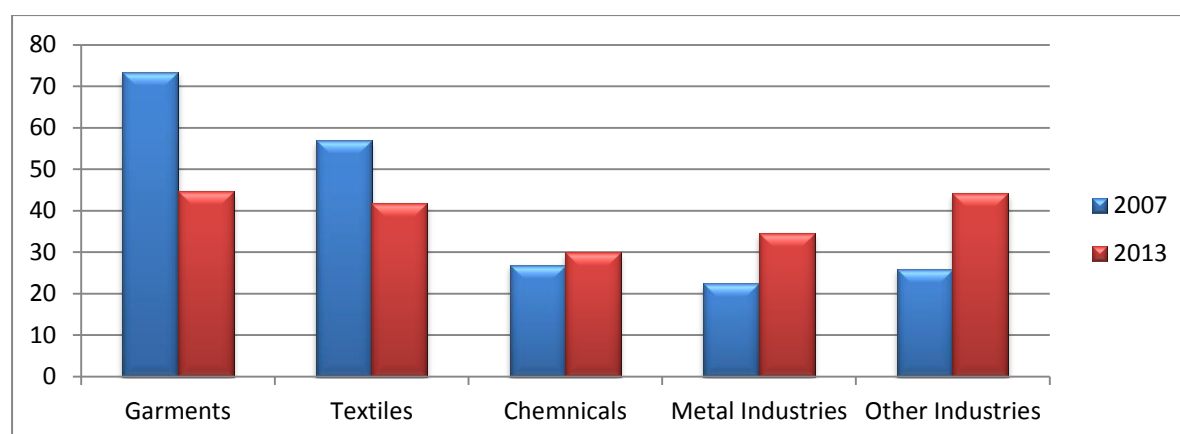
As shown in the figure above, roughly only one in three firms, participates in exporting in both 2007 and 2013. Looking at the export percentage of total sales, only 35 per cent in 2007 and 2013, showing low levels of both the participation rates in exports and volumes exported.

Figures 2. Export Intensity and Export Participation rate by Sector in 2007 and 2013:

2.a Participation Rate



2.b Export Intensity



In the two figures above, we can observe the evolution of both the export intensity and the participation rate by sector between 2007 and 2013. In Figure 2.a, there is a noticeable rise of participation in the chemical sector from over 40 per cent of firms reaching, 60 per cent. The rate increases for the Garments sector as well. As for the textiles, percentage of exporting firms decreases in 2013.

Looking at 2.b, the fall of exports in the garment sector is sharp from over 70 per cent to less than 45 per cent, similarly, exports fall in the textiles sector. The sectors that benefit from a rise in exports are those of chemicals and of metal industries, as well as the other sectors.

B – Infrastructure indicators as obstacles to operations:

Table 1. Percentage of Firms Classifying the Utility as Major or Very Severe Obstacle of Operation

Utilities	Electricity	Telecommunications	Water	Transport
2007	15.42	6.37	8.35	15.95
2013	48.30	12.47	-	19.27
2016	31.56	9.24	12.99	21.80

For electricity, the percentage of firms that reported it as a major or very severe obstacle was only 15 per cent in 2008. This percentage hugely increased to become 48 per cent, almost half of the sample's firms considering electricity to be a major obstacle to their operations. Although telecommunications is reported as a major or severe obstacle to operations, percentages of firms reporting it are relatively low compared to other utilities, signalling telecommunications not being the most standing-out obstacle. Looking at the quality of transportation, we observe that the percentage in 2007 is starting high and the percentage of firms affected by this measure increases reaching 19 per cent of firms in 2013.

5. FINDINGS

Using the models explained in section (3), we first estimate the effect of infrastructure variables on total sales. The infrastructure variables used are the number of water cuts, number of electricity cuts, average number of hours of water cuts, average number of hours of electricity cuts, the use of e-mail by the firm, the use of a website of the firm, the ownership of an electricity generator, the percentage of electricity generated by the shared or owned electricity generator and finally the severity of transportation as an obstacle to operations. In different variations of the models, we control for firms' characteristics such as the size, and percentage of public and foreign ownership, with government dummies, sector dummies and year fixed effects.

Table (2) shows the results of the different variations of the model. Public ownership seems to play a positive significant role in increasing the total sales of a firm, while the percentage of foreign ownership does not seem to have a significant effect. Owning a power generator has a consistently positive significant effect on sales across different stages of the model, while the number of hours of power outages as well as the average number of hours that power is interrupted, do not have significant effects on sales. Moving to telecommunications variables, having an e-mail used in communications has a positive effect on firms' sales but having a website doesn't seem to play a significant role. Similarly, transportation as an obstacle has no effect on sales.

Table (3) is a logit model of the probability of the firm to export. Sales and being a large firm both play consistently a positive significant role on the probability of a firm to export. However, being located in the centre and the percentage of public ownership of the firm do not have significant effects on the probability. Foreign ownership percentage has in some variations a significant positive effect on the probability to export. Looking at the infrastructure variables, water variables, average hours of power cuts and having website, these variables do not have significant effect on a firm's probability to export. On the contrary, owning a power generator and having an email used in communications, they both play significant high positive effect on the probability to export. Transport as an obstacle also has a negative significant effect on the decision to export.

Finally, Table (4) represents a Tobit model where we investigate the impact of infrastructure variables on the volume of exports once the firm is exporting. In this model as the previous model, sales and size play significant positive roles. However, all infrastructure variables do not play significant roles in determining exports' volume. Moreover, unlike the probability to export where foreign ownership matters, in this model, public ownership plays consistently a significant positive role.

6. CONCLUSION

To conclude, this paper attempts to assess the impact that different infrastructure measures have on the probability to export as well as on the exports' volume once the firm enters the foreign market. We find a positive significant effect of using telecommunication and owning or sharing a power generator on the probability to enter a foreign market. Transportation as an obstacle has a significant negative effect on the probability to export. Being a large firm matters in deciding to export. On the intensive margin of exports, local infrastructure variables do not have significant impacts on exports' volume once the firm starts to export. However, percentage of public ownership in the firm plays a positive significant role and size has a positive role in increasing exports' volume.

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Table (2): OLS Model

Y = ln(Sales)

	(1)	(2)	(3)	(4)	(5)
Size	1.4253***	1.2393***	1.2129***	1.2791***	1.2953***
% Owned by public sector	0.0189***	0.0219***	0.0201***	0.0204***	0.0198***
% Owned by foreign private sector	0.0082	0.0051	0.0037	0.0042	0.0044
No of times water was cut					
Avg no. of hours water was cut	-0.0081	-0.0041	-0.0058	-0.0087	-0.0127
Avg no. of hours power was cut	0.0143	0.0161	0.0149	0.0138	0.0121
Ownership of power generator		0.6162**	0.5583**	0.6058**	0.6673**
The firms communicates through an e-mail		0.9472***	0.5891*		
The firm has a website			0.5062		
Mail*Website				0.7829***	0.7493***
Transportation as an obstacle					0.6684
Sector dummies	Yes	Yes	Yes	Yes	Yes
Governorates dummies	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Constant	7.3541***	7.0221***	6.9512***	7.0589***	7.1328***
R2	0.79	0.79	0.8	0.79	0.79
N obs	234	234	234	234	232

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Table (3): Logit Model

Y =Exporter

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln(Sales)	1.661***	1.5398***	1.4893***	1.6077***	1.4881***	1.3283**	1.3223**	1.3882***	1.3973***
Large	2.5248***	4.4798***	3.6199***	3.5175***	3.3569***	2.5190**	2.4289*	2.5215**	2.4915*
Centre	1.5042**	1.0828	2.4445	0.8949	0.8099	0.7086	0.7092	0.7016	0.7544
% Owned by public sector	0.9968	1.0023	1.0068	1.0011	1.0004	1.0128	1.011	1.0034	1.0029
% Owned by foreign private sector	1.0128**	1.0154	1.0208*	1.0172*	1.0188*	1.0122	1.0104	1.0084	1.0069
No of times water was cut		1.0045							
Avg no. of hours water was cut			0.9601	0.9584	0.956	0.9579	0.9549	0.9519	0.9584
Avg no. of hours power was cut				0.9873	0.9793	0.9817	0.9813	0.9784	0.9859
Ownership of power generator					3.4527***	2.8297**	2.5536**	2.3357**	2.5129**
The firms communicates through an e-mail						17.6004***	11.4698***		
The firm has a website							1.8604		
Mail*Website								7.7284***	9.6299***
Transportation as an obstacle									0.6998**
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-6.1612***	-5.8767***	-6.6169***	-5.7309***	-5.6030***	-5.9665***	-5.8886***	-5.3909***	- 5.4066***
Pseudo R2	0.29	0.31	0.34	0.32	0.35	0.45	0.46	0.43	0.45
No. of Observations	730	274	226	233	233	233	233	233	231

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Table (4): Tobit Model Y = ln(exports)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln(Sales)	1.0157***	1.0179***	1.0215***	1.0203***	1.0088***	1.0068***	1.0094***	1.0066***	1.0105***
Size	0.0481	-0.1899	-0.2933	-0.4558**	-0.4642**	-0.4589**	-0.4309**	-0.4192**	-0.4178**
% Owned by public sector	-0.006	-0.0084**	-0.0086**	-0.0078**	-0.0074**	-0.0089**	-0.0085**	-0.0086**	-0.0089**
% Owned by foreign private sector	0.0035	0.0027	0.0006	0.0003	0.0011	0.0011	0.0019	0.0021	0.0022
No of times water was cut		0.0109							
Avg no. of hours water was cut			0.0329*	0.0242	0.0225	0.0226	0.0213	0.0214	0.02
Avg no. of hours power was cut				0.0059	0.0047	0.0067	0.0067	0.0065	0.0107
Ownership of power generator					-0.2678	-0.2825	-0.3025	-0.2994	-0.2804
The firms communicates through an e-mail						-0.3139	-0.0834		
The firm has a website							-0.2694	-0.2951	
Mail*Website									-0.3329
Transportation as an obstacle									-0.0690
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Governorates dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.1739***	4.0306***	4.2518***	4.6651***	5.0994***	4.8317***	5.4082***	6.9286***	6.9268***
Pseudo R2	0.51	0.55	0.55	0.57	0.58	0.58	0.58	0.58	0.58
No. of observations	237	101	99	92	92	92	92	92	92

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