Do Exports and Innovation Matter for the Demand of Skilled Labor? Evidence from MENA Countries

Theme: International Economics

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Abstract

The objective of the paper is to test the impact of exports and innovation on the demand of skilled labor in the MENA region using firm-level data. In this matter, our contribution is twofold. First, we extend the analysis of Bustos (2011) by examining the nexus between exports and skill bias through several indicators of innovation and technology adoption. Second, we test this relation for nine MENA countries using firm-level data from the World Bank enterprise survey (2013). Our results suggest a positive and significant impact of exports on innovation and technology adoption. We also find a significant and positive effect of technology on the demand for skilled production and non-production labor, especially for large firms. Meanwhile, medium enterprises seem to be disadvantaged when it comes to skilled labor demand, which appears to be negatively affected by innovation.

J.E.L. classification : F10, F12.

Keywords: Trade Openness, Skill Bias, Job Creation, Egypt.

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1. Introduction

Trade liberalization raises the demand for skilled workers in highly competitive firms. Along the lines of Melitz (2003), firms -in addition to different thresholds of their productivity- also differ in their skill intensity. Therefore, the tougher the competition, the more likely a firm shall improve its production process, innovate, and hire more skilled labor to be able to export.

The literature on this topic is relatively abundant. Feenstra and Hanson (1996, 1997) develop a model examining the simultaneous increase in the skill premium in developed and developing countries when they liberalize trade in the presence of trade in intermediate inputs and capital movements. Feenstra and Hanson (2001) also develop a theoretical model where trade in inputs has the same impact on labor demand as skill-biased technical change, since both of these will shift demand away from low-skilled activities and raise the relative demand and wages of the better skilled.

In the same line, Goldberg and Pavcnik (2007) test apply the methodology by Feenstra and Hanson (1996. 1997) for Latin American countries within an H-O framework. Harrigan and Reshef (2011) model skill-biased technology as a correlation between skill intensity and technological progress for the Chilean case in 1995. The result suggest that fall in trade costs leads to both greater trade volumes and an increase in the relative demand for skill, since the most-skilled firms expand to serve the export market. Moreover, Bustos (2011) finds that the reduction in Brazil's tariffs induces the most productive Argentinean firms to upgrade skill, while the least productive ones downgrade. Using a general equilibrium model, Bontout and Jean (1998) find that sector-biased technical change and North–North trade can significantly increase skilled labor's relative wages. Meschi, Taymaz, and Vivarelli (2009) find that Turkish firms operating in the sectors that increased their imported inputs from more developed countries witnessed a higher increase in their share of skilled workers. While Blom, Goldberg, Pavcnik, and Schady (2004) conclude that trade liberalization in Brazil did not significantly contribute to increased wage inequality between the skilled and unskilled workers through changes in industry wage premia, Araújo, Bogliacino, and Vivarelli (2009) demonstrate that Brazilian manufacturing firms raised their imports of capital goods involving a skill-biased technological change in this sector. Finally, Attanasio, Goldberg,

and Pavcnik et al. (2004) prove that, in Colombia, the increase in the skill premium has been driven by skilled-biased technological change thanks to drastic liberalization.

Hence, the objective of the paper is to test the impact of exports and innovation on the demand of skilled labor in the MENA region using firm-level data. In this matter, our contribution is twofold. First, we extend the analysis of Bustos (2011) by examining the nexus between exports and skill bias through several indicators of innovation and technology adoption. Second, we test this relation for nine MENA countries using firm-level data from the World Bank enterprise survey (2013). The case of MENA countries is interesting, their trade in the manufacturing sector being relatively open (as compared to the agriculture sector). Yet, workers in the region still suffer from a lack of skills required to make their exports competitive at the international level (OECD, 2015). Our results suggest a positive and significant impact of exports on innovation and technology adoption. We also find a significant and positive effect of technology on the demand for skilled production and non-production labor, especially for large firms. Meanwhile, medium enterprises seem to be disadvantaged when it comes to skilled labor demand, which appears to be negatively affected by innovation.

The paper is organized as follows. Section 2 presents some stylized facts on trade, innovation and skill bias from the World Bank Enterprise Survey (2013). Section 3 is devoted to the methodology adopted in the paper. Section 4 is a discussion of the econometric results, and Section 5 concludes.

2. Stylized Facts

2.1. Overview

The enterprise survey data show that, relative to other countries, the use of technology by MENA firms is limited. The share of innovating firms is reported in Table 1. This share is at its highest for countries like Djibouti, Yemen, Lebanon and Morocco (29.9% to 28%), and as low as 12% to less than 13% for Israel and Egypt. Table 2 focuses on innovation for exporting firms only by country. The composite technology index is highest for Yemen,

Djibouti, Lebanon and Morocco (1.17, 0.55, 0.53 and 0.52 respectively) and at its lowest for the West Bank and Gaza (0.00). Larger countries like Egypt or higher income countries like Israel seem to have a relatively modest performance (an index of 0.11 and 0.17 respectively). The occurrence of high values for the technology index in countries like Yemen and Djibouti could be explained by market size. In such small economies, the market is still emerging and the share of firms actually adopting new technologies, or of those taking part at international trade is relatively high compared to larger economies in the region.

Table 1. Innovation Dimensions by Country

	Djbouti	Egypt	Israel	Jordan	Lebanon	Morocco	Tunisia	WBG	Yemen
New Prod	34.2%	20.2%	24.2%	23.6%	43.9%	31.0%	27.2%	21.0%	40.8%
New Method	29.3%	15.8%	10.6%	19.9%	33.5%	29.2%	25.3%	17.5%	30.9%
New Logis.	27.4%	8.6%	6.0%	12.4%	19.3%	23.3%	16.0%	14.7%	26.9%
New. Sup. Act.	34.6%	10.3%	11.0%	16.1%	29.2%	32.4%	20.1%	21.9%	29.5%
New Structure	41.0%	10.5%	8.1%	9.6%	26.9%	28.0%	24.3%	18.0%	32.6%
New Market	25.6%	18.0%	10.1%	19.4%	31.7%	33.7%	28.2%	20.7%	32.3%
R and D	17.3%	6.5%	17.0%	12.7%	16.0%	18.2%	20.3%	11.1%	13.6%
	29.9%	12.8%	12.4%	16.2%	28.6%	28.0%	23.1%	17.8%	29.5%

Source: World Bank Enterprise Surveys.

Note: Reference year for all countries is 2013.

Table 2. Innovation Dimensions for Exporting Firms by Country

	Technology	New Prod.	New Method	New Logis.	New Sup. Act.	New Struc.	New Market	R and D
WBG	0.00	21.0%	17.5%	14.7%	21.9%	18.0%	20.7%	11.1%
Morocco	0.52	41.1%	37.9%	25.8%	37.1%	31.5%	35.5%	25.0%
Egypt	0.11	31.9%	25.6%	11.0%	19.2%	18.5%	29.6%	16.6%
Yemen	1.17	68.0%	50.0%	40.0%	60.0%	60.0%	60.0%	32.0%
Lebanon	0.53	53.2%	42.4%	20.8%	34.2%	29.7%	37.5%	21.9%
Djibouti	0.55	35.1%	26.0%	33.8%	42.9%	45.5%	36.4%	15.6%
Israel	0.16	49.7%	19.3%	9.0%	19.3%	14.5%	14.5%	47.6%
Tunisia	0.34	34.0%	33.7%	19.1%	22.4%	29.7%	32.3%	30.7%
Jordan	0.29	38.3%	35.3%	19.6%	25.5%	17.4%	30.6%	24.3%
Total	0.26	35.9%	29.0%	17.1%	25.4%	23.5%	29.6%	21.7%

Source: World Bank Enterprise Surveys.

Note: (i) Reference year for all countries is 2013.

(ii) Technology is an index constructed based on different dimensions using a principal component analysis.

Table 3 provides an overview of the different innovation dimensions for both exporting and non-exporting firms. For both the composite technology index and the seven dimensions of innovation, the share of innovating firms is always higher for exporters. This share is at its highest for launching new products and for the introduction of new marketing methods. 36% of exporting firms have introduced a new product; while 30% of all firms have applied new marketing methods and 29% have applied new production methods. Interestingly, only 7% of non-exporters invest in R&D, while this is the case for 22% of exporting firms. The larger share of innovating exporters versus that of non-exporters raises the issue of possible endogeneity between innovation and exports. On the one hand, for firms to be able to enter and compete in the market for exports, innovation is necessary. On the other hand, firms who enter the export market are more likely to be innovative as compared to firms who do not take part at international trade. The causality of the relation and endogenetiy issues will be further discussed in Sections 3 and 4.

Table 3. Innovation Dimensions for Exporting and Non-Exporting Firms

	Non-exp	Exp.
Technology	-0.13	0.26
New Prod.	21%	36%
New Method	16%	29%
New Logis.	11%	17%
New Sup. Act.	14%	25%
New Struc.	14%	24%
New Market	18%	30%
R and D	7%	22%

Source: World Bank Enterprise Surveys.

Note: (i) Reference year for all countries is 2013.

(ii) Technology is an index constructed based on different dimension using a principal component analysis.

The demand for skilled labor also appears to be higher for exporting firms than for non-exporting firms. This goes in line with previous results on innovative behavior for exporters, since new products, new methods or even new marketing methods require more skilled labor. Another interesting fact is that the demand for skilled production labor (i.e. blue collars) is often higher than that for skilled non-production labor (white collars). This observation holds for 5 out of the 8 countries of study (see Table 4).

Table 4. Export status and Demand for Skilled Labor (percentage of firms)

	Exporters		Non-exporters	
	Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.
WBG	11.73	10.81	-	-
Morocco	43.99	81.59	21.73	19.92
Egypt	106.69	224.20	13.77	26.68
Yemen	63.35	42.00	9.78	12.89
Lebanon	32.56	19.61	29.18	6.99
Djibouti	2.00	8.00	3.27	6.43
Israel	83.46	71.29	18.32	16.78
Tunisia	30.61	104.69	18.08	28.51
Jordan	34.39	171.62	12.23	20.36
Total	58.75	128.48	14.79	23.60

Source: World Bank Enterprise Surveys.

Note: (i) Reference year for all countries is 2013.

Table 5 provides a more detailed analysis of the demand for skilled production- and non-production labor by firm status (exporters vs. non-exporters) and across the different innovation aspects. In average, over 10% of exporting firms adopting new technology demand skilled labor, compared to 4.7% in the case of non-exporters. For exporting firms, the demand for skilled white collars is highest when the firm is applying significantly enhanced or new supporting activities (12.9% out of all exporters). Meanwhile, the demand for skilled blue collars is more frequent in the case of a new technology, a new supplementary activity and surprisingly, a new organizational structure.

Table 5. Exports, Labor Demand and Innovation

	Exporters			Non-exporters		
	Lab. Non-prod	Skill Prod.	Average	Lab. Non-prod	Skill Prod.	Average
Technology	11.5%	10.0%	10.8%	7.3%	2.1%	4.7%
New Prod.	9.5%	3.9%	6.7%	4.1%	0.0%	2.0%
New Method	3.6%	6.1%	4.8%	1.5%	0.6%	1.1%
New Logis.	5.0%	4.4%	4.7%	5.7%	3.0%	4.4%
New Sup. Act.	12.9%	8.5%	10.7%	5.8%	1.7%	3.7%
New Struc.	8.9%	10.3%	9.6%	6.4%	2.3%	4.4%
New Market	7.9%	8.9%	8.4%	4.3%	0.0%	2.2%
R and D	8.7%	6.3%	7.5%	9.2%	3.0%	6.1%

Source: World Bank Enterprise Surveys.

Note: (i) Reference year for all countries is 2013.

(ii) Technology is an index constructed based on different dimensions using a principal component analysis.

It is also interesting to observe technology adoption by firm size across our sample. We introduce some additional indicators from the enterprise survey (Table 6). We observe that the share of firms using technology licensed from foreign companies generally increases by firm size, reaching as high as 64.4% in Yemen, followed by 32.1% in Morocco. The ratio is relatively modest for the rest of the countries: in the case of countries with larger and relatively diversified industries such as Egypt, Morocco and Tunisia, this share ranges from 12.5 to 20%. Another interesting observation is that a slightly higher share of medium size firms in Morocco and Lebanon tend to use licensed foreign technology than large firms do. This could be explained by the low number of medium firms in both countries in absolute terms, or by increased competitiveness coming from medium size firms.

A higher share of large firms also has their own website and use email to communicate with their clients, as compared to medium and small firms. Firm size also seems to affect the capacity of the firm to use technology. For example, the share of large firms having introduced new products is higher than that of small and medium size firms. The same holds generally for the share of firms who introduced a process innovation and firms who spend on R&D. However, this conclusion does not hold for the introduction of a new product in the main market. A larger share of medium enterprises introduces to the exports market a new product at the same time of

introducing it locally. This allows to draw an important conclusion on potential competitiveness of medium size firms and their ability to provide products that not only do compete domestically, but also internationally.

Table 6. Innovation and Firm Size (exporters and non-exporters)

		Firms using technology licensed from foreign companies	Firms having their own Web site	Firms using e-mail to interact with clients/suppliers	Percent of firms that introduced a new product/service	Firms whose new product/service is also new to the main market	Firms that introduced a process innovation	Firms that spend on R&D
Djibouti	Small	5.5	35	62.1	23.8	65.2	34.1	15.4
	Medium	13.1	45.4	85.5	42.2	61.9	66.9	23.3
	Large		74.9	100	72.8	81.1	65	19.9
Egypt	Small	2.9	26	35.1	10.5	48.2	13.6	1.2
	Medium	5.1	45.5	54.6	13.4	69.4	15.5	2.1
	Large	12.5	75.5	84.1	19.6	67.8	26.6	10.4
Jordan	Small	5.7	35.9	52.1	13.6	44.4	14.4	3.3
	Medium	6.7	62.1	77	22.7	56.3	24.7	7.9
	Large	32.1	76.1	94.9	39.2	78.8	37.6	35.4
Lebanon	Small	1.4	53.8	78.3	31.5	61.3	39.9	8.1
	Medium	8.4	78.5	87.1	55.6	88.8	43.7	20
	Large	7.5	92.3	98.4	56.7	85.8	50.7	33.6
Morocco	Small	13	66.8	96.8	24.7	48.5	32.2	9.4
	Medium	21.9	71.4	98	32.8	62	50.1	17.7
	Large	20.2	74	94.4	39.3	37.2	58.1	24.8
Tunisia	Small	3.5	59.4	90.8	28	45.3	32.2	14.1
	Medium	10.7	73	97.4	27.1	70	39	22
	Large	13	80.7	95.9	27.1	62.5	39.6	25.2
Yemen, Rep.	Small	0.1	13.2	13.4	41.6	49.2	41.6	3
	Medium	8.4	53.6	57.6	47.7	88.3	60.7	8.9
	Large	64.4	95.5	100	82.7	74.5	86.2	68.1
West Bank and Gaza	Small	4.3	28.7	41.2	17.8	54.6	29.5	9
	Medium	8.4	44.8	71.6	27.6	92.8	48.7	17.9
	Large	12	70.3	92.2	42.3	100	53.9	37.5

Source: World Bank Enterprise Surveys.

Note: (i) Reference year for all countries is 2013.

3. Methodology

We perform our analysis in two steps. First, we estimate the impact of the change in exporting status on different measures of technology adoption by estimating the following regression:

$$Tech_{ijk} = \alpha_0 + \alpha_1 Prob(X_{ijk}) + f_j + f_k + \varepsilon_{ijk} \quad (1)$$

Where $Prob(X_{ijk})$ measures the probability of becoming an exporter of firm *i* in country *j* in sector *k*, $Tech_{ijk}$ is measured by new or significantly improved products/services during the last 3 years, new/improved products/services which were also new for the establishment's main market, new/significantly improved methods of manufacturing products /offering service, new / significantly improved logistics delivery or distribution methods for inputs, new or significantly improved supporting activities for the firm's processes, new or improved organizational structure or management activities, and new or improved marketing methods. We control for country dummies f_i and sector dummies f_k and ε_{ijk} is the discrepancy term. As the probability of becoming an exporter is endogenous, we adopt an instrumental variable approach by instrumenting this variable using the age of the firm, the highest level of education of the owner, the share of imported inputs and the size of the firm when it started operating. These variables are likely to increase the probability of becoming an exporter and hence are used as instruments[3].

Second, we document systematic differences in skill intensity of both production and non-production labor for different measures of technology adoption (taken from the first step) as follows:

$$Ln(Skill_{ijk}) = \beta_0 + \beta_1 Tech_{ijk} + f_j + f_k + \varepsilon_{ijk} \quad (3)$$

[3] We performed Durbin and Wu-Hausman Tests of endogeneity. Indeed, the probability of becoming an exporter is endogenous. When we instrument them using the instruments mentioned above, we tested whether the latter are weak or not and we rejected the null hypothesis according to which instruments are weak. Finally, the tests of Sargan and Basmann of overidentifying restrictions showed that our instruments are valid.

With $Skill_{ijk}$ is the share of skilled workers (workers are divided based on the share of production vs. non-production workers by firm), f_j and f_k are country and industry dummies respectively.

We use manufacturing establishment surveys carried out by the World Bank (World Bank Enterprise Survey) in most developing countries in 2013, including several from the MENA region. We examine this for nine countries which are Egypt, Jordan, Lebanon, Tunisia, Yemen, Djbouti, West Bank and Gaza, Morocco and Israel. The choice of these countries is chiefly driven by data availability. The surveys are answered by business owners and top managers. Typically 1200-1800 interviews are conducted in larger economies, 360 interviews are conducted in medium-sized economies and for smaller economies, and 150 interviews take place. The surveys cover a broad range of business environment topics including access to finance, corruption, infrastructure, crime, competition, and performance measures. The standard survey topics include firm characteristics, gender participation, access to finance, annual sales, costs of inputs/labor, workforce composition, bribery, licensing, infrastructure, trade, crime, competition, capacity utilization, land and permits, taxation, informality, business-government relations, innovation and technology, and performance measures. The manufacturing sector is the primary business sectors of interest. This corresponds to firms classified with ISIC codes 15-37, 45, 50-52, 55, 60-64, and 72 (ISIC Rev.3.1).

4. Empirical Findings

4.1. Exports and Technology Adoption

Table 8 exhibits the results for the instrumental variables. We use the estimated likelihood of becoming an exporter from the first step and test for its impact on use of different technology aspects by the firm. The results -shown in Table 9- suggest positive and significant effects of becoming an exporter on innovation across its seven dimensions as well as at the level of the aggregate technology index. We also control for country- and sector-specific dummies. Our results are in line with the literature, since new entrants are usually more likely to adopt new technologies in order to be able to enter and compete in the export market, which is usually not the case for

incumbent firms. Among the different technology dimensions, R&D and introducing new supporting activities are those with the highest coefficient. We also introduce formality as an explanatory variable and find -as in line with the literature- that registered firms are more likely to innovate. This could be explained by their easier access to credit, allowing them to upgrade their activities, while unregistered firms do not have access to such facilities.

Table 8. Results of the First Step

	Prob(Exp.)
Imp. Input	0.00305***
	(0.000198)
Ln(Age)	0.000112**
	(4.63e-05)
Ln(Size start)	0.0760***
	(0.00622)
High. Edu.	0.0863***
	(0.0171)
Constant	-0.0724***
	(0.0209)
Observations	3,291

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9. Results of the Second Step

	Technology	New Prod.	New Method	New Logis.	New Sup. Act.	New Struc.	New Market	R and D
Prob (Exp)	1.167***	0.344***	0.262***	0.222***	0.436***	0.365***	0.362***	0.478***
	(0.132)	(0.0649)	(0.0614)	(0.0496)	(0.0563)	(0.0532)	(0.0599)	(0.0513)
Form. Regis.	0.0250**	0.0103**	0.0124**	0.00617	0.00643	0.00860**	0.00744	-0.000847
	(0.0104)	(0.00512)	(0.00485)	(0.00391)	(0.00444)	(0.00420)	(0.00473)	(0.00404)
Constant	-0.557***	0.0781*	0.0965**	0.0354	-0.0152	-0.0460	0.0342	-0.0897***
	(0.0860)	(0.0423)	(0.0400)	(0.0323)	(0.0367)	(0.0347)	(0.0390)	(0.0334)
Country dum.	YES	YES	YES	YES	YES	YES	YES	YES
Sector dum.	YES	YES	YES	YES	YES	YES	YES	YES
Observations	3,633	3,633	3,633	3,633	3,633	3,633	3,633	3,633
R-squared	0.015	0.064	0.060	0.009	0.010	0.003	0.022	0.003

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.2. Technology and Demand for Skilled Labor

In a second step, we explore the impact of different measures of technology adoption on differences in skill intensity for production and non-production labor (Table 10). In general, the coefficients are positive and significant for both types of skilled labor across all technology indicators. Those who seem to matter most for demand of skilled labor are the adoption of new logistics and new methods of manufacturing. This is in line with Attanasio, Goldberg, and Pavcnik et al. (2004) who prove that, in Colombia, the increase in the skill premium has been driven by skilled-biased technological change thanks to drastic liberalization. At this level of the analysis, there do not seem to be differences in demand for production and non-production skilled labor by technology dimension. In the section to follow, we introduce firm size to observe differences in skill bias by type of labor.

Table 10. Demand for Skilled Labor

	(a)					(b)			
	Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.		Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.
Techn. Index	0.973***	0.946***			New Struc.	3.109***	3.021***		
	(0.0409)	(0.0457)				(0.131)	(0.146)		
New Prod.			3.280***	3.186***	New Logis.			5.094***	4.948***
			(0.139)	(0.155)				(0.215)	(0.240)
Constant	1.014***	1.253***	0.211	0.473	Constant	0.614***	0.864***	0.288	0.548*
	(0.226)	(0.296)	(0.234)	(0.304)		(0.229)	(0.299)	(0.233)	(0.303)
Country dum.	YES	YES	YES	YES	Country dum.	YES	YES	YES	YES
Sector dum.	YES	YES	YES	YES	Sector dum.	YES	YES	YES	YES
Observations	3,577	3,188	3,577	3,188	Observations	3,577	3,188	3,577	3,188
R-squared	0.199	0.224	0.198	0.223	R-squared	0.199	0.223	0.198	0.223
	(c)					(d)			
	Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.		Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.
New Method	4.227***	4.102***			R and D	2.401***	2.338***		
	(0.181)	(0.203)				(0.0999)	(0.112)		
New Market			3.137***	3.049***	New Sup. Act.			2.616***	2.544***
			(0.132)	(0.147)				(0.110)	(0.122)
Constant	0.0561	0.323	0.365	0.623**	Constant	0.711***	0.959***	0.517**	0.770**
	(0.236)	(0.306)	(0.231)	(0.302)		(0.228)	(0.298)	(0.230)	(0.300)
Country dum.	YES	YES	YES	YES	Country dum.	YES	YES	YES	YES
Sector dum.	YES	YES	YES	YES	Sector dum.	YES	YES	YES	YES
Observations	3,577	3,188	3,577	3,188	Observations	3,577	3,188	3,577	3,188
R-squared	0.195	0.220	0.199	0.224	R-squared	0.201	0.226	0.200	0.224

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.3. Does the Firm Size Matter?

We take the analysis to a deeper level by controlling for firm size while testing the impact of technology adoption on the demand for skilled production and non-production workers Tables 11 and 12). Our results are interesting for several reasons. First of all, the coefficients are all positive and significant for the aggregate as well as the separate technology measures. Second, firm size does matter for demand of skilled labor. The coefficient values are always higher for large firms across all innovation indicators. Third, the coefficient for skilled production labor is higher than that for non-production labor across all technology aspects in general, and for small and medium firms in particular. This indicates the importance of skilled production labor especially for small and medium firms who innovate. The same result does not always hold for large firms.

In a second step, we interact the different innovation dimensions with firm size. To our surprise, most of the coefficients are insignificant, except for medium size firms where there is a significant negative impact of technology on the demand for skilled labor. This is true for the aggregate technology indicator, R&D, and the introduction of new supporting activities. These results could be justified by the presence of some difficulties medium size firms may be facing to be able to innovate, compete with larger firms and increase their scale. Another reason may be the "missing middle" hypothesis, since the number of medium firms is generally low in the Middle East, as compared to large or small enterprises.

Table 11. Demand for Skilled Labor by Firm Size 1

	Technology Index		New Logistic		New Structure		New sup. act.	
	Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.
Small	0.427***	0.405***	0.413***	0.473***	0.436***	0.516***	0.438***	0.551***
	(0.0923)	(0.116)	(0.133)	(0.169)	(0.112)	(0.140)	(0.112)	(0.140)
Medium	1.426***	1.329***	1.406***	1.473***	1.435***	1.499***	1.430***	1.531***
	(0.0925)	(0.116)	(0.134)	(0.170)	(0.113)	(0.141)	(0.112)	(0.141)
Large	3.046***	2.902***	2.972***	2.863***	3.012***	2.925***	2.971***	2.932***
	(0.0964)	(0.121)	(0.141)	(0.179)	(0.120)	(0.150)	(0.119)	(0.149)
Technology	0.207	0.526**						
	(0.185)	(0.227)						
Tech*Small	-0.0211	-0.313						
	(0.189)	(0.232)						
Tech*Medium	-0.00904	-0.446*						
	(0.188)	(0.231)						
Tech*Large	0.145	-0.0723						
	(0.190)	(0.235)						
Logistic			0.948	1.502				
			(0.792)	(1.012)				
Logis*Small			0.124	-0.324				
			(0.803)	(1.030)				
Logis*Medium			0.148	-0.958				
			(0.803)	(1.029)				
Logis*Large			0.707	0.670				
			(0.819)	(1.048)				
Structure					0.726	1.412**		
					(0.544)	(0.677)		
Struc*Small					-0.0603	-0.700		
					(0.554)	(0.690)		
Struc*Medium					-0.0750	-1.114		
					(0.553)	(0.688)		
Struc*Large					0.299	-0.0353		
					(0.562)	(0.701)		
Sup. Act.							0.551	1.520**
							(0.531)	(0.644)
Sup. Act.*Small							-0.0772	-0.970

							(0.541)	(0.658)
Sup. Act.*Medium							-0.0281	-1.318**
							(0.539)	(0.655)
Sup. Act.*Large							0.435	-0.258
							(0.545)	(0.663)
Constant	0.503***	0.808***	0.355*	0.568**	0.396**	0.598**	0.408**	0.566**
	(0.173)	(0.243)	(0.202)	(0.277)	(0.184)	(0.256)	(0.185)	(0.256)
Country dum.	YES	YES	YES	YES	YES	YES	YES	YES
Sector dum.	YES	YES	YES	YES	YES	YES	YES	YES
Observations	3,577	3,188	3,577	3,188	3,577	3,188	3,577	3,188
R-squared	0.660	0.598	0.659	0.597	0.659	0.597	0.660	0.598

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 12. Demand for Skilled Labor by Firm Size (2)

	RD		New Market		New Method		New Product	
	Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.	Lab. Non-prod	Skill Prod.
Small	0.453***	0.489***	0.502***	0.639***	0.359**	0.638***	0.390**	0.722***
	(0.0931)	(0.118)	(0.146)	(0.180)	(0.175)	(0.225)	(0.161)	(0.208)
Medium	1.443***	1.449***	1.483***	1.653***	1.378***	1.694***	1.371***	1.770***
	(0.0939)	(0.119)	(0.147)	(0.181)	(0.175)	(0.226)	(0.162)	(0.208)
Large	2.998***	2.862***	3.017***	2.974***	2.906***	2.994***	2.803***	3.085***
	(0.101)	(0.128)	(0.155)	(0.191)	(0.184)	(0.236)	(0.170)	(0.218)
RD	0.893*	1.586**						
	(0.528)	(0.624)						
RD*Small	-0.497	-1.161*						
	(0.539)	(0.640)						
RD*Medium	-0.409	-1.396**						
	(0.536)	(0.635)						
RD*Large	0.0237	-0.337						
	(0.542)	(0.643)						
Market			0.991	1.858**				
			(0.632)	(0.770)				
Mar*Small			-0.412	-1.171				
			(0.644)	(0.785)				
Mar*Medium			-0.325	-1.599**				
			(0.641)	(0.782)				
Mar*Large			0.105	-0.397				
			(0.649)	(0.792)				
Method					0.668	1.881**		
					(0.646)	(0.821)		
Method*Small					0.308	-0.873		
					(0.654)	(0.833)		
Method*Medium					0.211	-1.436*		
					(0.653)	(0.831)		
Method*Large					0.674	-0.180		
					(0.666)	(0.848)		
Product							0.422	1.865***
							(0.510)	(0.636)
Product*Small							0.151	-1.080*

							(0.518)	(0.647)
Product*Medium							0.220	-1.527**
							(0.516)	(0.644)
Product*Large							0.859	-0.530
							(0.527)	(0.658)
Constant	0.438**	0.690***	0.313	0.427	0.331	0.334	0.408*	0.288
	(0.174)	(0.245)	(0.207)	(0.280)	(0.229)	(0.310)	(0.217)	(0.296)
Country dum.	YES	YES	YES	YES	YES	YES	YES	YES
Sector dum.	YES	YES	YES	YES	YES	YES	YES	YES
Observations	3,577	3,188	3,577	3,188	3,577	3,188	3,577	3,188
R-squared	0.660	0.599	0.660	0.598	0.659	0.596	0.660	0.597

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

The objective of this paper is to explore the nexus between exports, innovation and the demand for skilled labor. Our findings suggest that becoming an exporter increases the probability of adopting new technologies, which, in turn, increases the demand for skilled labor. Our findings also suggest that the demand of skilled labor increases with firm size. The larger the firm, the more likely it hires skilled employees. For medium and small enterprises, the demand for skilled production workers is more frequent than the demand for skilled non-production workers, especially when new products or new production methods are introduced. However, when firm size is interacted with innovation dimensions, the results are mostly negative for medium enterprises demanding skilled workers, and generally insignificant for the rest of the sample. These surprising results could be explained by financial constraints making medium size firms less able to hire and compete. They may also be attributed to the scarcity of medium size enterprises as compared to large and small ones in the MENA region.

The results highlight one of the main concerns in the MENA manufacturing sector: the lack of skilled workers. In this context, the OECD (2015) argues that the two key constraints on employment in the Arab countries are lack of job creation and employability (which is defined as the skills mismatch because of failures in the education system). This is why more open trade

policies may act as a driver for job creation in Arab countries, especially for skilled workers in order to face the fierce competition in international markets. However, more open trade policies without serious steps towards enhancing the quality of education and vocational training to respond to the needs of the labor market are less likely to yield significant outcomes.

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