

Revisiting the Impact of Trade Openness on Informal and Irregular Employment in Egypt

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Abstract This study examines the impact of trade openness on job quality, measured by the share of informal and irregular employment in total employment. By combining a microeconomic dataset (the Egyptian Labor Market Panel Survey) with macroeconomic variables (tariffs), we assess the effect of trade reforms on informal/irregular workers in Egypt. Our main findings show that there is a positive association between tariffs and both informal and irregular employments in Egypt. This effect is likely because the least productive informal firms will be forced to exit the industry and only the most productive (formal) firms will export to the international markets. This will increase the demand for formal (and eventually regular) workers that are usually more skilled and, in turn, lead to a likely decline in informal (and irregular) employment. While this effect on informality is robust, the one on irregularity is not.

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I. Introduction

Developing countries suffer not only from labor market participation problems but also from low quality jobs not backed by contracts, social insurance schemes, legal protection, or administrative rules covering commercial licensing. Moreover, these economies, in general, and Egypt, in particular, have been subject to several policy reforms (trade liberalization and privatization, among others), affecting their labor market.

It is important to note that informal employment is conventionally defined as any job that neither complies with labor market legislation nor provides worker social benefits. It primarily concerns small firms, which form the bedrock of the informal sector. However, there has been

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an increase in the number of informal jobs in formal establishments. Additionally, members from rural households comprise a major proportion of the informal workforce in developing countries. This informality is believed to have emerged from trade liberalization. Trade reforms expose formal establishments to increased foreign competition; this phenomenon leads to the replacement of permanent workers with part-time labor, subcontracting in the informal sector, or the abatement of workers seeking employment in this sector (Goldberg and Pavcnik 2003). However, owing to the diversity of the informal sector, it may not be appropriate to consider the sector as the provider of only inferior jobs. Moreover, many informal jobs are in the non-traded services sector, and should, therefore, be untouched by a trade reform.

Empirical works, however, are inconclusive regarding the association between trade reform and informality. For instance, Goldberg and Pavnick (2003) tested an efficiency wage model using household survey data for Brazil and Colombia collected over the 1980s and 1990s. They did not find any evidence of a significant positive or negative relationship between trade liberalization and informality in Brazil. For Colombia, they presented evidence of an increase in informality after trade liberalization. However, this finding appears directly related to the degree of labor market flexibility. Specifically, Goldberg and Pavnick (2003) reported that prior to the labor market reform, when costs of firing formal workers were high, an industry-specific tariff reduction was associated with a greater likelihood of becoming informal. After the labor market reform, however, industry-specific tariff reductions were associated with a small increase in the likelihood of informality in the industry. Nevertheless, using a heterogeneous firm model, Aleman-Castilla (2006) showed that in a trade liberalization scenario (i.e., lower trade costs), some firms will find it more profitable to enter the formal sector rather than staying in the informal sector. The least productive informal firms will be forced to exit the industry and only the most productive (formal) firms will export to the international markets. Moreover, the exit of the least productive firms as well as the rise in the output of the most productive (formal) firms lead to an aggregate increase in productivity. The empirical part of this study used the North American free trade agreement (NAFTA) experience to assess the impact of trade liberalization on informality in Mexico. Using Mexican and US import tariff data and data from the Mexican National Survey of Urban Labor, the study's findings suggest that lower import tariffs are related to lower informality in tradable industries.

Therefore, an increase in openness may allow the most productive firms to expand their market shares and force the least productive ones to exit the market, thereby inducing aggregate productivity gains through within-industry reallocations (Melitz 2003). Thus, the rationalization effect of trade is not only driven by competition from imports but also *via* the “pull” of the export market—high productivity firms expand their market shares and use of resources at the expense of low-productivity firms, which are forced to exit. By incorporating informality into a heterogeneous firm trade model à la Melitz (2003) with a fair wage specification, Becker

(2014) showed that trade liberalization reduces informal employment unambiguously. Selwaness and Zaki (2015), by combining a microeconomic dataset (the Egyptian labor market panel survey (ELMPS)) with macroeconomic variables (tariffs), examined the effect of trade reforms on informal jobs in Egypt and found that trade liberalization reduced informality in Egypt's manufacturing sector.

Our study examines the impact of trade openness on two aspects of low quality employment: informal and irregular employment. Egypt has experienced several waves of liberalization and implemented many labor market reforms. Moreover, the impact of several events on the economy manifested in the form of severe political instability, which, in turn, affected production, exports, employment, and employment conditions. Informal and irregular employment exacerbated in the wake of the political turmoil of 2011. Thus, by combining a microeconomic dataset (the ELMPS) with macroeconomic variables (tariffs), we try to assess the extent to which trade reforms affected informal workers in Egypt. Our main findings show a positive association between tariffs and both informal and irregular employment in Egypt. This effect is likely because the least productive informal firms will be forced to exit the industry and only the most productive (formal) firms will export to the international markets. This scenario will increase the demand for skilled formal (and eventually regular) workers and will likely lead to a decline in informal (and irregular) employment. While this effect on informality is robust, the one on irregularity is not.

The remainder of the paper is organized as follows. Section 2 presents some stylized facts on informality and irregular employment in Egypt. Section 3 describes the methodology. Section 4 discusses the empirical results. Section 5 concludes the study.

II. Stylized Facts

First, we present an overview of the Egyptian labor market, followed by descriptive statistics¹⁾ on informal and irregular employments. We conclude this section with statistics on Egyptian tariffs and their correlations with the two kinds of employment mentioned earlier. Data on employment are collected from the ELPMS for the periods 1998, 2006, and 2012, and they corresponded to three rounds. Data on industrial tariffs (2 digits), expressed as weighted means, are collected from the online database of the World Trade Organization for the years 1997, 2005, and 2011. These tariffs are the most-favored nation applied rate, and hence are considered normal non-discriminatory tariffs charged on imports (which exclude preferential tariffs, under free trade agreements and other schemes, or tariffs charged inside quotas).

1) We use the panel weights defined for each round and provide the number of observations, for the sample and the population, in Table A1 in the Appendix.

A. The Egyptian labor market

1. Overview

The traditional labor market outcomes are reported in Table 1a. The labor force participation and, employment rates in Egypt are found to be low in the sampled periods, compared to developed countries—only one out of every two Egyptians of working age participates in the labor market, and slightly fewer than this share is employed, which implies that the number of unemployed is very low when compared to the working age population. However, the table shows a high unemployment rate, even if it declines over the periods. The reason behind these mixed findings can be identified by looking at these labor market outcomes by gender, as reported in Table 1b. The labor market participation and unemployment rates are not very sensitive to the International Labor Office's definition of unemployment, which considers job search. Furthermore, these labor market outcomes have been seemingly unaffected by the political turmoil that took place in 2011. At the sectoral level, industry hires around 25% of the total employment, and agriculture slightly lesser than industry. The service sector accounts for the highest employment share, with over 50% of Egyptians working in this aggregate sector. These shares have been relatively stable over the sampled periods.

Table 1a. Egyptian labor market outcomes

	1998	2006	2012
Unemployment rate (%)	12.3 (10.5) ²⁾	9.1 (8.0)	9.2 (8.3)
Employment rate (%)	43	48.1	47.2
Participation rate (%)	49.1 (48.1)	53 (52.4)	52 (51.5)
Employment in industry ³⁾	25	22.5	26.6
Employment in services (% of total employment)	54.6	51.8	54.7
Employment in agriculture (% of total employment)	20.7	25.9	18.7

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

Table 1b reports two different numbers—the shares of men and women in the different labor market outcomes (the first line) and the labor market outcomes by gender (numbers in *italic*). It shows a usual feature of labor markets in developing countries; it also depicts the low level of female participation in the labor market (less than one out of four women). Furthermore, it depicts the probability that women's employment is around 16%. Consequently, the unemployment rate of women is seen to be very high, between 20% and 30%, over the period. Indeed around 60% of unemployed people and less than 20% of employed people are

2) Numbers in parenthesis indicate that the unemployment definition takes into account job search.

3) The aggregate sector (services and agriculture sectors, respectively) covers the following categories in the ISIC4 classification: from B to F (respectively from G to U and A).

women. The year 2006 shows an improvement in the outcomes for women. However, this improvement is deteriorated at the wake of the political turmoil of 2011; this trend is maintained in the subsequent year, unlike the outcomes in 1998. For men, the situation is closer to developed countries' outcomes, with an increase in participation and employment rates, respectively, from 76% to 81% and 70% to 78% over the sampled periods. Male unemployment is not an issue as it is low and decreases to 4% in 2012.

An examination of the shares by economic activity shows that male workers constitute a major proportion of the total workforce in the Egyptian labor market (more than 75% of Egyptians). While the services sector is the major employer of men and women, the industrial sector hires more men than women, and the agricultural sector hires more females than males.

Table 1b. Egyptian labor market outcomes by gender

	1998		2006		2012	
	Male	Female	Male	Female	Male	Female
Unemployment(% of total labor force)	43.4	56.6	39.3	60.7	34.9	65.1
<i>Unemployment rate (%)</i>	<i>6.9</i>	<i>30.1</i>	<i>4.9</i>	<i>20.3</i>	<i>4.2</i>	<i>25.4</i>
Employment (% of the working age population)	81.6	18.4	76	24	80.7	19.3
<i>Employment rate (%)</i>	<i>70.4</i>	<i>15.8</i>	<i>74.3</i>	<i>22.7</i>	<i>77.6</i>	<i>17.9</i>
Participation (% of the working age population)	37.8	11.3	38.5	14.4	39.8	12.2
<i>Participation rate (%)</i>	<i>75.7</i>	<i>22.5</i>	<i>78.1</i>	<i>28.5</i>	<i>81</i>	<i>24</i>
Employment in industry (% of total employment)	91.8	8.2	90.2	9.8	94	6
<i>(% of gender employment)</i>	<i>27.7</i>	<i>11</i>	<i>26.5</i>	<i>9.1</i>	<i>30.9</i>	<i>8.2</i>
Employment in services (% of total employment)	74.9	25.1	74.4	25.6	74.9	25.1
<i>(% of gender employment)</i>	<i>50.1</i>	<i>74.8</i>	<i>50.6</i>	<i>55.5</i>	<i>50.7</i>	<i>71.3</i>
Employment in agriculture (% of total employment)	87.4	12.6	67.3	32.7	79	21
<i>(% of gender employment)</i>	<i>22.2</i>	<i>14.1</i>	<i>22.9</i>	<i>35.3</i>	<i>18.3</i>	<i>20.4</i>

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

In Table 2a, we provide more insights on the extremely high levels of female unemployment. The educational level facilitates a differentiation between employment and unemployment. The highly educated population accounts for more than 80% of the unemployed, and women represent more than 50% of these highly educated unemployed people. Interestingly, the share of highly educated employed people increased over the sampled periods to reach over 50%, whereas this number remained stable for women. Finally, unemployment in Egypt can be attributed to highly educated women who do not find jobs that match their skills. A significant proportion (60% of the working-age population) of the women are married, and prefer to wait for a desirable job. This explanation also holds true for younger⁴⁾ women with basic education.

4) The statistics for young women are similar to the ones found for women in general.

Table 2a. Employment by educational level, gender, and age

		1998			2006			2012		
		All	Female	Young ⁵⁾	All	Female	Young	All	Female	Young
Basic education ⁶⁾	% employed	53.6	6.5	57	48.3	11.4	45	41.2	6.4	44.9
	% unemployed	16.6	6.2	14.5	6	2	5	10.6	4.4	11.6
Higher education	% employed	46.2	11.8	43	51.7	12.4	54.9	58.6	12.8	55.1
	% unemployed	83.2	50.2	85.5	94	58.7	95	89	60.6	88.4

(Source) Constructed by the authors using the EL(1998, 2006, and 2012).

Table 2b shows that education facilitates a differentiation between economic sectors as well. Services with a high share in the total employment hire the maximum number of workers with a lower education level. Less educated people represent more than 75% of workers in the service sector, and this share increased over the sampled periods. However, the evolution of skills in the industrial sector is slow; this is because more than half of the workers attain higher education at the end of the sampled periods. Agriculture follows the same evolutionary trend; this can be explained by the general pattern of higher educational achievement in the entire population over the sampled periods.

Table 2b. Educational level by economic sector

		%	1998	2006	2012
Industry	Basic education		61	50.2	45.8
	Higher Education		39	49.8	54.2
Service	Basic education		67.2	72.3	76.7
	Higher Education		32.8	27.7	23.3
Agriculture	Basic education		79.4	75.3	70.2
	Higher Education		20.6	24.7	29.8

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

An examination of the transition of a working-age individual from employment to unemployment to inactive positions in the Egyptian labor market, as reported in Table 3, reveals the unexpected difference between unemployment and the two positions. These positions have a low-level of persistence—the probability to remain unemployed is lower than 20%, whereas this probability is higher than 60% for the other statuses. Employment holds the strongest perception, with probabilities greater than 80%. Eventually, transition to unemployment is scarce—less than 2% when employed (respectively, 8% for individuals who are out of the labor force). However, the exit from unemployment is frequent and it is as high as the other positions (around 45% to unemployment and 40% to inactivity).

5) These statistics are computed for the 15-24 years age group by excluding students.

6) Basic (higher) education covers the following categories: "Illiterate, Reads, and Writes" and "Less than Intermediate" ("Intermediate" and "Above Intermediate").

Table 3. Transitions between the different labor market outcomes

%		2006		
		Employed	Unemployed	Out of the labor force
1998	Employed	87.6	1.3	11.1
	Unemployed	47.8	13.3	38.9
	Out of the labor force	29.8	6.9	63.3
		2012		
2006	Employed	82.3	1.9	15.7
	Unemployed	44.8	16.3	38.9
	Out of the labor force	22.4	7.4	70.2

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

In order to analyze the impact of trade liberalization on the labor market, we will focus on employment and, especially, the change in the shares of the informal and irregular components of employment.

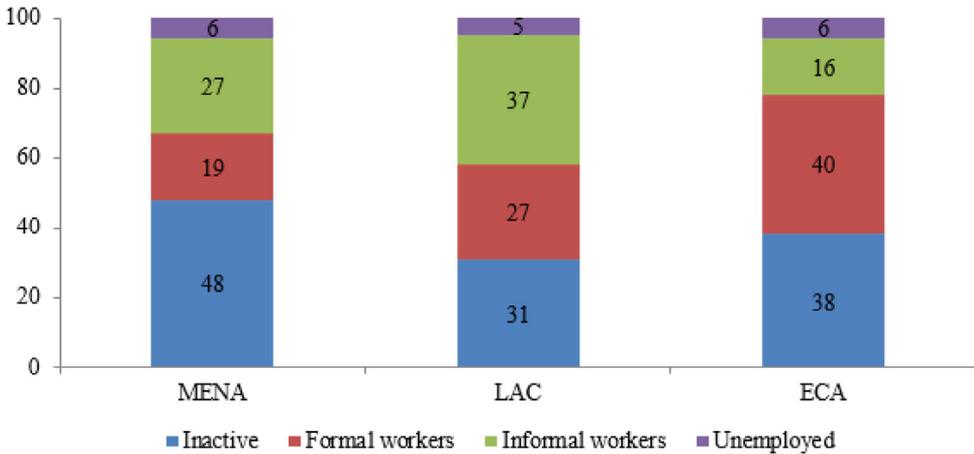
The theoretical and empirical literature showed that trade liberalization is always associated with higher levels of employment since each economy specializes in the sector where it has a comparative advantage. However, the effect of trade liberalization on employment in the Middle East and North Africa (MENA) region was limited. This may be attributed to the rigidity of the labor market that reduces the positive effect of exports on employment (Selwaness and Zaki 2018). Moreover, the labor market of the MENA region is characterized by a significant segmentation and a large informal sector (Figure 1). The MENA region is positioned between the Latin American Countries (LAC) and Eastern Europe and Central Asia (ECA) regions with regards to the share of informal workers; they are defined as workers who neither benefit from a social security scheme nor have a working contract. Hence, trade is likely to have different effects on formal versus informal workers.

Figure 2 reports similar distributions of the working-age population (15-64) only for Egypt. In the view of the country special features, in this case, the following two distributions appear relevant: the one between formal, informal, and irregular workers in terms of the labor force share⁷⁾ in the first panel, and the other one between formal regular and irregular employment and informal regular and irregular employment. There exists overlapping between informal and irregular employments as the share of formal irregular jobs is equal to 0.4% only. First, informal jobs increased over the sampled periods, and more than 50% of Egyptian workers have informal jobs. Irregular jobs follow the same evolutionary pattern during the sampled periods, despite their decline in 2006. Finally, formal jobs only concern around 40% of the workers. Now,

7) We select the market definition and the three-month-reference for each kind of employment. The shares are simply the ratio of the corresponding frequency to the labor force one—they do not correspond to the definition of employment rates (reported to the working-age population). The frequencies are given in Table A2 in the Appendix.

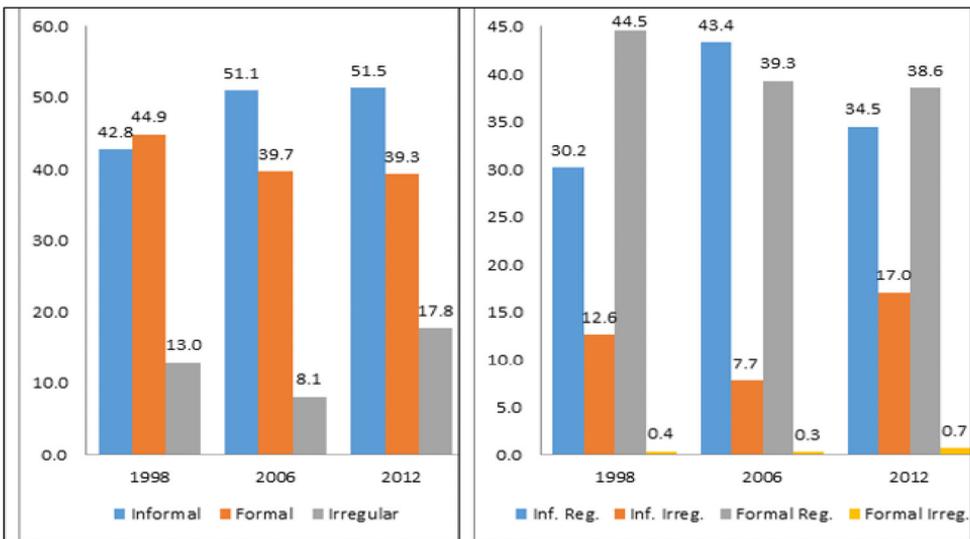
if we distinguish between regular and irregular jobs in terms of formal and informal employment, 40% of workers cumulate the two desirable features of having a formal and a regular job. However, informal jobs are mainly regular, but an increasing share of informal jobs has been transformed into informal irregular jobs; the proportion of these jobs have increased from 12.6% to 17%. These evolutions will be described more precisely in the following sections.

Figure 1. Composition of the working-age population in selected MENA, Latin America and the Caribbean, and Eastern Europe and Central Asia Region, 2010



(Source) World Bank 2013, based on ILO

Figure 2. Composition of employment in the Egyptian labor force

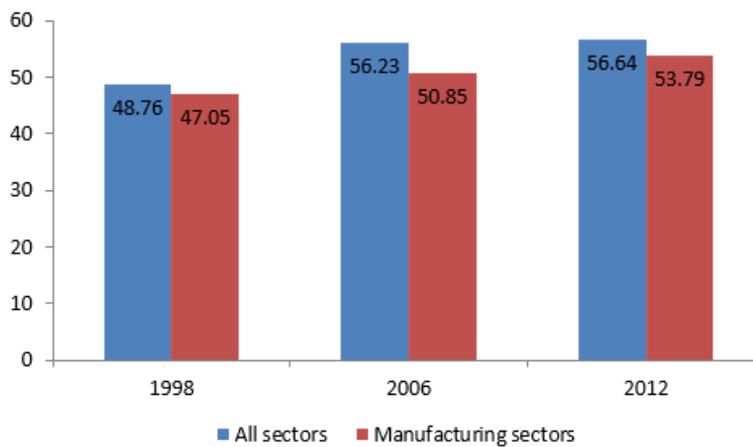


(Source) Constructed by the authors using the ELMPS(1998, 2006, and 2012).

2. Informal employment in Egypt

In Egypt, informal employment increased between 1998 and 2006 and, in a less pronounced way, between 2006 and 2012 (Figure 3). The share of informal jobs in manufacturing sectors across time is similar to that of all sectors, even it is lesser; in other words, informal jobs accounted for the major proportion of jobs since 2006⁸). The focus on this special economic sector is explained by the availability of tariff data; it facilitates an investigation of the impact of trade liberalization on employment informalization.

Figure 3. Share of Informal workers in total employment, in 1998, 2006 and 2012



(Source) Constructed by the authors using the ELMPS(1998, 2006, and 2012).

At the sectoral level (Figure A2 in the Appendix), informality can be observed in the activities of most sectors, except for electricity, education, health, water supply, information and communication, defense, and financial insurance. While informality remained low in these sectors over the period 1998~2012, the big picture remains the same—informal jobs increased in almost every sector (16 out of 20 sectors), including the manufacturing sector. A deeper look at the manufacturing sector (Figure A3 in the Appendix) shows that food products and beverages, apparels, and furniture contribute to more than 40% of the overall employment, while the share of informal jobs in these subsectors is greater than 50%.

The features of Egyptian informal workers in all sectors and the manufacturing one, correspond to the usual features (Table A2 in the Appendix). An examination of all sectors shows that males are more affected since women face labor force participation problems. This

8) There is an inconsistency in the definition of subsectors—the waves 1998 and 2006 rely on the International Standard Industrial Classification (ISIC) rev 3.1 classification, whereas the sectors of 2012 are defined according to the ISIC 4 classification. Since the tariff data rely on the older version, we follow the older revision (3.1). According to the correspondence website, we redefine the economic activity in two-digit in 2012 by using the four-digit variables.

also explains why household heads and married individuals frequently engage in informal jobs; in 2012, the proportion of the aforementioned population engaged in informal jobs accounted for 50% of the total workforce. Age and higher education keep individuals from engaging in informal jobs; hence, it was observed that more than half of the young and less educated people have informal jobs. Settlement in rural areas and employment in small private firms lead to similar probabilities of engaging in informal jobs. From a sectoral perspective, the share of informal workers in manufacturing remains the same; the only difference in their composition lies in the fact that they are older than the rest of the workers in the economy. The share of younger workers clearly decreases over the three rounds, whereas it increases at the national level. The proportion of informal wage earners accounted for 75%, which is above the average when considering non-agricultural employment (less self-employed).

The transition probabilities in Tables 4a-4c are computed using the panel weights, covering two years⁹). In Table 4a, the probability to stay formal is very stable, whereas the one to stay informal witnesses a slight increase. The two situations are very persistent with probabilities around 90% and exceeding 75% for formal and informal workers, respectively. Moreover, the likelihood of an informal worker engaging in a formal job is higher than a formal worker shifts to the informal sector. The scenario changes when considering only the manufacturing sector; this is because the two probabilities to stay formal or informal decrease—the first probability decreases by 2 percentage points and the second by 6 percentage points. Moreover, if informal jobs seem to act as stepping stones for formal jobs in the all the economic sectors,

Table 4a. Transition probabilities between formal and informal jobs

All sectors		2006	
		Formal	Informal
1998	Formal	89.9	10.1
	Informal	23.8	76.2
		2012	
2006	Formal	90.1	9.9
	Informal	21.8	78.2
Within the manufacturing sector		2006	
1998	Formal	83.3	16.7
	Informal	17.5	82.4
		2012	
2006	Formal	81.2	18.8
	Informal	21.5	78.5

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

9) It is worth noting that when using the panel weights covering the corresponding years, the probability to stay in the same status reduces marginally.

then the pattern would differ in the manufacturing sector as the transition probabilities are rather similar, around 18% of formal workers became informal.

Tables 4b and 4c provide similar transitions (frequencies and probabilities in italics) for the manufacturing sector only; Table 4b presents transitions of workers to the manufacturing sector, whereas Table 4c reports transitions of workers from the manufacturing sector. First, transitions of workers to the manufacturing sector remain stable over the two rounds (around 50%). Second, there is a significant rigidity in the labor market since people who were formal remain formal even when changing their sector, but with the probability decreasing strongly in 2012 (16 percentage points). This probability should be compared to that of workers already engaged in the manufacturing sector (83.3% in Table 4a). The transition from inactivity to employment implies a likelihood of getting an informal job, with a stable probability of 68%.

Table 4b. Transitions between formal and informal jobs in the manufacturing sector (joining)

	Outside Manuf. → Inside Manuf.	2006		
		Formal	Informal	Total
1998	Formal	50 <i>84.1</i>	9 <i>15.9</i>	59 <i>100.00</i>
	Informal	23 <i>37.6</i>	37 <i>62.4</i>	60 <i>100.00</i>
	Not working	100 <i>32.2</i>	211 <i>67.8</i>	311 <i>100.00</i>
	Total (all flows)	173 <i>20.6</i>	257 <i>30.6</i>	430 <i>51.2</i>
		2012		
2006	Formal	54 <i>68.6</i>	25 <i>31.4</i>	79 <i>100.00</i>
	Informal	44 <i>41.7</i>	62 <i>58.3</i>	106 <i>100.00</i>
	Not working	92 <i>32.1</i>	195 <i>67.9</i>	287 <i>100.00</i>
	Total (all flows)	190 <i>20.8</i>	282 <i>30.9</i>	472 <i>51.7</i>

(Note) Numbers in italics represent percentages from the total in the given row. For example, 84.08 is the proportion of formal workers remaining formal between 1998 and 2006, among formal workers in 2006. The other numbers are frequencies; for example, 50 formal workers outside the manufacturing sector remain formal but enter the manufacturing sector.

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

The proportion of workers leaving the manufacturing sector increased across the two rounds, from 37% to 45%; a similar proportion was observed in the case of informal and formal workers in 2006 and a greater proportion of informal workers was noted in 2012. The rigidity observed previously is not evident in these two rounds; this is because the probability of remaining

formal is lower than the other probabilities for an older formal worker in another sector. Those who joined the sector as formal workers in 1998 were most likely forced to exit it in 2006.

Table 4c. Transition probabilities between formal and informal jobs in the manufacturing sector (leaving)

Inside Manuf. → Outside Manuf.		2006			
		Formal	Informal	Not working	Total (all flows)
1998	Formal	44 <i>12.3</i>	28 <i>7.8</i>	67 <i>18.7</i>	139 <i>38.7</i>
	Informal	24 <i>8.3</i>	46 <i>16.0</i>	29 <i>10.1</i>	99 <i>34.4</i>
	Total	68 <i>100</i>	74 <i>100</i>	96 <i>100</i>	238 <i>36.8</i>
		2012			
2006	Formal	50 <i>13.3</i>	50 <i>13.3</i>	55 <i>14.7</i>	155 <i>43.3</i>
	Informal	31 <i>7.9</i>	88 <i>22.4</i>	85 <i>2.6</i>	204 <i>5.9</i>
	Total	81 <i>100</i>	138 <i>100</i>	138 <i>100</i>	357 <i>44.7</i>

(Note) Numbers in italics represent percentages from the total in the given column. For example, 12.3 is the proportion of formal workers remaining formal between 1998 and 2006, among formal workers in 2006. The other numbers correspond to frequencies; for example, 44 formal workers inside the manufacturing sector remain formal, but exit the manufacturing sector.

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

It is important to note that although labor markets in MENA are heavily regulated, many workers in the region remain largely unprotected. According to the Doing Business dataset (2010), the MENA region (non-GCC) has the highest rigidity of hiring and firing in the redundancy index (43.3), and it holds the third spot in the difficulty of hiring index (32.8)¹⁰. While Egypt is not an exception, a law came into effect in early 2004 aiming to increase hiring and firing flexibility. Under this law, employers can issue definite duration contracts and renew contracts for an indefinite number of times; they can also lay off workers for economic reasons, subject to the payment of severance pay. Wahba and Assaad (2015) showed that more flexible labor regulations increase formal employment and reduce informalization. However, this law favored the employed (prime-age and males), whereas young first-time labor market entrants (outsiders) were not affected by this reform (Wahba 2009).

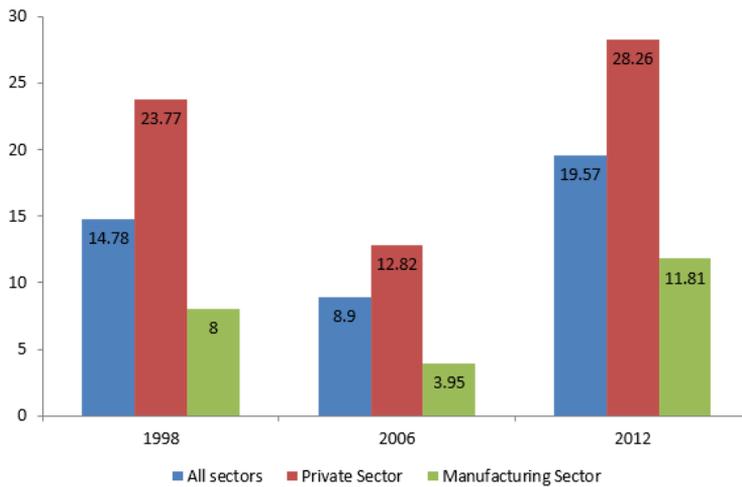
3. Irregular employment in Egypt

Irregular employment refers to workers with a contract duration of less than 12 months,

¹⁰) Those indices range from 0 to 100, with higher values indicating more rigid regulations.

own-account workers, and contributing (unpaid) family workers (irregular employment). Even though regular jobs occupy the major proportion of the total jobs in the private sector, irregular jobs are representative of jobs witnessing a steady growth in the private sector: the probability of having a regular job was 85% (lower in the private sector, with a share of more than 70% of total workers, and higher in the manufacturing sector, with a share of 90%) and 80% in 1998 and 2012. Since 2006, the job quality has increasingly deteriorated in Egypt; this can be attributed to different events, such as the financial crisis, the political instability, or the continuing effect of trade liberalization (Figure 4). Irregular and informal jobs overlap as irregularity captures job insecurity in any job, informal and formal. We assess this connection through Figure A3 in the Appendix. It reveals that three quarters of the regular jobs are informal in the private sector, whereas this share is below 50% in the manufacturing sector. Furthermore, 95% of irregular jobs are informal, irrespective of the sector.

Figure 4. Share of Irregular workers in total employment, in 1998, 2006 and 2012



(Source) Constructed by the authors using the ELMPS(1998, 2006, and 2012).

An examination of individual characteristics of irregular workers (Table A4 in the Appendix) shows their similarities with informal workers' characteristics. However, we can point out that 90% of the irregular workers are wage earners and more than 70% live in rural areas.

The transition probabilities between regular and irregular jobs have a similar pattern as the informal one. There is a significant rigidity in the pattern since those who are regular remain regular, with a probability greater than 85%, irrespective of the period. Irregular workers also remain irregular, but the probability exceeds 50% only after 2006. Moreover, these shares have been higher between 1998 and 2006 than between 2006 and 2012 (Table 5a).

Again, we focus on the link between irregularity and informality, by distinguishing between

Table 5a. Transition probabilities between regular and irregular jobs

All sectors		2006	
		Regular	Irregular
1998	Regular	97.7	2.3
	Irregular	72.6	27.41
		2012	
2006	Regular	87.32	12.68
	Irregular	42.16	57.84
Within the manufacturing sector		2006	
1998	Regular	98.27	1.73
	Irregular	87.35	12.65
		2012	
2006	Regular	91.48	8.52
	Irregular	53.13	46.87

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

Table 5b. Transition probabilities between formal, informal, and irregular jobs

All sectors		2006			
		Regular Formal	Regular Informal	Irregular	Total
1998	Regular Formal	1965	173	16	2154
		<i>91.23</i>	<i>8.03</i>	<i>0.74</i>	<i>100</i>
	Regular Informal	326	864	64	1254
		<i>26.00</i>	<i>68.90</i>	<i>5.10</i>	<i>100</i>
	Irregular	128	314	167	609
	<i>21.02</i>	<i>51.56</i>	<i>27.42</i>	<i>100.00</i>	
	Total	2419	1351	247	4017
		<i>60.22</i>	<i>33.63</i>	<i>6.15</i>	<i>100.00</i>
		2012			
2006	Regular Formal	2011	344	114	2469
		<i>81.45</i>	<i>13.93</i>	<i>4.62</i>	<i>100</i>
	Regular Informal	373	1190	454	2017
		<i>18.49</i>	<i>59.00</i>	<i>22.51</i>	<i>100</i>
	Irregular	47	143	261	451
	<i>10.42</i>	<i>31.71</i>	<i>57.87</i>	<i>100</i>	
	Total	2431	1677	829	4937
		<i>49.24</i>	<i>33.97</i>	<i>16.79</i>	<i>100</i>

(Note) Numbers in italics represent percentages from the total in the given row. For example, 91.23 is the proportion of regular and formal workers who remain regular and formal between 1998 and 2006, among regular formal workers in 2006. The other numbers are frequencies; for example, in 1965, formal regular workers remain formal regular.

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

regular informal and regular formal jobs. Irregularity becomes more persistent after 2006 as the probability of transitioning from irregular to regular jobs decreases drastically (see Table 5b).

B. Trade openness

Despite the recent liberalization, MENA's trade regimes remain more restrictive than the other countries, such as the middle-income countries. MENA countries lowered tariffs over the past two decades; this was primarily driven by trade agreements with the EU or the United States of America. However, tariffs remain high (averaging 12%; see Table 6). Among our countries of interest, Jordan reached the lowest levels of tariffs in both the manufacturing and primary sectors, while Tunisia's and Egypt's primary sector remained highly protected, with an average tariff of 27% and 36%, respectively.

Table 6. Tariff rates by country

	1995	2000	2005	2008
<i>Applied Tariff rate (simple mean)</i>				
Egypt	24.3	19.65	19.09	12.52
Jordan	..	23.82	12.35	10.62
Tunisia	29.67	29.38	13.28	21.88
Middle income	13.99	14.4	10.2	8.7
<i>Applied Tariff rate. Manufacturing (simple mean)</i>				
Egypt	24.12	..	12.04	9.5
Jordan	..	23.26	11.9	10.03
Tunisia	29.77	..	12.1	21.41
Middle income	13.99	14.2	9.83	8.49
<i>Applied Tariff rate. Primary (simple mean)</i>				
Egypt	25.88	..	85.16	36.14
Jordan	..	27.86	15.54	14.43
Tunisia	28.68	..	26.63	26.76
Middle income	13.95	15.84	13.16	10.33

(Source) World Development Indicators online database.

Egypt experienced two waves of trade liberalization. The first wave took place in the early 1990s, after the implementation of the economic reform and the structural adjustment program by the World Bank and the International Monetary Fund. This program was relatively exogenous. The second wave, in 2004, was part of a larger reform program that aimed to improve the investment climate in Egypt by reducing tariffs, simplifying administrative barriers, and increasing the ease of doing business. Therefore, tariffs in Egypt are less likely to be endogenous than those in other countries

Industry tariffs and informal employment move in the same direction, as indicated by

correlations in Table 7, whereas the correlation between irregular employment and industry tariff have been negative, but weak, for the years 1998 and 2006. The brutal change in 2012 could be explained rather by the 2011 political events than the trade reforms.

Table 7. Correlation between informal/irregular employment and industry tariffs

	Industry tariffs rates (weighted mean)		
	1998	2006	2012
Informal employment	0.347	0.339	0.307
Irregular employment	-0.016	-0.055	0.106

(Source) Constructed by the authors using the ELMPS (1998, 2006 and 2012).

Figures A4a, A4b, and A4c (see the Appendix) illustrate the evolution of irregular and informal employment shares and the industry tariff for each manufacturing subsector. The global correlation hides the significant heterogeneity between these sectors. Indeed, we get three different cases. First, high degrees of job insecurity are associated with middle tariffs. For example, three sectors (wood, tanning and leather, and furniture) comprise 90% of informal employment, whereas their tariff varies, on average, from 5 to 20. Second, opposite transitions between informality and trade openness across time are also present. In the paper industry, the sharp increase in informal and irregular employment shares across is combined with a decrease in the tariff. Finally, the motor vehicle sector illustrates a significant decline in informality with stable tariffs. Irregularity in employment follows the evolution of informality, but to a lesser extent, in those sectors.

After examining informal and irregular employment in Egypt, we will empirically examine the relationship between such labor characteristics and trade openness.

III. Methodology

To understand the impact of trade effect on labor market informality/irregularity, a two-step analysis approach is adopted, following Goldberg and Pavnick (2003) and Selwaness and Zaki (2015). In this approach, the informality premium is regressed on the tariffs in order to determine the impact of tariffs reduction on informality/irregularity premia. The informality/irregularity premium is the change in the probability of informal/irregular employment due to the industrial affiliation of the workers.

Two steps are taken in this approach. In the first step, a probit model for the probability of working in the informal/irregular sector is estimated while controlling for the industry indicators as well as the individual, household, and regional variables. The first stage regressions

are estimated separately for each year in our sample (1998, 2006, and 2012) as follows:

$$Informal_{ijt} = \alpha_1 X_{ijt} + \alpha_2 H_{ijt} + \alpha_3 R_{ijt} + \alpha_4 IP_{jt} + v_{ijt} \quad (1)$$

$$Irregular_{ijt} = \alpha_1 X_{ijt} + \alpha_2 H_{ijt} + \alpha_3 R_{ijt} + \alpha_4 IP_{jt} + v_{ijt} \quad (2)$$

where v_{ijt} is the discrepancy term.

The dependent variable is a binary variable that takes the value of 1 if the individual i employed in sector j at time t is working informally (or irregularly), and 0 otherwise. It is important to note that an informal worker has no contract and/or is not covered by social security. Irregular workers do not have jobs on a regular basis; however, they might be hired for a specific period of time or a specific task.

The explanatory variables consist of the individual characteristics X_{ijt} , which include gender (a dummy for female gender), age, age squared, marital status (a dummy for being married), and educational level (three dummies for less than intermediate, intermediate, and above intermediate levels). Household characteristics H_{ijt} are mainly captured by the household size, a dummy for the household head status, the share of dependents aged 0 to 14 years or above 65 years old in the household, and the share of workers aged 15 to 64 years who are out of the labor force. We add five regional dummies (Alexandria and Canal Cities, urban Lower Egypt, urban Upper Egypt, rural Lower Egypt, and rural Upper Egypt) to control for regional characteristics R_{ijt} . Finally, industry indicators IP_{jt} are added to control for the unobserved industry-specific characteristics. The coefficient of the industry dummy is considered “the informality/irregularity premium.” This coefficient captures the part of the variation in the probability of being informal/irregular, which cannot be explained by the worker characteristics but by workers’ industry affiliation.

In the second step, the industry coefficients α_4 retrieved from the first step regressions are pooled over time (for 1998, 2006 and 2012) and are regressed on the tariffs. These coefficients are obtained by filtering out the effects of observable worker characteristics to ensure that they indicate the variation in the probability of informality due to the workers’ affiliation to a given industry and known. They are known as industry informality (irregularity) differentials, according to Goldberg and Pavnick (2003). Therefore, regressing informality (irregularity) differentials on tariffs facilitates explanation on the change in informality in each industry by trade policy.

$$IP_{jt}^* = \delta_1 Tar_{jt} + \delta_2 D_j + \delta_3 D_t + v_{jt} \quad (3)$$

where v_{jt} is the discrepancy term.

We follow Goldberg and Pavnick (2003) who included lagged values of tariffs to reduce

endogeneity and we do not consider exports and imports.

The dependent variable IP_{jt}^* used in the second step is the estimated industry coefficients after they are transformed and expressed as deviations from the employment-weighted average informality (irregularity) differential. This transformation is conducted to address the sensitivity of the estimated industry informality differentials with respect to the omitted industry dummy. It ensures that both the coefficients and their standard errors are independent of the base industry choice (Haisken-DeNew and Schmidt 1997)¹¹). Each normalized informality (irregularity) differential (or industry dummy coefficient) IP_{jt}^* can hereafter be interpreted as the percentage point difference in the probability of informal (irregular) employment for a worker in a given industry relative to an average worker in all industries with the same observable characteristics (Goldberg and Pavnick 2003).

IV. Empirical Findings

Table A5 in the Appendix reports the first stage of the two-step analysis for informality. We find that the results are similar to those provided in the descriptive statistics section. As per industry dummies, most industry indicators of the manufacturing sectors are statistically significant in this first stage of the estimation. Eight industry indicators have a negative impact on informality, and this impact is stable across time¹²). Over years, the production of coke and refined petroleum appears to have the highest negative impact on the probability to be informal, whereas the production of wood has the highest positive impact. Moreover, the informality premium computed at the end of this estimation stage is highly correlated over time since it reaches the 60%, 90%, and 66% levels between 1998~2006, 2006~2012, and over the whole period, respectively. In the case of the probability of irregular employment, a weak number of observations does not allow us to obtain an estimated value for all the industry sectors. Nevertheless, these high year-to-year correlations leave some room for an impact of trade liberalization on informal employment. The strategy for obtaining the impact of the

11) The normalization procedure of the industry coefficients and their standard errors are adopted following Haisken-DeNew and Schmidt (1997), and this procedure is known as the two-step restricted least squares procedure (Haisken-DeNew and Schmidt 1997). It involves the transformation of each industry coefficient, estimated through equation 1, to a deviation from the employment-share weighted average of all other estimated industry coefficients. Thus, each industry coefficient is not affected by the choice of the reference industry omitted.

12) While five sectors are dropped for insufficient number of observations, the following eight sectors have a negative coefficient: tobacco products; textiles; paper and paper products; coke and refined petroleum products; chemicals and chemical products; radio, TV, and communication; medical, precision, and optical instruments; and motor vehicles and trailers. The following seven sectors have a positive coefficient: apparel; dressing and dyeing, tanning and leather products; wood and wooden products; publishing, printing and reproduction; other non-metallic products; fabricated metal products; furniture; and manufactured goods that are not specified elsewhere.

manufacturing sub-sector is the same for the probability to be informal, even if the smaller number of observations does not always allow the computation of an estimate for manufacturing indicators. Nevertheless, there is one exception. The apparel production increases the probability of remaining in informal employment, whereas it decreases the probability of remaining in irregular employment. Moreover, the year-to-year correlations are rather low—11%, 21%, and 30% between 1998~2006, 2006~2012, and over the period, respectively.

As it was mentioned above, since we control for workers characteristics in the first stage (and thus control for industry composition each year), our second stage results are not driven by differences in worker composition across sectors. We run the second stage (Tables 8 and 9) for 1998, 2006, and 2012 separately in order to obtain the coefficients. Moreover, we pool both years together, including a year dummy for 1998 and 2006, among the regressors, to consider the fluctuations in business cycles that can affect the tariff formation and informal employment simultaneously. Moreover, the inclusion of the 2006-year dummy controls for the change introduced in the labor market environment, following the adoption of the new 2003 labor law (December 2003). The 2012 dummy controls for the instability that affected Egypt in the wake of the political turmoil. Industry dummies were also controlled for in the pooled regression. The inclusion of these controls additionally reduces the potential estimation biases.

Overall, estimations were fit using two techniques, both yielding similar results. The first is the ordinary least squares (OLS) weighted by the inverse of the estimated transformed variance, as presented above (Haisken-DeNew and Schmidt 1997). The second is the variance-weighted least squares; it differs from OLS regression in that it does not assume homogeneity of variance but requires the estimation of the conditional variance of the dependent variable prior to the regression. The estimated variance need not be constant across observations. This method treats the estimated variance as the true variance when computing the coefficients standard errors. Tables 8 and 9 present the results of the second step and show that tariffs are positively associated with the informality premium for both wage workers and all the workers of the manufacturing sector¹³). Although the coefficient on tariff is significantly positive, it is small in magnitude. These results imply that trade liberalization has a positive effect on the labor market in terms of decreasing informal employment. This is in line with the heterogeneous firm model of Aleman-Castilla (2006) in which trade liberalization (i.e., lower trade costs) implies that some firms will find it more profitable to enter the formal sector rather than to remain informal. The least productive informal firms will be forced to exit the industry and only the most productive (formal) firms will export to the international markets. Thus, lower tariffs imply less informality. This is in line with what has been observed in the Egyptian market. Over the same

13) Our dataset presents the following four employment statuses under the primary job category: wage worker, employer, self-employed, or unpaid family worker. Hence, we wanted to distinguish the effect of trade liberalization on a narrow category (wage workers) and a larger one (all workers) to check the robustness of our results.

Table 8. Total workforce in the manufacturing sector: informality premium

	1998		2006		2012		Panel	
	OLS	WLS	OLS	WLS	OLS	WLS	OLS	WLS
Tariff	0.0193 (0.0119)	0.0193*** (0.00107)	0.0242 (0.0163)	0.0242*** (0.000985)	0.0381** (0.0178)	0.0381*** (0.000803)	0.0184 (0.0132)	0.0184*** (0.00188)
Constant	-0.475* (0.260)	-0.475*** (0.0234)	-0.676** (0.299)	-0.676*** (0.0180)	-0.675** (0.253)	-0.675*** (0.0114)	-0.547 (0.388)	-0.547*** (0.0550)
Industry dum.	YES	YES	YES	YES	YES	YES	YES	YES
Year dum.	NO	NO	NO	NO	NO	NO	YES	YES
Observations	22	22	21	21	21	21	64	64
R-squared	0.116		0.103		0.194		0.905	

Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.**Table 9.** Wage workers in the manufacturing sector: informality premium

	1998		2006		2012		Panel	
	OLS	WLS	OLS	WLS	OLS	WLS	OLS	WLS
Tariff	0.0130 (0.0174)	0.0130*** (0.00162)	0.0366* (0.0205)	0.0366*** (0.00204)	0.0243 (0.0184)	0.0243*** (0.00126)	0.0141 (0.0138)	0.0141*** (0.00301)
Constant	-0.334 (0.349)	-0.334*** (0.0326)	-0.350 (0.402)	-0.350*** (0.0401)	-0.227 (0.269)	-0.227*** (0.0184)	-0.435 (0.391)	-0.435*** (0.0854)
Indus. dum.	YES	YES	YES	YES	YES	YES	YES	YES
Year dum.	NO	NO	NO	NO	NO	NO	YES	YES
Observations	22	22	21	21	21	21	64	64
R-squared	0.027		0.144		0.085		0.913	

Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

period, as trade liberalization increased, the value of exports increased between 2006 and 2010, while the number of Egyptian exporting firms declined by an average of 3.6%, with the largest decline in 2008. This indicates that only competitive firms could compete and stay in the market following the 2008 financial crisis, with each firm exporting more on average. Thus, a higher level of openness allowed the most productive firms to expand their market shares and forced the least productive ones to exit (Melitz 2003).

While the results for the first step of the probability of working in an irregular job are reported in Table A6 in the Appendix, both Tables 10 and 11 show the results of the second step. It is worth noting that the effect of tariffs on the irregularity premium is less robust than the one on informality. While Table 11 shows that the effect of tariffs is negative for 2006, it is insignificant for the others. Moreover, when the regressions are limited to wage workers, the effects of tariffs in 2006 and in the panel are significantly negative and positive, respectively. However, all the other years and regression techniques are insignificant. Consequently, informal

employment is more connected to trade policy issues than irregular employment.

Table 10. Total workforce in the manufacturing sector: irregularity premium

	1998		2006		2012		Panel	
	OLS	WLS	OLS	WLS	OLS	WLS	OLS	WLS
Tariff	-0.000133 (0.00153)	-0.000133 (0.000508)	-0.00383 (0.00331)	-0.00383*** (0.00106)	0.000674 (0.00312)	0.000674 (0.000492)	0.000598 (0.00444)	0.000598 (0.00112)
Constant	0.0272 (0.0295)	0.0272*** (0.00983)	0.234*** (0.0528)	0.234*** (0.0169)	-0.0695 (0.0498)	-0.0695*** (0.00786)	0.0243 (0.124)	0.0243 (0.0310)
Industry dum	YES	YES	YES	YES	YES	YES	YES	YES
Year dum.	NO	NO	NO	NO	NO	NO	YES	YES
Observations	22	22	21	21	21	21	64	64
R-squared	0.000		0.066		0.002		0.637	

Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table 11. Wage workers in the manufacturing sector: irregularity premium

	1998		2006		2012		Panel	
	OLS	WLS	OLS	WLS	OLS	WLS	OLS	WLS
Tariff	-0.000588 (0.00159)	-0.000588 (0.000600)	-0.00384 (0.00342)	-0.00384*** (0.00112)	-0.000349 (0.00536)	-0.000349 (0.000663)	0.00301 (0.00529)	0.00301** (0.00129)
Constant	0.0366 (0.0302)	0.0366*** (0.0114)	0.253*** (0.0531)	0.253*** (0.0174)	-0.0823 (0.0839)	-0.0823*** (0.0104)	-0.0320 (0.149)	-0.0320 (0.0364)
Indus. dum	YES	YES	YES	YES	YES	YES	YES	YES
Year dum.	NO	NO	NO	NO	NO	NO	YES	YES
Observations	22	22	21	21	21	21	64	64
R-squared	0.007		0.062		0.000		0.704	

Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Furthermore, irregular employment, compared to the informal one, is a recent trend of the Egyptian labor market and the share of irregular employment is smaller in this market. Indeed, as already said, in the manufacturing sector, only 10% of the jobs are irregular. Moreover, the significant positive response of remaining in irregular employment appears only for wage workers in the manufacturing sector as 90% of irregular jobs are in the form of paid employment. Nevertheless, besides these less-convincing results about irregular employment, the advent of this phenomena on the Egyptian labor market must not be neglected. In other countries, developing as well as developed ones, the number of short terms contracts have surged, increasing employment vulnerability. However, this tendency cannot be attributed to trade globalization in Egypt according to our result as the overall positive impact of tariff on the irregularity premium

is similar to the response of the probability to be informal. This implies that declines in tariff are supportive of regular employment.

Finally, in order to check for the robustness of the impact of trade liberalization on our labor market outcomes, we consider the labor law of 2003 in Egypt. This law is primarily concerned with increasing the flexibility of the labor market by reducing hiring and firing costs. Consequently, this can reduce the reliance of firms on informal/irregular jobs and, subsequently, reduce the intensity of the link between trade liberalization and these labor outcomes. Therefore, we introduce an interaction between tariffs and a binary variable, which is one after 2003 and zero otherwise, in order to test the potential variation in the relationship between tariffs and the informality/irregularity premium. The results for the panel are presented in Table 12, for the two types of employment. The evidence remains the same regarding the significant and positive impact of tariffs for the two probabilities of informality and irregularity. Again, this impact is four times higher for informal workers than the irregular ones. The interactive variable is insignificant but negative; it means that, potentially, the labor law of 2003 could have reduced the impact of trade liberalization on labor market.

Table 12. Informality/irregularity premium with labor reform of 2003

	Informality premium in the manufacturing sector				Irregularity premium in the manufacturing sector			
	All workers		Wage Workers		All workers		Wage Workers	
	OLS	WLS	OLS	WLS	OLS	WLS	OLS	WLS
Tariff	0.0178 (0.0158)	0.0178*** (0.00222)	0.0169 (0.0167)	0.0169*** (0.00360)	0.000709 (0.00526)	0.000709 (0.00130)	0.00393 (0.00607)	0.00393*** (0.00147)
Tar.*post labor ref.	0.000815 (0.0104)	0.000815 (0.00146)	-0.00329 (0.0107)	-0.00329 (0.00231)	-0.000127 (0.00313)	-0.000127 (0.000775)	-0.00123 (0.00386)	-0.00123 (0.000933)
Constant	-0.534 (0.424)	-0.534*** (0.0593)	-0.490 (0.434)	-0.490*** (0.0936)	0.0222 (0.136)	0.0222 (0.0336)	-0.0485 (0.159)	-0.0485 (0.0385)
Ind. dum	YES	YES	YES	YES	YES	YES	YES	YES
Year dum.	YES	YES	YES	YES	YES	YES	YES	YES
Obs.	64	64	64	64	64	64	64	64
R-squared	0.905		0.913		0.637		0.705	

Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

V. Conclusion

This study examines the impact of trade openness on two aspects of low-quality employment—informal and irregular employment. In fact, Egypt has experienced several waves of liberalization and implemented many labor market reforms. Moreover, the impact of several

events on the economy manifested in the form of severe political instability, which, in turn, affected production, exports, employment, and employment conditions. Informal and irregular employment have exacerbated in the wake of the political turmoil of 2011. Thus, combining a microeconomic dataset (the ELMPS) with macroeconomic variables (tariffs), we try to assess the extent to which trade reforms affected informal workers in Egypt.

Our main findings show a positive association between tariffs and informal employment. The effect of tariffs on irregular employment is less robust. This effect is likely because the least productive informal firms will be forced to exit the industry and only the most productive (formal) firms will export to the international markets. Therefore, increasing openness may allow the most productive firms to expand their market shares and force the least productive ones to exit, thereby inducing aggregate productivity gains through within-industry reallocations. It is also important to note that the demand for skilled formal workers increases after openness. Indeed, skill-biased technical change favors skilled over unskilled labor in terms of the ability to face fierce competition. Hence, the relative demand for formal and skilled workers is likely to increase, leading to a decline in informal employment.

From a policy perspective, as trade liberalization leads to a reduction in informal employment, there is a need to consider the existence of an informal sector and the economic environment jointly in policy decisions on trade. Therefore, the government should ensure the establishment of a sound macroeconomic framework that provides enough incentives for firms to expand in periods of trade openness. These incentives include tax exemptions, better investment climate conditions, and simplified procedures, since all these factors are likely to affect firms' productivity and, consequently, their expansion and labor demand. Second, as the demand for formal and skilled workers increases after trade liberalization, providing technical training for these workers is crucial to increase their productivity; this will enable workers to face fierce competition when the economy becomes more exposed to the rest of the world. Finally, a more flexible legal setting would amplify the effect of trade reforms on employment. An increase in labor market flexibility will facilitate the transition from informal to formal employment and amplify the benefits of trade openness for employment in terms of job quality and quantity.

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Appendix

Table A1. Number of observations across sectors and employment

Employment (number of workers)	1998		
	Sample	Population	
		cross-section	panel
All sectors	1 233	2 898 177	894
Informal	573	1 432 182	434
Irregular	120	308 447	109
Manufacturing sector	1055	2470067	681
Informal	466	1162205	309
Irregular	77	197 501	63
Private Sector	835	2 031 694	611
Informal	561	1 414 602	428
Irregular	118	305 262	108
		2006	
All sectors	1 959	3 606 597	1 153
Informal	922	1 890 279	543
Irregular	106	190 872	65
Manufacturing sector	1554	2855 504	847
Informal	799	1 451187	440
Irregular	62	112 539	31
Private Sector	1 511	2 797 295	892
Informal	1 016	1 854 592	593
Irregular	103	188 401	63
		2012	
All sectors	2 141	3 739 583	1 263
Informal	1 203	2 044 939	735
Irregular	296	489 165	182
Manufacturing sector	1726	3023 280	921
Informal	953	1626123	519
Irregular	214	356480	109
Private Sector	1 668	2 933 273	1 015
Informal	1 177	1 997 515	724
Irregular	291	476 892	179

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

Table A2. Labor force

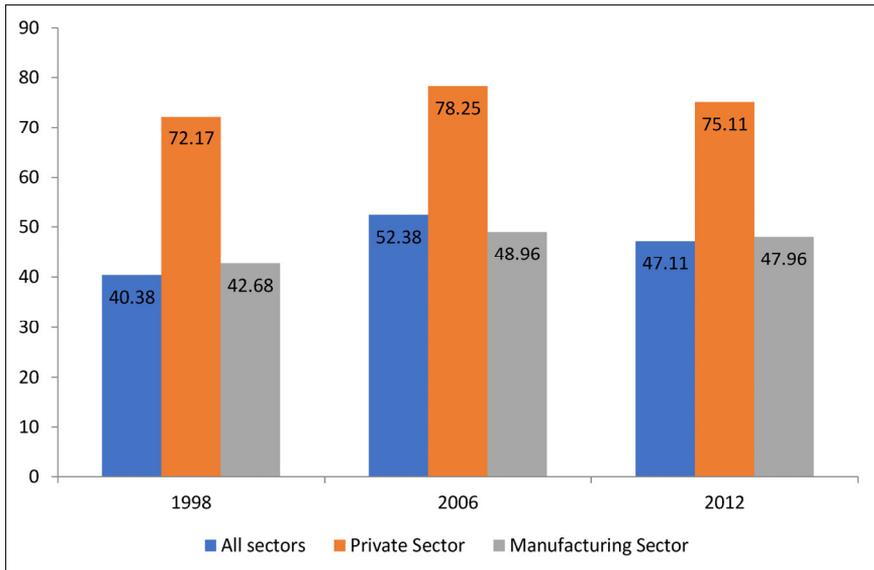
Frequencies	Formal E.	Informal E.	Irregular E.	Unemployment	In	Out
1998	1465995.3	1432182.2	328142.4	148066.5	3019369	770971.17
2006	1716317.8	1890278.8	202317.6	138165.6	3726382	890482.23
2012	1694644.9	2044938.6	500822.6	82369.31	3810781	435866.44

Table A3. Characteristics of informal workers: working-age population (15-64 years)

	1998		2006		2012	
	All sectors	Manuf.	All sectors	Manuf.	All sectors	Manuf.
Gender						
Male	85.50	85.79	76.01	81.29	85.55	89.17
Female	14.50	14.21	23.99	18.71	14.45	10.83
Age						
15-29	49.47	59.99	41.91	57.69	54.77	43.33
30-49	37.42	31.03	44.50	35.48	37.45	46.99
50-64	13.12	8.98	13.60	6.83	7.78	9.69
Education						
Ill. R & W	53.43	46.39	46.79	35.93	35.56	35.09
Less than Intermediate	21.54	28.57	18.56	24.56	21.93	26.12
Intermediate	18.75	20.66	27.14	31.32	32.43	30.68
Above Intermediate	6.05	4.26	7.49	8.15	9.93	8.12
Marital Status						
Married	53.86	42.98	59.88	51.11	67.02	54.43
Not married	46.14	57.02	40.12	48.89	32.98	45.57
Household position						
Head	40.66	33.88	39.43	37.32	54.80	49.66
Non-Head	59.34	66.12	60.57	62.68	45.20	50.34
Region						
Gr. Cairo	12.98	16.74	11.44	20.71	12.85	16.26
Alx.Sz C.	4.66	4.75	5.00	6.58	5.68	8.26
UrbLwr	8.18	15.82	7.79	13.96	8.88	11.66
UrbUpp	6.05	5.18	6.05	6.10	6.53	5.34
RurLwr	37.13	37.81	32.53	32.00	34.38	33.29
RurUpp	31.00	19.71	37.19	20.65	31.68	25.19
<i>Urban</i>	<i>31.87</i>	<i>44.60</i>	<i>30.28</i>	<i>47.35</i>	<i>33.77</i>	<i>40.94</i>
<i>Rural</i>	<i>68.13</i>	<i>55.40</i>	<i>69.72</i>	<i>52.65</i>	<i>66.23</i>	<i>59.06</i>
Employment status						
Wage worker	54.45	75.76	44.19	70.93	57.38	74.33
Employer	14.40	5.83	18.26	10.14	15.00	10.01
Self-employed	14.50	12.54	14.49	13.42	15.21	12.59
Unpaid family worker	16.64	5.88	23.06	5.51	12.41	3.08
Size of firms						
1-4	28.89	26.32	57.71	36.74	68.52	51.90
5-9	4.97	9.06	5.95	10.22	6.36	8.11
10-29	1.20	3.08	1.87	4.96	2.08	5.03
30-49	11.82	19.45	14.75	14.89	16.39	17.98
50 and more	2.45	9.57	2.18	10.62	4.44	10.92
DK	50.67	32.52	17.53	22.58	2.21	6.05
Nature of firms						
Public	1.32	1.01	0.78	1.09	1.20	1.81
Private	98.50	98.68	98.98	97.96	98.45	97.53
Other	0.18	0.30	0.24	0.95	0.35	0.65
Proportion of Informal	48.76	47.05	56.23	50.82	56.64	53.80
Population	7.642.606	2.470.067	12079338.1	2855504.2	12842983.6	3021152.9

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

Figure A1. Share of informal jobs in regular employment in 1998, 2006, and 2012



(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

Figure A2. Share of Informal Workers by Economic Activity in 1998, 2006, and 2012

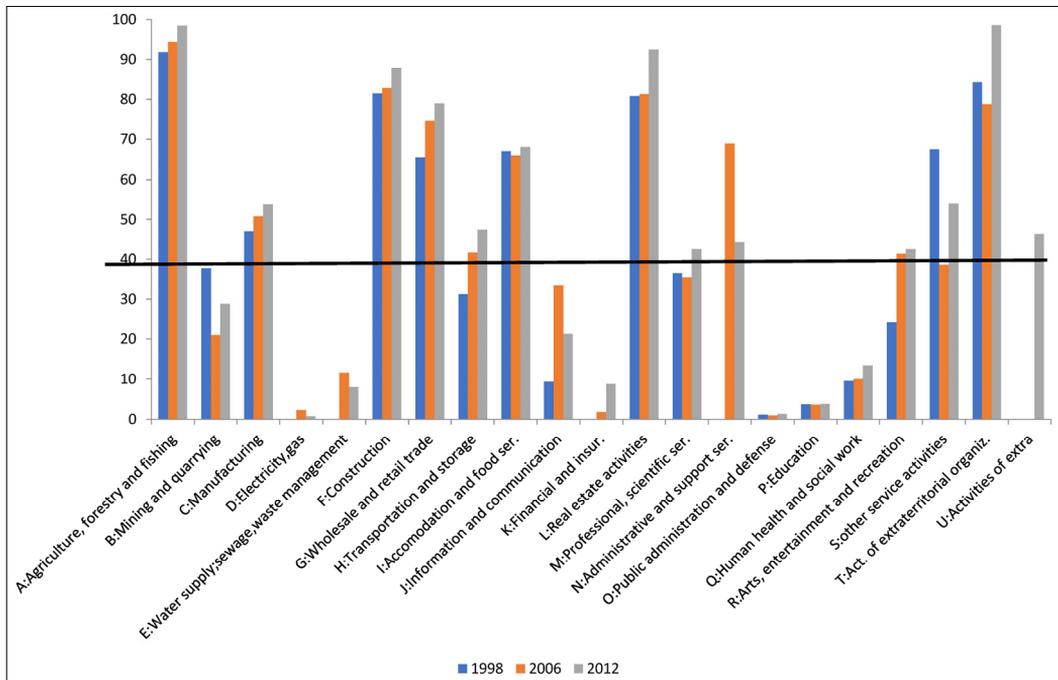


Table A4. Characteristics of Irregular Workers: Working-Age Population (15-64 years)

	1998		2006		2012	
	All sectors	Manuf.	All sectors	Manuf.	All sectors	Manuf.
Gender						
Male	91.66	88.50	91.69	82.45	93.82	89.65
Female	8.34	11.50	8.31	17.55	6.18	10.35
Age						
15-29	53.07	62.95	53.70	43.90	48.46	50.32
30-49	37.07	35.05	37.31	41.13	42.85	40.78
50-64	9.86	2.00	9.00	14.97	8.69	8.90
Education						
Ill. R & W	57.05	52.90	46.77	40.84	33.62	36.86
Less than Intermediate	22.88	21.30	21.47	27.61	25.52	36.86
Intermediate	16.61	23.44	28.41	30.24	35.83	33.10
Above Intermediate	2.88	2.37	3.34	1.31	4.86	1.81
Marital Status						
Married	51.50	42.54	56.68	63.78	63.53	59.77
Non-married	48.50	57.46	43.32	36.22	36.47	40.23
Household position						
Head	41.26	26.84	43.29	43.46	53.77	51.27
Non-Head	58.74	73.16	56.71	56.54	46.23	48.73
Region						
Gr. Cairo	8.15	11.40	8.37	15.63	10.73	14.95
Alx.Sz C.	5.24	6.79	5.97	5.07	4.53	2.99
UrbLwr	5.85	12.33	5.71	17.89	6.43	13.59
UrbUpp	5.79	5.42	6.89	11.38	8.01	12.78
RurLwr	35.72	36.96	27.60	27.50	30.07	26.62
RurUpp	39.26	27.11	45.46	22.54	40.23	29.07
<i>Urban</i>	25.02	35.94	26.94	49.96	29.48	44.31
<i>Rural</i>	74.98	64.06	73.06	50.04	70.52	55.69
Employment status						
Wage worker	88.91	87.16	90.09	79.96	88.01	86.64
Employer	1.15	4.08	1.45		2.21	0.97
Self-employed	2.95	4.68	5.54	17.66	5.99	10.66
Unpaid family worker	6.99	4.08	2.92	2.38	3.79	1.73
Size of firms						
1-4	49.00	33.65	49.42	52.38	61.70	56.09
5-9	8.15	11.69	11.48	8.24	9.43	7.35
10-29	1.75	3.74	3.03	8.38	2.17	5.28
30-49	19.34	25.69	21.43	10.75	20.55	14.06
50 and more	1.49	7.26	1.73	10.07	2.74	5.09
DK	20.28	17.97	12.91	10.19	3.40	12.14
Nature of firms						
Public	0.90	0.86	0.35	1.29	0.39	2.26
Private	99.03	98.39	99.60	97.80	99.54	97.10
Other	0.07	0.75	0.05	0.91	0.07	0.63
Proportion of Irregular	14.78	8	8.90	3.95	19.57	11.81
Population	2,314,254	197,501.17	1,910,039	112,539.27	4,433,867	356,480.8

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

Figure A3. Share of informal workers within the manufacturing sector, 1998, 2006 and 2012

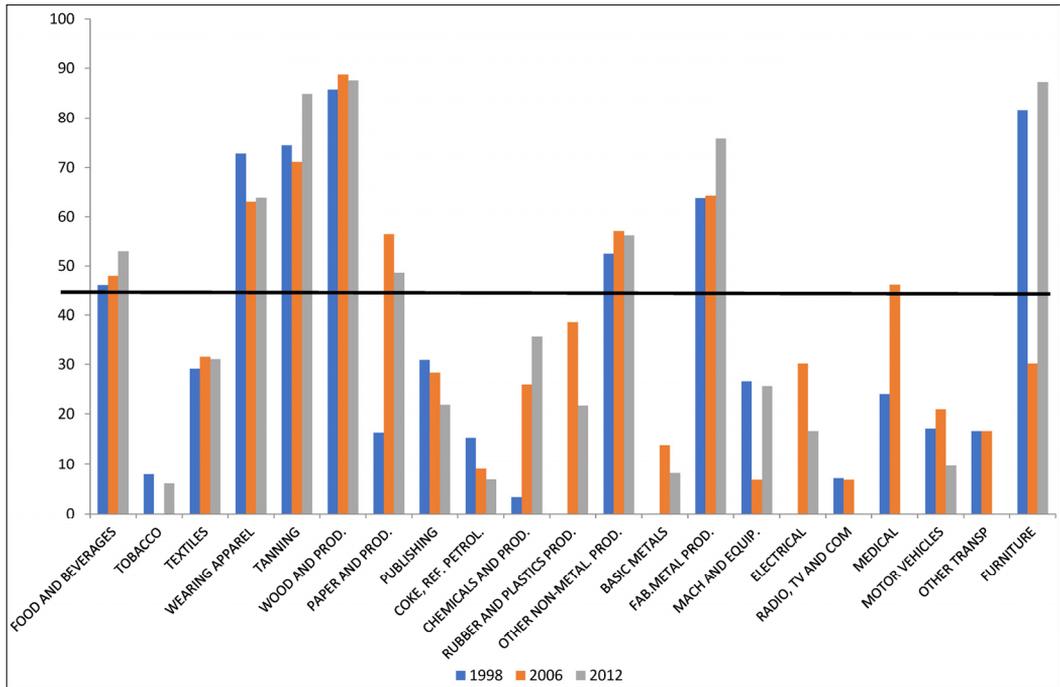
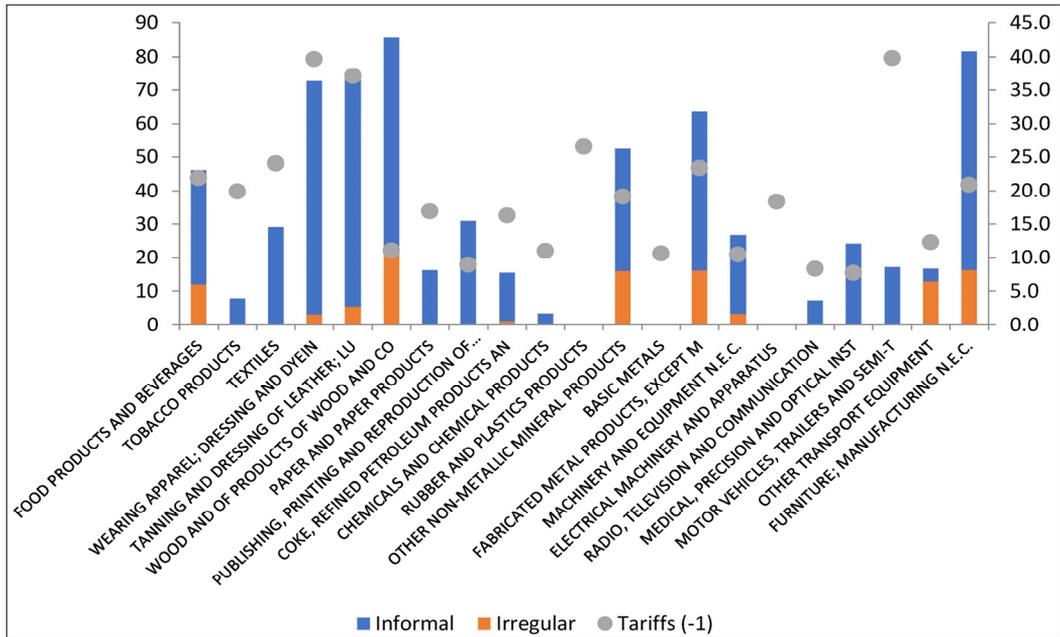


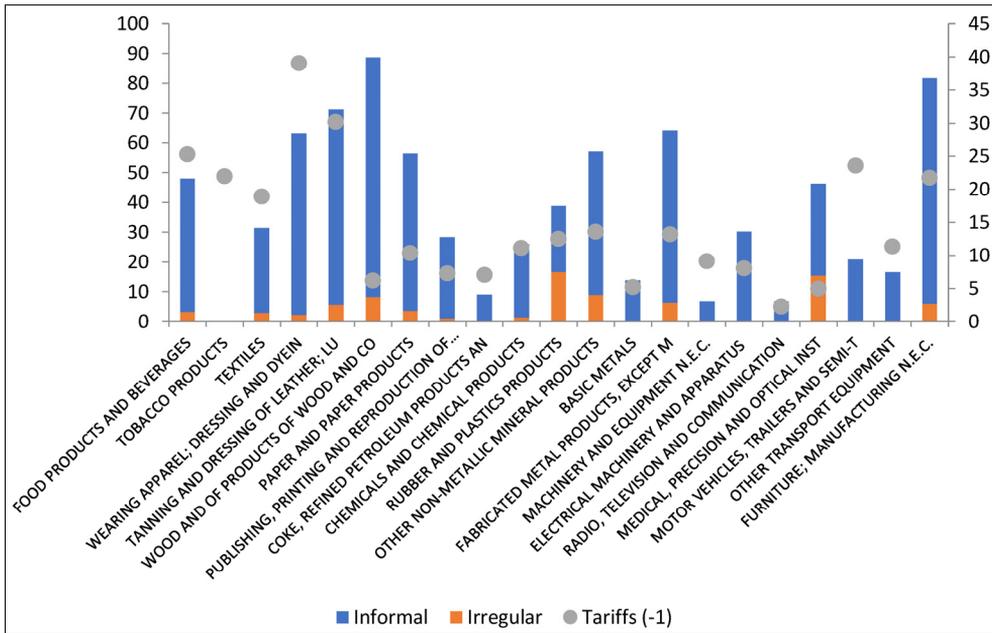
Figure A4a. Shares of informal and irregular employment and industry tariffs in 1998



(Note) Tariff(-1) means tariffs in the previous year.

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

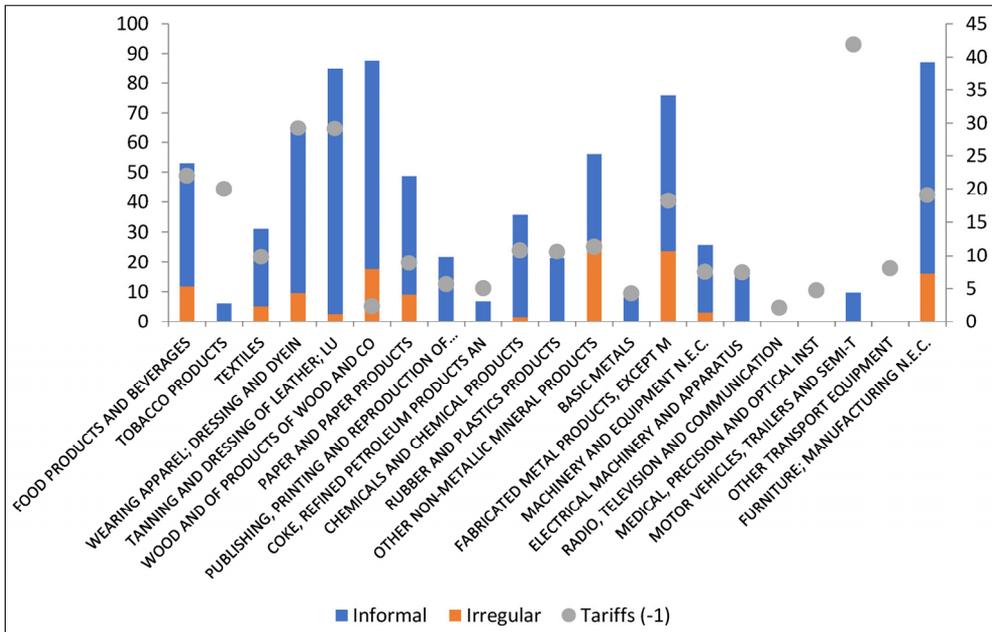
Figure A4b. Shares of informal and irregular employment and industry tariffs in 2006



(Note) Tariff(-1) means tariffs in the previous year.

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

Figure A4c. Shares of informal and irregular employment and industry tariffs in 2012



(Note) Tariff(-1) means tariffs in the previous year.

(Source) Constructed by the authors using the ELMPS (1998, 2006, and 2012).

Table A5. Results for informality - First step

	All workers manufacturing sector			Wageworkers manufacturing sector		
	1998	2006	2012	1998	2006	2012
	Probability to be informal			Probability to be informal		
Female	0.347** (0.153)	0.176 (0.198)	0.146 (0.133)	0.0962 (0.262)	-0.126 (0.230)	-0.135 (0.146)
Non-married	0.343* (0.199)	0.133 (0.142)	0.304** (0.131)	0.269 (0.285)	0.0624 (0.137)	0.428** (0.187)
Age	-0.101** (0.0485)	-0.000216 (0.0472)	-0.0620** (0.0253)	-0.140*** (0.0409)	-0.00597 (0.0420)	-0.0767*** (0.0277)
age squared	0.000819 (0.000588)	-0.000468 (0.000556)	0.000462* (0.000260)	0.00121** (0.000522)	-0.000530 (0.000563)	0.000569* (0.000291)
Less than interm.	-0.257* (0.137)	-0.443*** (0.113)	-0.218** (0.111)	-0.279 (0.197)	-0.486*** (0.153)	-0.204 (0.135)
Intermediate	-0.735*** (0.189)	-0.856*** (0.116)	-0.675*** (0.116)	-0.802*** (0.236)	-1.050*** (0.124)	-0.741*** (0.131)
Above Intermediate	-0.775*** (0.224)	-0.988*** (0.151)	-0.982*** (0.130)	-0.804*** (0.240)	-1.210*** (0.229)	-1.053*** (0.134)
Alx.Sz C.	-0.377** (0.167)	-0.362** (0.145)	-0.255 (0.189)	-0.514*** (0.140)	-0.277 (0.181)	-0.250 (0.205)
UrbLwr	0.159 (0.214)	0.165 (0.166)	0.321** (0.160)	0.258 (0.306)	0.158 (0.169)	0.380** (0.183)
UrbUpp	0.401** (0.182)	0.267** (0.131)	0.305 (0.194)	0.279 (0.246)	0.285 (0.184)	0.285 (0.197)
RurLwr	0.673*** (0.167)	0.0988 (0.185)	0.198 (0.140)	0.633*** (0.206)	0.0784 (0.228)	0.170 (0.174)
RurUpp	0.649** (0.296)	0.534** (0.213)	0.603*** (0.152)	0.437 (0.333)	0.394 (0.303)	0.446** (0.196)
Non-Head	0.123 (0.172)	0.308 (0.205)	0.0323 (0.161)	-0.0771 (0.182)	0.252 (0.202)	-0.120 (0.215)
Household size	-0.00837 (0.0279)	-0.00958 (0.0279)	-0.00436 (0.0243)	0.00688 (0.0292)	0.0160 (0.0317)	0.0178 (0.0348)
Share 15-	-0.462 (0.441)	-0.138 (0.349)	0.116 (0.314)	-0.414 (0.531)	-0.342 (0.347)	0.0349 (0.301)
Share 15-64 old	-0.648 (0.434)	-0.672* (0.351)	-0.226 (0.244)	-0.0726 (0.503)	-0.698** (0.351)	-0.0375 (0.305)
Share 65+	-1.683*** (0.630)	-0.247 (0.789)	-0.422 (0.377)	-1.813* (1.048)	0.0801 (0.704)	-0.363 (0.458)
Constant	2.449** (0.992)	0.976 (0.975)	1.851*** (0.538)	3.140*** (0.809)	1.167 (0.849)	2.138*** (0.601)
Industry dummies	YES	YES	YES	YES	YES	YES
Observations	992	1,545	1,715	811	1,205	1,430

Robust standard errors in parentheses (clustered by economic activity, one-digit. ISIC4)

*** $p < 0.0$, ** $p < 0.05$, and * $p < 0.1$

Table A6. Results for irregularity - First step

	All workers manufacturing sector			Wageworkers manufacturing sector		
	1998	2006	2012	1998	2006	2012
	Probability to be irregular			Probability to be irregular		
Female	0.477 (0.308)	0.0414 (0.167)	0.322* (0.180)	0.358* (0.194)	-0.184 (0.178)	0.394 (0.250)
Non-married	0.249 (0.271)	-0.113 (0.235)	0.175 (0.159)	0.0740 (0.384)	-0.291 (0.252)	0.238** (0.105)
Age	0.0829** (0.0342)	-0.0107 (0.0548)	-0.0415* (0.0226)	0.0802** (0.0334)	-0.0474 (0.0601)	-0.0141 (0.0229)
age squared	-0.00144*** (0.000433)	0.000159 (0.000638)	0.000466* (0.000240)	-0.00146*** (0.000431)	0.000659 (0.000735)	0.000170 (0.000288)
Less than intermediate	-0.436*** (0.154)	-0.0573 (0.137)	0.0286 (0.133)	-0.327** (0.134)	-0.00943 (0.230)	0.0409 (0.142)
Intermediate	-0.286 (0.282)	-0.347 (0.215)	-0.149 (0.146)	-0.209 (0.288)	-0.315 (0.328)	-0.161 (0.140)
Above Intermediate	-0.898** (0.388)	-1.270** (0.563)	-0.857*** (0.268)	-0.769* (0.408)	-1.186* (0.668)	-1.064*** (0.297)
Alx.Sz C.	0.229 (0.341)	-0.149 (0.275)	-0.466 (0.296)	0.184 (0.331)	-0.149 (0.340)	-0.685** (0.270)
UrbLwr	0.246 (0.231)	0.235 (0.191)	0.254 (0.306)	0.108 (0.203)	0.410* (0.221)	0.224 (0.307)
UrbUpp	0.232 (0.285)	0.487* (0.263)	0.798*** (0.263)	0.245 (0.301)	0.799*** (0.245)	0.785*** (0.272)
RurLwr	0.269 (0.276)	0.125 (0.163)	0.00794 (0.203)	0.0619 (0.298)	0.136 (0.247)	-0.151 (0.220)
RurUpp	0.495 (0.340)	0.164 (0.210)	0.587** (0.270)	0.438 (0.371)	0.249 (0.256)	0.651** (0.271)
Non-Head	0.0269 (0.246)	0.344*** (0.0994)	0.211 (0.138)	-0.0248 (0.281)	0.436* (0.227)	0.301** (0.121)
Household size	-0.0171 (0.0370)	-0.0323 (0.0264)	-0.00345 (0.0393)	-0.00584 (0.0430)	-0.0345 (0.0314)	0.0146 (0.0472)
Share 15-	0.358 (0.294)	-0.122 (0.341)	0.512 (0.353)	0.228 (0.381)	-0.308 (0.595)	0.766*** (0.269)
Share 15-64 old	0.530 (0.529)	-0.482 (0.368)	0.120 (0.348)	0.523 (0.712)	-0.759 (0.544)	0.515 (0.462)
Share 65+	0.541 (0.512)	1.338*** (0.495)	0.0368 (0.501)	0.0330 (0.783)	1.246* (0.671)	0.0623 (0.697)
Constant	-2.709*** (0.911)	-1.163 (1.029)	-0.799 (0.609)	-2.385** (1.087)	-0.468 (1.103)	-1.612*** (0.531)
Industry dummies	YES	YES	YES	YES	YES	YES
Observations	775	1.363	1.433	593	1.028	1.151

Robust standard errors in parentheses (clustered by economic activity, one-digit).

*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.