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2016

working paper series

**INFORMAL COMPETITION, FIRMS' PRODUCTIVITY
AND POLICY REFORMS IN EGYPT**

Nesma Ali and Boris Najman

Working Paper No. 1025

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July 2016

This work was supported by CEPREMAP and UPEC. We would like to thank David Francis from the World Bank Enterprise Survey Unit for his active collaboration. We would also like to thank Amirah El-Haddad (Cairo University), Hadi Salehi Esfahani (Illinois-Urbana-Champaign), and Caroline Krafft (St. Catherine University) and the ERF training workshop's participants for providing us with useful comments and guidance. All errors remain ours.

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First published in 2016 by
The Economic Research Forum (ERF)
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Dokki, Giza
Egypt
www.erf.org.eg

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Abstract

This paper investigates the effect of the competition stemmed from informal firms on formal firms' productivity in Egypt. Using the World Bank's Enterprise Surveys, we update the two-step methodology of Guiso et al. (2004) to build a regional indicator of informal competition intensity. Our estimation reports a positive effect of this indicator on formal firms' productivity that remains valid to the instrumental variable approach and to multiple robustness check. This result is subject to factors accounting for the characteristics of the firm and is segmented by formal firms' size. We also identify informal firms' cost advantage as the main channel through which this effect occurs. Our results call on the importance of tax reforms and effective regulation to be implemented in Egypt.

JEL Classification: O17, D22, L25.

Keywords: Informal competition, productivity, firms, regulation, Egypt

ملخص

تبحث هذه الورقة تأثير المنافسة النابع من الشركات غير الرسمية على إنتاجية الشركات الرسمية في مصر. باستخدام مسوحات البنك الدولي عن المؤسسات، نقوم بتحديث منهجية جويسو وآخرون. (2004) لبناء مؤشر إقليمي لشدة المنافسة الرسمية. تقديرونا أن هناك تأثير إيجابي لهذا المؤشر على إنتاجية الشركات الرسمية التي لا تزال صالحة للنهج متغير أساسي ومثانة الاختيار المتعددة. هذه النتيجة تخضع لعوامل المحاسبة لخصائص الشركة ومجزأة حسب حجم الشركات الرسمية. نقوم أيضا بتحديد ميزة التكلفة للشركات غير رسمية كقناة رئيسية من خلالها يحدث هذا التأثير. تدعو نتائجنا إلى أهمية الإصلاحات الضريبية والتنظيم الفعال لتنفيذها في مصر.

1. Introduction

Since the beginning of the 21st century, the growth patterns in developing countries, compared to developed economies, are impressive despite all the economic and social issues embedded in these societies. The growth of the informal sector in Egypt represents an interesting example in this matter. Although most of studies showed theoretically and empirically the negative impacts of the informal sector on the overall economy (as in De Soto (1990, 2000), Gardes and Starzec (2009), Djankov *et al.* (2004), Galal (2004), El-Hamidi (2011), etc.), its size continues to grow very fast in Egypt. The share of informal activities to the total non-agriculture activities increased from 36.2% in 2003 to 51.2% of in 2009 (ILO, 2012b). However, this fact didn't prevent the Egyptian Economy to attain an average economic growth of 6.2% between 2005 and 2010 (Unit, 2013).

This ironic picture encouraged recent studies to integrate the informal sector in their studies on the determinant of GDP growth and economic development (La Porta and Shleifer, 2014). This paper try to do so by focusing on one of the main driver of economic growth; the competition process. In other words, this paper looks at the effect of competition between informal firms and formal private firms (hereafter informal competition) on productivity levels.

To the best of our knowledge, this type of competition had always been considered as harmful. That's why no study has so far tested the significance of this default assumption or the channel through which informal competition could impact the economy. Papers considering informal competition, as the papers of González and Lamanna (2007) and Friesen and Wacker (2013), have focused exclusively on detecting the main characteristics of formal firms that make them more or less vulnerable to the competition stemmed from informal firms. These papers have ignored the fact that the growing number of informal firms will create a very strong competitive pressure on the formal sector.

Our paper tries to fill this gap by showing empirically how informal competition, analysed on a local level, would affect the productivity of formal private firms. Then, it identifies the channel through which this effect would happen. Our analysis is at the local-level because the existing literature on informal competition showed the importance of analysing the effect of informal competition locally as its effect are felt more locally than they are nationally or internationally (see González and Lamanna, 2007). Especially in a country like Egypt where local business environment and ease of doing business are substantially heterogeneous across governorates.

Our empirical analysis contributes to the literature in different ways. We start by constructing a regional indicator of informal competition using the two-step methodology of Guiso *et al.* (2004). The intensity of informal competition is reflected in our data set only through a perception (or subjective) variable. Therefore, the constructed indicator prevents any bias linked to the direct inclusion of this variable and provides a measure for the intensity of informal competition in each governorate included in the sample.

Second, we test the effect of this indicator on the productivity of formal private firms using a simple ordinary least squares estimation with different measure of firms' productivity. In order to avoid potential endogeneity issues, we instrument our endogenous indicator of informal competition intensity by the voter turnout of the 2012 presidential elections in Egypt measured at the governorate level. We provide evidence that this instrument satisfies the exclusive restriction condition of the instrumental variable approach. We also include other controls and we present different robustness test to corroborate our results.

Third, based on a difference- in-difference model of the effect of the 2005 new tax law, we identify the differential in cost between formal and informal firms as the main channel through which regional informal competition would affect formal private firms' productivity in Egypt.

Our estimation is based on the Egyptian panel manufacturing World Bank Enterprise Survey (WBES). It is an unbalanced panel of 3129 manufacturing private formal firms interviewed in 2004, 2007 and 2008. And it covers 8 manufacturing industries over 23 governorates in Egypt. Our first results show a positive effect of the regional intensity of informal competition indicator on formal private firms' productivity. This positive effect remains valid when using different measures of productivity, and reports stronger effects when instrumenting our endogenous indicator by voter turnout. Second, the difference-in-difference model shows to what extent this positive effect could be explained by the informal firms' cost advantage which is identified as the main channel through which informal firms can exert a competitive pressure on formal firms. We, therefore, provide evidence on the importance of the reduction in tax rates and the alleviation of tax procedures.

This paper is laid out as follows. We discuss, first, the economic situation and informal sector in Egypt (section 2). In section 3 we present a short review of the literature. In section 4 we present the dataset. In the section 5, we describe our methodology and in section 6 we present our main econometric results and we finally conclude in section 6.

2. Snapshot on the Egyptian Economy and Informal Sector

The size of the informal sector in Egypt today mirrors the impacts of many reforms held since 1970s. More specifically, the 1974's open trade policy after decencies of state controls and the adoption of the economic reform and structural adjustment program in 1991. The majority of these reforms targeted the reduction of the pressure over the public sector by encouraging workers to join the private formal sector and by privatizing many state-owned companies. However, the formal private sector was unable to absorb the excess of labour force resulting in the creation of a very strong and persistent informal sector.

In the context of low labour participation (around 50%), underemployment and decreasing public jobs, the share of informal employment in total non-agriculture economy increased from 38.8 % in 1980 to 65.3 % in 1990. Its level dropped to 36.2% in 2006 as a result of the 2003 new labour law (no.12/2003) and the 2005 new tax law (no.91/2005). These new laws introduced more flexibility in the Egyptian labour market in terms of legal contracts in the private sector, reduced the tax rates and improved tax collection by protecting taxpayers' rights and alleviating tax administration procedures. However, in 2009 its rate increased again and reached 51.2% (Charmes, 2000, Assaad, 2009 and ILO, 2012b). In addition, barriers to formal jobs encouraged many Egyptians to start small activities. In 2010, MSEs and medium-sized enterprises accounted for 90% of active enterprises in Egypt and contributed with over 80% of the GDP and to 75% of total employment (OECD, 2010)

Many sectors contributing to GDP growth are also concerned by the development of the informal economy. El-Fatah (2012), showed that employers have a higher probability of remaining informal in the manufacturing sector. The 1998 ELMS (1998) and 2006 ELMPS surveys indicated that the informal manufacturing sector is characterized by a relatively higher share of female workers, of young and less educated workforce and small enterprises. Between 1998 and 2006, 18.8% of workers in this sector shifted from informal to formal jobs, while 24% of workers shifted from formal to informal sector activities. In addition, the share of informal activities in this sector increased from 44.24% to 54.86% in the same period. That's why the incidence of unfair competition is largely pronounced in the Egyptian manufacturing sector.

Egypt also faces large governance weakness. In the World Bank "2014 Doing Business Report" the country is ranked 105 over 128 in ease of Doing Business (World Bank, 2014). According to the World Bank MENA Enterprise survey (2007-2014), Egyptian formal private firms considered political instability, corruption and competitors' practices in the informal sector as the top 3 business environment obstacles as shown in figure 1. They also reported the access to

finance as one of their major constraint due to the lack of sufficient collaterals. Formal firms claimed the importance of alleviating burdensome laws, red tape and high costs of licensing and registration that push firms to operate informally. They also call for more transparency as more connected and well established firms gain unexplained privileges (Doing Business report-World Bank, 2014). The dataset used in this paper shows the same patterns (see appendix 2.3).

The size of the informal sector is equally important across rural and urban areas and across Egyptian governorates. However, the incidence of informal competition and the ease of doing business vary a lot across these areas. For example, Alexandria is ranked first in ease of starting a business but showed among the governorates with the highest intensity of informal competition in 2014. Also, the perception of formal firms toward informal competition obstacle was at its highest level in Damietta and Qalyubia governorates, comparing to Sharqia, Gharbiya and Upper Egypt governorates (Doing Business report-World Bank, 2014). The ease of starting and a registering a business is easier in Cairo and Giza comparing to Aswan, Port Said and Sohag.

Although Egypt was considered as a fast growing economy since 2000 (over 5% GDP growth between 2000 and 2011) and the largest economy within the MENA region, the post-revolution economic growth show a dramatic decrease (2% in 2013- Central bank of Egypt, 2013), unemployment rates increased (from 9% to 13% between 2010 and 2013- CAPMAS, 2014) and fiscal deficit reached a very high level (100% of GDP during mid-2013- Economic intelligence unit, 2013). The economic crisis contributed to the raise of social frustration. The informal sector became very persistent and people started to consider it as the norm.

3. Literature Review

3.1 Theoretical and empirical background

Historically, the relationship between formal and informal firms has been analysed from the perspectives of different schools of thought, which underlines the controversy raised by this sector (see Lewis, 1954; Harris and Todaro, 1970; Hart, 1973; Rauch, 1991; De Soto, 1990, 2000). Beginning from this historical background, the ideas laid out in our paper and in our main hypothesis are based on the results of two more recent papers. These papers are, to the best of our knowledge, the only ones to address the question of informal competition using the firm-level WBES.¹

The paper of González and Lamanna (2007) studies the characteristics of formal firms subject to the practices of competitors in the informal sector in 14 Latin American countries in 2006. Using a probit regression model, they proved that formal and informal firms compete with each other and are not in segmented or separated markets as suggested by the dual economic theory. Their main result was to show that formal firms most resembling informal ones are the ones most adversely affected by informal competition. These formal firms are usually small, credit constrained firms, operating in industries with low entry costs and serving the same kind of consumers as informal firms. They also concluded that informal competition is a threat, especially in countries with low government capacity and highly regulated.

The paper of Friesen and Wacker (2013) investigates the relationship between formal firms' access to finance and informal competition in 114 developing and transition countries over the period 2006 to 2011. They built their analysis upon the results of González and Lamanna (2007) by assuming that the existence of informal competition threatens the operations of formal firms. Using a nonlinear ordered response model, they showed that the more financially constrained formal firms are, the more they are subject to competition from the informal sector. They

¹ To the best of our knowledge, this is the only survey that provides information about the perception of formal firms towards informal firms' practices in many countries. These two papers do not include the Egyptian case in their analysis

concluded that the financial constraint is the first determinant of informal competition's severity. This last result is also affected by other variables, such as corruption, labour regulation and firm size.

As already mentioned, the increasing informality trend of in Egypt goes hand by hand with the different adjustment program adopted and reforms period. The 1970's reform to downsize the public sector and to privatize public enterprises has resulted in a large informal sector as the private formal sector was unable to absorb the excess of labour force (El-Mahdi, 2000; El-Fatah, 2012). Between 1973 and 1988, several shocks helped in nourishing the development of this sector: the increase in oil prices followed by the Arab-Israel war in 1973, the "Dutch disease" associated with foreign aid inflows and real exchange rates' appreciation and the collapse of the Egyptian economy due to budget and current account deficit.

All these shocks and policy mismanagements pushed the government to adopt the 1991 economic reform and structural adjustment program in order to stabilize the economy at the cost of much lower growth (Assaad, 2002). Moreover, other factors played an important role in expanding the size of the informal sector. The rigidity of the 1981 labour law adopted till 2003, pushed many private employers to favour informal employment. Trade reforms in 1991 and 2004 that pushed employers to favour part-time employment and informal employment to reduce costs in response to the severe foreign competition (Selwaness and Zaki, 2013). Also, the complexity of registration, licensing and tax administrative procedures and the cost related to it.

By consequences, the large expansion of the informal sector led to the distortion of regulation and decent work concept, as well as the underestimation of GDP and the loss of confidence towards institutions. That is why the informal sector became a permanent state of employment - or a dead end as described by Wahba (2009) - instead of a temporary shelter for poor (or a stepping stone), especially for uneducated and for female workers. The informal sector has also highlighted the importance of the gender gap in the Egyptian labour market. Comparing to men, female workers are more concentrated into the informal sector especially in rural areas and in manufacturing (ILO, 2012b). Furthermore, Assaad (2009) highlighted the fact that barriers to female work imposed by the society and the tradition, led educated women to drop out of the labour force.

Assuming that informality is the main driver of productivity gap between developed and developing countries, Hendy and Zaki (2012) have showed that the probability of belonging to the informal sector is a function of firm age, entrepreneur gender, age and education. Using dataset on micro and small enterprise in Egypt and Turkey, they have concluded that the productivity differential between formal and informal firms in Egypt is not significant comparing to the Turkish case.

We share with Charmes (2000) the inexistence of a perfect dichotomy between the formal and informal participants, as most of formal workers tend to supplement formal earnings with additional informal jobs to compensate decreasing purchasing power. In fact, micro and small enterprises (MSEs) are one of the main features of the Egyptian markets. They are considered as the core of the economic system that fosters growth and employment (Ayyagari *et al*, 2007). Yet, the majority of these firms are informal. As reported by El-Mahdi (2006), MSEs represent more than 90% of the total number of enterprises, but around 80% are informal units.

Ali (2014) emphasized the multiplier effect associated with informality: once a firm or a person joins the informal sector, the social stigma associated to operate informally and to violate rules decreases. Then, more firms and persons are encouraged to join this sector. The realisation of this vicious cycle is subject to the quality of the regulatory environment and institution. The complexity in establishing a new firm in terms of tax rates, regulatory burdens and access to

finance encourages firms to join the informal sector. As highlighted by De Soto (1990), informal enterprises are a consequence of government bureaucracy. As a consequence, participants in the informal sector in Egypt might choose to remain informal not only to evade taxes and regulation but also due to the inability of the government to enforce law and regulation (Charmes, 2000).

The transition between the formal and the informal sector is hard. Tansel and Ozdemia (2014) showed that the probability of transition from formal to informal sector and vice versa is the same using the Egyptian Labour Market Panel Survey (ELMPS 2006-2012). Yet, the probability of transition from unemployment to informal employment is higher than from unemployment to formal employment. According to Gatti et al. (2011), between 2008 and 2009, an informal worker had only 4% chance to move to a private formal job and 5% chance to move to a public sector job in Egypt.

As highlighted by Galal (2004), the formalization process will be socially accepted in Egypt if it is associated with substantial reforms. Government should find policies that outweigh the costs of operating informally and highlights the benefits of formalization. A good business environment is one that ensures effective regulation and business law, the fluidity of the financial system and the availability of sound infrastructure. Such an enabling environment helps the competition process to generate positive effects.

3.2 Main mechanisms

Most of the literature highlights the inefficiency of informal firms and the threats from informal competition. So, how does the intensity of the informal competition affect the productivity of formal firms? In fact, several channels might explain the relationship between these two aspects.

The first channel is related to the main causes of informality (Schneider et al., 2010), whereby the growth of the informal sector results from the burden imposed by the tax system, social security schemes and severity of labour regulation. This burden can induce formal firms to participate in the informal sector by under-reporting revenues, labour and/or outputs. It can also encourage new entrepreneurs to start their businesses informally. The larger the size of the informal sector, the lower is the national tax revenues. This, in turn, causes a reduction in public service provision and/or an increase in tax rates. Therefore, the incentive to join the informal sector becomes stronger. This vicious cycle creates a reallocation of labour resources in the direction of the informal sector, which then allows informal enterprises to exert a competitive pressure on formal firms located within the sector in which they operate.

The second channel is related to the characteristics of informal firms. Competition from informal firms is mainly based on creativity, since efficiency is very challenging for them due to economy of scale issues. In their case, creativity typically does not relate to the development of new technologies, but it is rather in terms of adopting new managerial practices. As informal firms are small and usually managed by a single person, they have more simple communication strategies and more flexible production processes. They are able to quickly move in to markets where there is a demand and to serve that market with new services. They are also able to adapt more easily their labour organisation and internal management to handle different market shocks (Saviotti and Pyka, 2008; Gülbiten and Taymaz, 2000; Duchêne and Rusin, 2002).

The third and last channel considers the advantage in cost that informal firms typically have over formal ones, since they are less regulated, less taxed and do not comply with competition law. This cost advantage is considered as a positive force, allowing informal firms to operate more efficiently (Schneider & Enste, 2000). Although informal firms are less productive than formal ones and even though they use inefficient production techniques, the higher the cost

differential between formal and informal firms, the greater the ability of informal firms to take market share from bigger, more productive firms (La Porta & Shleifer, 2008a).

In section 6.3 of this paper, we will focus on the effectiveness of the third channel. We identify this channel using a difference-in-difference model. In a country with constraining and burdensome regulation and laws like Egypt, this third channel creates the link with the first two channels. In such a country, the increase of the size of the informal sector reflects a higher cost differential between formal and informal firms allowing a strong informal competition. Competition pushes formal firms to change their internal organisation in order to respond to the pressure stemmed from informal firms able to adapt easily to market change. This logic underlines the main hypothesis on which our paper is based.

4. Dataset

We based our statistics work on the Egyptian panel manufacturing World Bank Enterprise Survey (WBES).² The surveys have been administrated to a representative sample of firms in the non-agricultural formal private economy including small (37%), medium (30%) and large-sized (33%) enterprises in the manufacturing sector. The sample design of the WBES is based on stratified random sampling. Three levels of stratifications are used: the sector of activity, size and location. Enterprises with less than five employees or the one fully government-owned were excluded from the survey. This sampling methodology generated an appropriate sample size to benchmark the business environment of each economy from the perspective of the firm, using face-to-face interviews with the owner or the manager of the firm.

Our pooled sample period covers the period 2004, 2007 and 2008. It includes 3129 manufacturing private formal firms, of which 735 firms were interviewed once, 366 firms were interviewed twice and 554 were interviewed 3 times. As the number of firms included in each panel is very limited, we use this dataset as a pooled sample of firms by controlling for the year in which each firm has been interviewed and for the number of times each firms has been interviewed. This dataset covers 8 manufacturing industries: agro industries, garments, textile, electronics, machinery and equipment, chemicals, metal and non-metal industries. It also covers 5 big regions: Alexandria, Delta region, Greater Cairo, Northern & southern Upper Egypt, and Suez Canal & Sinai. These regions cover 23 governorates: Cairo, Alexandria, Port-Said, Dakahliya, Sharkiya, Qalyubia, Gharbiya, Menoufiya, Beheira, Giza, Minya, Assuit, Damietta, kafr-El-Sheikh, Bani-Suef, Fayoum, South Upper Egypt (Souhag, Qena, Aswan and Luxor), Ismailia, Suez and South Sinai (see the map in appendix 1).

The underlying characteristics make the WBES ideal for the purpose of our study. First, this survey provides unique information about the degree of informal competition, comparable across all the governorates included in the sample. Therefore, it allows us to construct a regional indicator of informal competition intensity. Second, the standardised WBES covers not only large enterprises; it also covers small and medium enterprises, which is crucial for investigating the incidence of informal competition on the productivity of formal firms in Egypt.

5. Methodology

This section presents the econometric specification used to estimate the effect of regional informal competition on formal firms' productivity, our benchmark specification (equation 1). To do so, we first construct the regional indicator of the intensity of informal competition (hereafter IRIC) using the updated two-step method of Guiso *et al.* (2004). Then, we estimate our benchmark specification using a simple ordinary least squares estimation (OLS) and an instrumental variable approach (IV). We also use this benchmark specification to implement a

² The data are available and downloadable through the World Bank portal: <http://www.enterprisesurveys.org>

difference-in-difference model that estimates the effect of the 2005 new tax law (see section 6.3).

$$lProd_i = \beta_0 + \beta_1 IRIC_k + \beta_2 Z_i + \alpha_r + \alpha_g + \alpha_p + \alpha_t + \varepsilon_i \quad (1)$$

5.1 Indicator construction

Our baseline hypothesis assumes that competition stemming from informal firms has a local effect rather than a national effect, because informal firms are less susceptible to operate, compete and to supply the market nationally, and much less so internationally. As stated in the paragraph below, the intensity of informal competition is reported by the WBES only through a subjective variable that depends on the perception of formal firms' managers towards the degree of informal competition.³

Do you think that the practices of competitors in the informal sector are No Obstacle, a Minor Obstacle, a Moderate Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment?

Although perception variables could be very insightful, their direct inclusion in the model may bias the results because of over-reporting or under-reporting behaviours.⁴ That is why this perception variable was used to construct an indicator of informal competition intensity in each Governorate included in the sample that will avoid any bias linked to direct perception variables in our benchmark specification.

To do this, we updated the two-step method developed by Guiso *et al.*, 2004, who estimated a regional indicator of financial development in Italy.⁵ Based on their methodology, we created the IRIC. We did this using firm-level perception variables and a subjective assessment of the factors affecting the intensity of informal competition as perceived by formal firms in each of the 23 governorates included in the sample over the periods 2004, 2007 and 2008.⁶ As our dependent variable is binary we estimate the first-step equation of Guiso *et al.*, 2004's methodology using a probit regression as follow:

$$Perceive_i = \alpha_0 + \alpha_1 X_i + \delta governorates_k + D_p + D_y + \varepsilon_i \quad (2)$$

Perceive_i is our dependent subjective variable that reflects the intensity of informal competition. It is a dummy variable that takes the value of one if formal firms perceive the practices of their competitors in the informal sector as a moderate, major or very severe obstacle, and the value of zero if they perceive it as no obstacle or as a minor obstacle. *X_i* is the vector of firm-specific attributes that might explain firms' responses and includes variables measuring the size of the firm, its age, its capacity utilization, its ability to offer trainings to workers, the highest level of education of the top manager, the percentage of unionized workers and the different constraints faced by the firm in terms of tax rates, corruption and finding

³ WBES measures the competition from informal firms as the establishment's perception that it may be competing with firms that may be smuggling, not abiding by copyrights or other intellectual property restrictions, avoiding the payment of taxes or duty, producing and/or selling counterfeit items and/or skirting regulations or other measures prescribed by law.

⁴ Formal firms will be more motivated to over-report their answers in order to blame the poor business climate on the existence of informal firms.

⁵ Guiso *et al.* (2004)'s paper studied the effects of local financial development by estimating a regional effect on the probability that a household is excluded from the credit market. This methodology was also used in Bagayev and Najman (2014) and Villegas-Sanchez (2009).

⁶ For the purpose of the study some governorates have been grouped to increase the number of observation. Our analysis, thus, includes 16 grouped governorates instead of 23 (see appendix 1)

We are aware that a local indicator of informal competition will be more interesting if it differs not only by governorates but also by industries (6 industries). As our sample is divided among 8 industries and 23 governorates, this regional-sectoral informal competition indicator requires a representative sample of firms in each industry of each governorate (at least 20 firms by industry and governorate, otherwise those firms will be dropped from the analysis). Due to our small sample size, this regional-sectoral indicator cannot be correctly specified.

adequate skilled and educated workers. We also include fixed effects to control for the number of times the firm is interviewed (D_p), for the unobserved year-specific (D_g) factors that might affect our dependent variable and we introduce region-industry clusters in our regression.

Our variable of interest is $governorates_k$. It is a set of dummy variables for each of the 16 groups of governorates included in our regression. Our reference governorate is Port-Said, in which there is the smallest number of formal enterprises perceiving informal competition as a binding constraint. There is an average of 129 formal firms perceiving informal competition as a binding constraint in each governorate. According to our sample, the practices of competitors in the informal sector are considered as the third most important binding constraint faced by formal firms, behind macro-economic uncertainty and tax rates constraints. Our data show that 68% of formal firms perceive the practices of competitors in the informal sector as a binding constraint. The competing firms are ultimately small enterprises, located in governorates like Qalyubia, Cairo and Gharbiya. They also perceive that access to finance and electricity and the severity of corruption and taxes as major obstacles hindering them from operating in a good business environment.

The measure of IRIC is provided by the estimated coefficient δ_k associated with each governorate k . If informal competition does not matter in a given governorate, then, its coefficient will not be significant. All governorates dummies report positive and significant coefficients. Hence, compared to firms located in Port-Said, our reference governorate, formal firms located in all other governorates report a higher and significant probability of informal competition intensity being a binding constraint.

Table 1 shows the results of our first step probit estimation. The probability that formal firms perceive less severely the intensity of informal competition increases when their average capacity utilization and the percentage of unionized and educated workers increase, and when the constraints associated with tax rates and corruption practices are alleviated. This is far to be the case in Egypt as around 50% of formal firms included in our sample perceive corruption and tax rates as major and very severe constraints, 40% of them find it very hard to find an adequate educated workforce, and 76% of them have no unionized workforce. These first results confirm the findings of our benchmark papers and add to the wide literature covering the relationship between the business environment and informality.

The second step of Guiso et al, 2004's methodology consists in providing measures of informal competition intensity by ranking the coefficients δ_{ik} of the governorates dummies included in our probit estimation, as reported in column 1 of table 2. We then transform these measures to our indicator $IRIC$ by normalising these coefficients by the following equation:

$$IRIC_k = \frac{\delta_k}{\max(\delta_k)} \quad (3)$$

Where $IRIC_k$ stands for the regional indicator of informal competition of formal firms located in governorate k and δ_k is the coefficients associated to the governorate k . This normalised measure creates an indicator varying between zero and one: zero for firms located in governorates less affected by informal competition intensity (*i.e.* Port-Said, Menoufiya, Upper Egypt), and one for firms located in governorates most affected by informal competition intensity (*i.e.* Gharbiya, Qalyubia, Damietta and Kafr-El-Sheikh).

The reported intensity levels of IRIC across Egypt's governorates can be relied to their geographical location, their population density and to the predominant sector of activity. Informal firms are usually more concentrated in the capital city and in big cities surrounding the capital (Delta region) because they are more labor intensive and they operate where the demand is. They also find better shelter in cities with high population density. That's why high

levels of informal competition intensity are reported in Cairo, Giza and Gharbiya, Dakahliya, Alexandria and Kafr-El-Sheikh. Our dataset show, as well, that firms located in these governorates are mainly operating in manufacturing activities with low entry cost such as garments, textile and metal products. The reported classification of governorates by informal competition intensity is robust to the exclusion of some variables (firms' size and obstacle to tax rates) and to the exclusion of the regions-industry cluster and fixed effects.

5.2 Benchmark specification

As already mentioned, our benchmark specification estimates the effect of the constructed indicator of regional informal competition (IRIC) on the productivity of formal firms. There are many different measures of firms' productivity (OECD, 2001). The choice between them depends on the purpose of the productivity measurement, and in many cases, on the availability of data. Using firm's value added, we compute two different measures of productivity: labour productivity and machine productivity.

According to the equation (4, 5 and 6) below, the value added is measured by the difference between total sales revenues and intermediate goods (including costs of materials, energy & fuel, transports, water, telephone, communication and electricity and excluding taxes). All monetary values are in Egyptian pounds.

$$VA_i = \text{total sales revenues}_i - \text{intermediate goods}_i$$

In our benchmark specification, we use our first measure of formal firms' labor productivity. As shown by equation (4), for each firm i , the logarithm of productivity of formal firms is the ratio of the annual value added to the total number of full-time permanent workers.

$$\log(PROD_i) = \log \frac{VA_i}{\text{Total fulltime permanent workers}_i} \quad (4)$$

To validate our results and to control properly for the size effect, we present two other measures of firms' productivity (section 6.2). The value added to the total number of workers including full-time permanent workers sum with a weighted measure of part-time permanent workers and temporary workers (equation 5).⁷

$$\log(PROD_i) = \log \frac{VA_i}{\text{Total workers}_i} \quad (5)$$

Where, $\text{Total workers}_i = \text{total fulltime permanent worker}_i + \text{total parttime permanent workers}_i * 0.625 + \text{total temporary}_i$

And the value added to the total hours per week operated by the firm (equation 6).

$$\log(PROD_i) = \log \frac{VA_i}{\text{Total annual hours operated by the firm}_i} \quad (6)$$

We also exclude firms with very large sales (firms with labour productivity in Egyptian pounds three standard deviations away from the mean value) in order to ensure we keep the most credible data.⁸ The remaining data can be trusted, especially given that in the WBES, the enumerators are asked to confirm the accuracy of monetary information. Excluding extreme productivity values is not changing our results (see appendix 3)

As highlighted in appendix (2), formal firms' average annual value added to total number of workers is around 484000 EGP (62000\$) and the average annual value added to total hours per

⁷ The total number of part-time permanent workers is weighted by 0.625 according to a computation made by the authors using the ILO part-time convention of 1994 (no. 175) and the Egypt Labor Market Panel Survey 2012 dataset (Economic Research Forum). According to our computation using ELMPS, the average hours worked per day for a part-time worker in Egypt is 5 hours, comparing to 8 hours a days for a full-time worker.

⁸ In total, about 78 firms were identified as outliers.

week operated by the firm is around 17200 EGP (2200\$). These values correspond to an average annual total workforce of 502 (including full-time permanent workers and a weighted measure of part-time permanent workers and temporary worker) and an average of 62 hours per week operated by the establishments. The highest averages of annual value added to total workers are reported for firms located in South Upper Egypt, Giza and Dakahliya governorates and operating in metal and non-metal industries, electronics and chemical sectors. Productivity is also higher for medium-sized enterprises, operated by educated top managers (vocational education or higher) and that favour private ownership (domestic, Arab and foreign private ownerships), which reflect a more secure human and financial capital for the firm.

According to these measures of productivity, our benchmark equation will be estimated using an OLS regression as follows:

$$lProd_i = \beta_0 + \beta_1 IRIC_k + \beta_2 Z_i + \alpha_r + \alpha_g + \alpha_p + \alpha_t + \varepsilon_i \quad (1)$$

Where $lprod_i$ corresponds to the 3 measures of productivity explained above. $IRIC_k$ is the constructed regional indicator of informal competition varying across governorates k . Z_i is a vector of explanatory variables. We include the size of the firm, its age, its type of ownership, its level of human and financial capital and the percentage of exports. We include fixed effects to control for unobserved region-specific (α_r), industries-specific (α_g) panel-specific (α_p) and year-specific (α_t) factors that might affect our dependent variable. As $IRIC$ is constructed from a preliminary estimation, we implement a bootstrap resampling methodology to ensure the compliance of this variable with standard statistical properties.

5.3 Instrumental variable approach: 2012 presidential elections' voter turnout

Yet, our specification reveals two econometrics issues. First, our regional indicator of informal competition intensity may have a direct effect on the productivity of formal firms and vice versa (reverse causality). Second, an omitted variable bias can affect our specification since both variables can be driven by the propensity of informal firms to cut their prices due to gain a cost advantage. In order to control for this bias we, first, involve in our estimation, dummies for regions, for industries, for the number of times each firm is interviewed and for the interview year. These fixed effects reduce the number of variables on which we have to rely, as well as the range of possible alternative explanations. Second, to solve the endogeneity issue, we instrument our endogenous indicator of informal competition by voter turnout of the 2012 presidential elections measured at the governorate level (k), as follows

$$\widehat{IRIC}_k = \partial_0 + \partial_1 Voter\ Turnout_k + \partial_2 Z_i + \alpha_r + \alpha_g + \alpha_p + \alpha_t + v_i \quad (7)$$

Where, $Voter\ Turnout_k = \frac{actual\ voters_k}{registered\ voters_k}$

Then we introduce the predicted indicator of informal competition intensity in our benchmark specification as follows

$$lProd_i = \delta_0 + \delta_1 \widehat{IRIC}_k + \delta_2 Z_i + \alpha_r + \alpha_g + \alpha_p + \alpha_t + \varepsilon_i \quad (8)$$

The voter turnout of the 2012 presidential elections is extracted from the Egyptian High Elections Committee website.⁹ We choose to use the 2012 presidential elections as they are the most reliable, impartial and free elections Egypt has ever experienced. In addition the 2012 voter 'turnout data show large differences across the governorates included in our sample (from 28.7% to 60.1%). We expect that the relation between informal competition and vote 'turnout will be negative (equation 7). Citizens tend to less participate to election when the informal sector is very developed and when the legal system is corrupted.

⁹The data are available and downloadable through the Egyptian High Elections Committee portal: <http://pres2012.elections.eg/>

Considering the exclusion restriction condition of the IV approach, the 2012 presidential elections' voter turnout at the governorate level can be considered as a good instrument for the regional indicator of informal competition intensity. There are no reasons to think that the 2012 voter turnout can be correlated to labor productivity measured in 2004, 2007 or 2008 (Hibbs, 2005). According to the existing literature, Kerwin and Stephens (2011) found no evidence of relation between wages (proxy for labor productivity) and Presidential turnout in major elections. In addition, Blaydes (2006), showed that in Egypt the voter turnout is not related to the average income per capita in governorate. Therefore, we assume that voter turnout at the governorate level doesn't have direct effect on formal firms' productivity other than those driven by its effect on the regional intensity of informal competition. We use vote 'turnout external instrument at the governorate level and in 2012 to avoid risks of possible spurious correlation.

6. Results

We present and discuss our results in three stages (Tables 3-5). The first one is the presentation of our benchmark regression. We test regional informal competition impact on Egyptian formal firm productivity (6.1). In a second momentum, we check for the validity of our first results through different specifications (6.2). And finally we identify the channel through which informal competition affects formal firms' productivity by evaluating the 2005 new tax law (6.3).

6.1 Benchmark results: informal competition and labour productivity in Egypt

Our benchmark specification (table 3) shows that the higher the intensity of regional informal competition, the higher the productivity of formal firms measured as the annual value added to total full-time permanent workers. The IRIC coefficients remain stable, significant and positive in all specifications (table 3, columns 1-3).¹⁰ This suggests that formal firms seem to have higher productivity levels when they face a higher intensity of informal competition in their governorate. As stated in many study (Charmes, 2000, Assaad, 2009 and ILO, 2012b), the size of the informal sector in Egypt is huge, and thus, the intensity of informal competition is very high and persistent. We propose three explanations for this positive effect. These interpretations suggest a segmentation of the positive effect of informal competition by formal firms' size and call on the importance of scales economy.

A first, straightforward, interpretation of this seeming paradox is that formal firms subject to more intense competition from informal firms may need to boost their productivity in order to prevent informal firms from benefiting from their typical cost advantage. This is, especially, the case for small and medium-sized formal firms. This interpretation is partly in line with the hypothesis of González and Lamanna (2007), who assumed that formal firms more similar to informal firms are the most affected by informal competition. In contrast to their default hypothesis, we show that those firms are positively affected by informal competition. Hence, we can say that those firms fear something that might push them to do better.

Another possible interpretation is that formal firms do not distinguish between the sources of competition – whether it stems from informal firms or from other formal firms – because they are aware of the importance of the size of the informal sector in their region and sector. Therefore, the behaviour of formal firms towards informal competition is the same as their behaviour towards competition stemming from other formal firms. In both cases, firms try to be more efficient and productive in order to increase their own competitiveness and minimize costs. This interpretation is in line with the fact that the informal sector has become the norm

¹⁰ Column 4 shows that the effect of the regional direct average is in line with our hypothesis. However, the coefficient is slightly overestimated and do not consider endogeneity issues.

in many developing countries. Thus in this situation, the difference between informal competition and formal (normal) competition melts away.

A last possible interpretation is related to the fact that some formal firms face a very weak intensity of competition from the informal sector and hence do not need to boost their productivity to face it. They are essentially protected from informal competition. This is the case of formal large and very productive firms that already have economy of scales. It is also the case of firms protected by regulations (for instance labour regulations or state interventions), connected firms and firms operating in industries with very high cost of entry (as chemical or electronic industries comparing with textile industries).

These interpretations are in line with the effect reported by some important variables included in our regressions. Table 3 (columns 1-3) shows that formal firms' productivity increase when they are operated by better educated manager and more trained workers and when they are located in industrial zones. It also proves that the type of ownership has a significant effect of formal firms' productivity. Comparing with private domestic ownership shares, private Arab and foreign ownerships shares help more in improving the productivity of firms, while government ownership shares decrease the productivity of firms.

Furthermore, our results prove the segmentation of the positive effect of informal competition by formal firms' size. Our regression shows that small and medium-sized enterprises are better performing comparing to larger ones. It means that formal firms most affected by informal competition are those who gain the most in terms of productivity. It also proves the importance of economy of scales in improving productivity as firms' value added per worker increase when firms have more branches or factories, have property and casualty insurance on their assets and have their annual financial statement checked and certified.

While informal firms are able to exert a competitive pressure on formal firms via their ability to change their internal organisation and to cut-off the prices thanks to their advantage in cost; formal firms are able to improve their productivity levels via their ability to innovate and to create economy of scales through investment (Van Biesebroeck, 2005). We account for these factors by including some variables that reflects formal firms' technology levels and their ability to access different source of funding, helping them to invest more (table 3, columns 2 & 3). We also choose to include these variables, as the access to finance and to basic infrastructure was considered as a major obstacle to the daily operation of formal and especially for small firms in Egypt (Enders, 2007; World Bank, 2014)

The positive effect of the regional informal competition remains valid when controlling for these factors. In column 2 (table 3), we show that higher technology levels (reflected by acquiring a technology licensed from a foreign-owned company or/and a department specialized in research and development or/and an internationally recognized quality certification) increase significantly the annual total value added by worker (+ 28%).

In column 3 (Table 3), we prove to what extent firms' access to different sources of finance provided by banks is highly important. Comparing to firms financing their working capital based on internal earnings or family and friends, firms financing their working capital based on loans or overdrafts provided by banks report higher and more significant productivity levels (+24%). Also, this last increases significantly when firms have a saving account that, actually, helps them increase their ability to be provided by different source of finance from banks, and hence, increases their productivity (+16%). However, only 22% of formal firms included in our dataset have a saving account, only 15% have a loan from a financial institution and only 9% finance their working capital through banks (vs. 84% financing their working capital through internal earnings).

These first results indicate that the positive effect of regional informal competition on formal firms' productivity is subject to other important factors. These factors ensure the stability and the improvement of formal firms' productivity that make them more capable to face the increasing pressure of informal competitors. These factors account for the importance of the human and financial capital of the firm. We test for the validity of the positive effect of IRIC in the next section.

6.2 Robustness check: other productivity measures & Instrumental variable 2sls estimation:

In order to test the validity of our benchmark results, we first implement the OLS estimation using two different measures of formal firms' productivity as dependent variables (table 4, columns 5 & 8). Then we implement the Instrumental variable 2sls estimation using the 2012 presidential elections' voter turnout as instrument for the endogenous regional indicator of informal competition intensity (table 4, columns 6, 7, 9 & 10)

Comparing to our first productivity measure (column 1, Table 4) we can see that our variable of interest, IRIC, is still positive and highly significant at the 1% level when using the two other productivity measures: the logarithm of the annual value added divided by the total number of workers (full-time permanent workers, part-time permanent workers and temporary workers-column 5), and the logarithm of the annual value added to the total annual hours operated by the firm (machine productivity- column 8).

The effect of the other explanatory variables remain the same except for the variables; size of the firm, that changes of sign and significance when using the third measure of productivity (column 8, table 4). Using firm annual value added divided by the total annual hours operated by the enterprise allows us to control, in a more accurate way, for the size effects in our regression. Larger firms, compared to medium or small firms, are more productive because of economies of scale.

As explained in section 5.3, the use of an instrumental variable approach is necessary to solve for the endogeneity issue. We do so by instrumenting our endogenous regional indicator of informal competition intensity by the 2012 presidential elections' voter turnout computed at the governorate level. We start by implementing a Durbin–Wu–Hausman test of endogeneity that confirms the endogeneity of our indicator (IRIC). Then we report the first stage regression statistics that proves that our instrument is good.

As expected, our first stage results show a negative effect of voter turnout on the intensity of informal competition (columns 6 & 9). A higher intensity of informal competition reflects a stronger and larger informal sector that challenges institution legitimacy and undermines the rule of law and governance. In such corrupted environment, people are no longer motivated to participate into the political life. The reason is simple: why should we vote if the regulations are not respected? That's why the dominant behavior is the exit strategy. As highlighted by blaydes (2006, p.19): "*Voter abstention signals a protest of the political system and opposition newspapers use low turnout figures as evidence of lack of political trust in the regime.*"

Considering the second stage regression (columns 7 & 10), the predicted regional indicator of informal competition intensity shows a positive and highly significant effect on formal firms' productivity.¹¹ This last result proves that our benchmark results are still valid and consistent when solving for the endogeneity issue.¹²

¹¹ We can note that the effect is much stronger but it remains within the range of our dependent variable.

¹² The results are the same when using the benchmark productivity measure: Annual value added to total full-time workers (appendix 5)

6.3 Difference-in-difference: informal competition and the new tax law

The time coverage of our dataset (years 2004, 2007 and 2008) allows us to evaluate the effect of an interesting policy reform: the 2005 new tax law (no.91/2005). This period was subject to other reforms such as the reduction of tariff in 2004 that was approved as a part of the 2005 tax reform agenda, already considered in our analysis. To mention also the enactment of the 2005 protection of competition and prohibition of monopolistic practices introduced by the Egyptian Competition Authority. However, this law was mainly targeting formal firms competition behaviours among each other and informal firms was not subject to this law by any mean. In addition its effect remains considered very weak and could not alter our results.

After many years of high tax rates in Egypt, tax evasion became the norm with mutual distrust between tax payers and tax authorities. The main objective of this law was to increase tax revenues and competitiveness through extensive growth and to downsize the informal sector by reducing tax rates, improving tax collection, protecting tax payers' rights and creating more transparent and uncorrupted tax administration procedures. The main result of this law was the significant increase of the number of tax payers from 1.7 million in 2005 to over 2.5 million in 2006, adding 610k returns during the first year of the reform (Egypt Ministry of Finance, 2007 and Ramalho, 2007).¹³ Revenues from personal taxes in fiscal year 2005-2006 were up to LE1bn (\$176m) from LE400m (\$70.4m) in the previous year. Corporate tax also increased by some LE3bn (\$528m) which reflect the significant increase of taxable firms and people (African Development Bank, 2009).

As already mentioned, we assume that the differential in costs between formal and informal firms in Egypt is the main channel through which informal firms can exert a competitive pressure on formal ones. As the size of the informal sector and the cost differential was reduced due to the implementation of the 2005 tax law, the competitive pressure stemmed from the informal sector was therefore limited and the competition between both groups of firms became more equal. That's why we assume that formal firms located in areas with high level of informal competition intensity will be affected by the law differently than those located in areas with low level of informal competition intensity. Thus, we use a difference-in-difference estimation to answer the following question: *How did the 2005 tax law affect the productivity of formal firms located in areas with high informal competition intensity?*

First, we divide our firms into two groups. The pre-intervention group that includes formal firms interviewed before the implantation of the law (2004 sample= 977 firms, $t=0$) and the post intervention group that includes formal firms interviewed after the implantation of the law (2007 and 2008 samples= 2152 firms, $t=1$). Second, we divide the post intervention group into two sub groups to compare formal firms located in governorates with high informal competition intensity to those located in governorates with low informal competition intensity. Third, as we use a pooled sample of firms interviewed in 3 different years, we consider firms followed after the 2004 round as treated. Thus our treatment group accounts for formal firms interviewed after 2004 and located in governorates with high informal competition intensity ($T=1$).

In order to identify the sub groups of firms located in governorates with high or low informal competition intensity, we use as thresholds the first, second and third quartiles of the predicted indicator of region informal competition intensity.¹⁴ According to the 1st quartile cut-off, firms are considered located in governorates with high informal competition intensity if the predicted indicator of region informal competition intensity is higher or equal than 0.74, which corresponds to 72% of the sample being treated. With the 2nd and 3rd quartile these numbers are

¹³ See appendix 4 for more information about the 2005 tax law

¹⁴ the predicted indicator of region informal competition intensity is measured using equation (7)

respectively: 0.83 which corresponds to 51% of the sample being treated; and 0.88 which corresponds to 34% of the sample being treated.

We estimate the following model;

$$\log(Y_i) = \alpha + \beta T_{i1}t + \delta T_{i1} + \partial t + \phi X_i + \alpha_g + \alpha_r + \alpha_p + \varepsilon_i$$

Where, $\log(Y_i)$ is the logarithm of formal firms' annual value added to total workers (including full-time permanent workers, a weighted measure of total part-time permanent workers and total temporary workers). T_{i1} refers to the treatment group. We define the treatment group as formal firms located in areas with high informal competition intensity ($T=1$) whilst the comparison group are those located in areas with low informal competition intensity ($T=0$). t is a time dummy and refers to the post policy change period and gets the value of $t=1$ for 2007-2008 and $t=0$ for 2004. X_i is a vector of firm specific characteristics that accounts for the size of the firm, its age, its type of ownership, and its level of human and financial capital. We also include fixed effects to control for unobserved industries-specific (α_g), regions-specific (α_r) and panel-specific (α_p) factors that might affect our dependent variable. We also account for year and industry clusters.

The effect of the 2005 tax law on the productivity of firms located in areas with high informal competition intensity is reported by our coefficient of interest β . Table 5 shows a positive and highly significant effect of this coefficient. Thus, the productivity of formal firms located in governorates with high informal competition intensity significantly increased to up to 30% points thanks to the implementation of the 2005 tax law. This result remains valid when using different cut-offs of the predicted indicator of region informal competition intensity. It also shows that even very weak intensity of informal competition (3rd cut-off) could affect the effectiveness of the reform.

Hence, this result verifies our hypothesis assuming that informal firms' cost advantage is the main channel through which informal firms exert a competitive pressure on formal firms that would help them in boosting their productivity. In a context of high informal competition intensity, the reduction of tax rates and the alleviation of tax administration procedures allow formal firms to overcome this cost's advantage and to improve their performance. According to the three quartiles used in our analysis, the regional indicator of informal competition intensity was reduced after the implementation of the law and the productivity of formal firms was significantly enhanced (Appendix 2.7). This conclusion adds to the findings of Wahba and Assaad (2015) who showed that the 2003 new labor law that allowed more flexible labor market regulation, had a positive effect on the incidence of formal employment. It also highlight the importance of integrating the informal sector's effects in the Egyptian policies and reforms.

7. Conclusion

This paper investigates the effect of regional competition stemming from informal firms on the productivity of formal firms in the Egyptian manufacturing sector. We update the two-step methodology of Guiso et al. (2004) to construct a regional indicator of informal competition intensity using the Egyptian manufacturing World Bank Enterprise Survey over the period 2004, 2007 and 2008. We start our analysis by estimating the effect of the constructed indicator of regional informal competition on the productivity of formal firms using an OLS estimation. Then we verify our first results using an instrumental variable approach by instrumenting our indicator by the Egyptian 2012 presidential elections voter turnout measured at the governorate level. Finally, we identify the channel through which informal competition affects formal firms' productivity based on a difference-in-difference model that estimates the effect of the 2005 new tax law on the productivity of formal firms located in areas with high intensity of informal competition.

We provide evidences that informal competition can be a powerful incentive for formal enterprises. Our constructed indicator of informal competition constructed at the governorate level shows a stable and significant positive effect on formal firms' productivity. This effect remains stable when we use different measures of productivity and when we instrument the endogenous indicator by voter turnout. We control for several factors such as finance, technologies, percentage of exports, firms' size, type of ownership, manager education, worker' training and our result remains stable. Therefore, formal firms most affected by informal competition are those who gain the most in terms of productivity.

The second main contribution in this paper is that we identify informal firms' cost advantage as the main channel through which regional informal competition would affect formal firms' productivity. Our estimation shows that the reduction of tax rates and the alleviation of tax procedures implemented in the light of the 2005 new tax law increase significantly the productivity of formal firms located in governorates with high intensity of informal competition. When effective reforms and regulation take place in an environment characterized by a large informal sector, the cost differential between formal and informal firms is reduced. Hence, formal firms become stronger in terms of facing informal competition and improving their productivity.

Our results allow us to draw some interesting policy implications. The findings of this paper suggest that Egyptian government should recognise the importance of informal firms and integrate them into undertaken policies as an effective economic actor in order to improve the effectiveness of policy drawn. To do so, authorities must ensure the creation of a secure business environment and more flexible and effective regulation. There is still a long way to go for formalisation to take root. Especially that in Egypt, formalising the informal sector depends on the willingness of governments to implement good business environment and not just on the willingness of informal firms, who may prefer to remain informal.

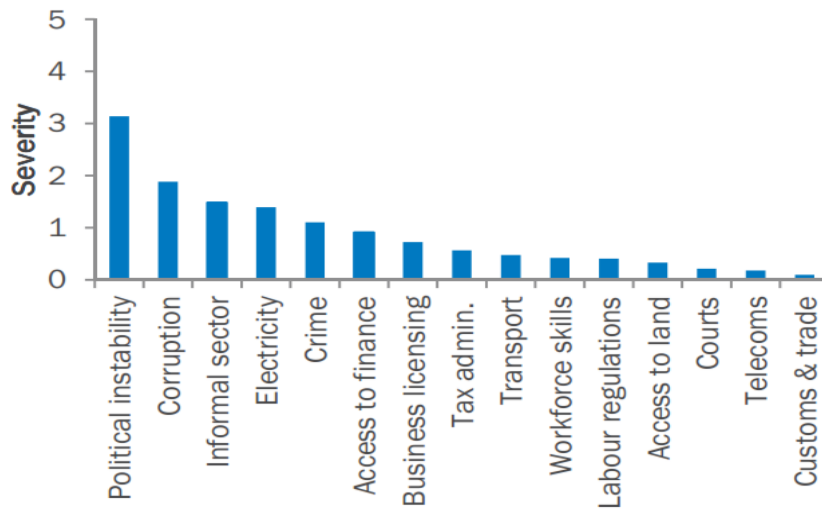
Reference

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Figure 1: Formal Firms' Most Important Obstacle in Egypt



Notes: Estimated for a hypothetical “average” firm. Higher values correspond to a weaker business environment.
Sources: Doing Business report-World Bank, 2014

Table 1: First Step Estimation - Probit Estimation: Regional Indicator Construction

| Variables | Dependent variable: formal firms' perception toward informal competition |
|---------------------------------------|--|
| Total annual workers | -0.000275 (3.21e-05) |
| Firm's age | 0.000848 (0.00173) |
| Skills and education constraint | 0.118** (0.0551) |
| Tax rates constraint | 0.227*** (0.0607) |
| Corruption constraint | 0.359*** (0.0665) |
| Capacity utilization | -0.00651*** (0.00173) |
| Top manager's education | 0.0211 (0.0252) |
| Workforce union | -0.00181** (0.000856) |
| Internal or external training offered | -0.0515 (0.0742) |
| Constant | -0.824*** (0.237) |
| Observations | 2,864 |
| pseudo R2 | 0.0656 |
| Governorates FE | YES |
| panel ID dummy | YES |
| year dummy | YES |
| level of se cluster | Region-industry |

Notes: the dependent variable is a dummy variable taking the value of one if formal firms perceive the practices of competitors in the informal sector as a binding constraint and zero otherwise. Total annual workers i.e. the annual total number of full-time permanent workers and reflects the size of the firms. Firm age is the difference between the date of the interview and the date the firm began operation (plus one). Tax rate, skills and education, corruption constraints are dummy variables taking the value of one if the firm perceives tax rates/finding adequate educated workforce/corruption practices as binding constraints and zero otherwise. Capacity utilization reflects the last year amount of output actually produced relative to the maximum amount that could be produced with existing machinery and equipment and regular shifts. Top manager level of education is a discrete ordinal variable with 7 states going from primary education to PhD degree. Workforce union is the percent of firms' workforce that is unionized (in Workers' General Union). Governorates FE are a set of dummies for each governorate included in the sample. The reference governorate is Port-Said. Fixed effects for interview year and panel ID (number of times the firm is interviewed) are included as well as region-industry clusters. Robust standard errors are reported in brackets. *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

Table 2: Regional Indicator of Informal Competition Intensity (IRIC)

| Governorate | Coefficient (1) | IRIC (2) |
|---|--------------------|-------------|
| Port Said | 0 | 0 |
| Menoufiya | 0.465** | 0.42 |
| South upper Egypt (Souhag, Qena, Aswan & Luxor) | 0.543** | 0.49 |
| Assuit | 0.606** | 0.54 |
| Ismailia, Suez & South Sinai | 0.636** | 0.57 |
| Minya | 0.681** | 0.61 |
| Beheira | 0.780*** | 0.70 |
| Sharkiya | 0.851*** | 0.76 |
| Giza | 0.861*** | 0.77 |
| Alexandria | 0.874*** | 0.78 |
| Dakahliya | 0.986*** | 0.88 |
| Cairo | 1.011*** | 0.91 |
| Bani-Suef & Fayoum | 1.013*** | 0.91 |
| Damietta& Kafr-El-Sheikh | 1.021*** | 0.92 |
| Qualyubia | 1.107*** | 0.99 |
| Gharbiya | 1.115*** | 1 |

Notes: The governorates' dummy coefficients are obtained from a probit estimation of the equation (2) using Egyptian manufacturing WBES in 2004, 2007 and 2008. The IRIC is the normalized measure of regional informal competition intensity computed as in equation (3). *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

Table 3: informal Competition and Formal Firms' Productivity: Annual Value Added to Total Permanent Full-Time Workers (OLS estimation)

| Variables | Dependent variable : log annual value added to total full-time workers | | | |
|-----------------------------------|--|--------------------------------|----------------------------------|------------------------|
| | Benchmark regression | With technology level variable | With access to finance variables | With direct average |
| | (1) | (2) | (3) | (4) |
| IRIC | 0.667*** (0.183) | 0.608*** (0.187) | 0.656*** (0.186) | |
| Direct average | | | | 1.355*** (0.425) |
| Small firms | 0.403*** (0.0828) | 0.487*** (0.0891) | 0.468*** (0.0798) | 0.395*** (0.0826) |
| Medium-sized firms | 0.323*** (0.0775) | 0.376*** (0.0808) | 0.365*** (0.0771) | 0.322*** (0.0797) |
| Firm age | -0.00259 (0.00160) | -0.00283* (0.00165) | -0.00276* (0.00165) | -0.00261* (0.00151) |
| Property & insurance | 0.272*** (0.0555) | 0.267*** (0.0553) | 0.249*** (0.0546) | 0.267*** (0.0520) |
| Top manager's education | 0.0525** (0.0221) | 0.0414* (0.0224) | 0.0527** (0.0221) | 0.0519** (0.0221) |
| Workers' training | 0.142* (0.0807) | 0.0863 (0.0865) | 0.100 (0.0856) | 0.141* (0.0809) |
| Financial statement checked | 0.123** (0.0579) | 0.119** (0.0595) | 0.124** (0.0608) | 0.130** (0.0605) |
| Factories & branches | 0.181** (0.0715) | 0.178** (0.0738) | 0.169** (0.0743) | 0.181** (0.0753) |
| Industrial zone | 0.364*** (0.0681) | 0.334*** (0.0706) | 0.350*** (0.0710) | 0.367*** (0.0676) |
| Ownership: private Arab | 0.523*** (0.155) | 0.541*** (0.166) | 0.510*** (0.155) | 0.520*** (0.157) |
| Ownership: private foreign | 0.553*** (0.178) | 0.558*** (0.188) | 0.502*** (0.183) | 0.547*** (0.173) |
| Ownership: government | -0.397 (0.245) | -0.473* (0.271) | -0.524* (0.275) | -0.399 (0.255) |
| Ownership: other | 0.281 (0.299) | 0.296 (0.300) | 0.258 (0.300) | 0.275 (0.302) |
| Exports | 0.00148 (0.00131) | 0.00116 (0.00154) | 0.00124 (0.00135) | 0.00150 (0.00134) |
| Technology level | | 0.281*** (0.0793) | | |
| Working capital: banks | | | 0.238** (0.105) | |
| Working capital: friends & family | | | 0.0494 (0.0935) | |
| Saving account | | | 0.160** (0.0804) | |
| Year dummy | Yes | Yes | Yes | Yes |
| Panel ID dummy | Yes | Yes | Yes | Yes |
| Industry dummy | Yes | Yes | Yes | Yes |
| Region dummy | Yes | Yes | Yes | Yes |
| Constant | 9.440*** (0.221) | 9.397*** (0.223) | 9.402*** (0.217) | 9.060*** (0.323) |
| Observations | 3,062 | 2,855 | 2,967 | 3,062 |
| R-squared | 0.097 | 0.102 | 0.100 | 0.097 |

Notes: The dependent variable is the log of the annual value added to total full-time permanent workers in Egyptian pounds. IRIC is the regional indicator for informal competition intensity, our explanatory variable of interest, showing the intensity of informal competition in each governorate included in the sample. Direct average is the average of formal firm perceiving informal competition as a binding constraint in each governorate. Dummies for firms' size are included taking large firms as reference. Firm age is the difference between the date of the interview and the date the firm began operation (plus one). Top manager level of education is a discrete ordinal variable with 7 states going from primary education to PhD degree. Workers' training is a dummy variable taking the value of one if the workers of the firms received internal or external trainings. Financial statement checked is a dummy variable taking the value of one if the annual financial statement of the firm is checked and certified. Factories & branches is a dummy variable taking the value of one if the firm has other factories or branches. Industrial zone is a dummy variable taking the value of one if the firm is located in an industrial zone. Ownership is a discrete variable for the share of each type of ownership in the firm. The reference type of ownership is private domestic. Exports is the percentage of direct and indirect exports in firms' total annual sales. Technology level is a dummy variable taking the value of one if the firm has a quality certification or/ & R&D department or/ & use technology licensed from a foreign-owned company. Working Capital is a discrete variable taking the value of zero if the firm has more than 20% of its working capital financed by internal earning (reference category), the value of one if the firm has more than 20% of its working capital financed by domestic or international commercial banks and the value of two if the firm has more than 20% of its working capital financed by friends and family. Saving account is a dummy variable taking the value of one if the firms has a saving account. We control for the interview year, firms' sector, location and the number of times it has been interviewed by introducing fixed effects for year, industries, region and panel ID. Non-parametric robust bootstrapped standard errors (1000 replications) are reported in brackets in all the columns. *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

Table 4: Robustness Check: OLS Estimation with Other Productivity Measures and The Instrumental Variable 2SLS Estimation

| Variables | Benchmark OLS estimation | OLS estimation | 2sls estimation | | OLS estimation | 2sls estimation | |
|-----------------------------|--|---|---------------------------------|---|---|---------------------------------|---|
| | Log annual value added to total full- time workers | Log annual value added to total workers | first stage: Dep. var.: IRIC | second stage: Dep. var.: log annual value added to total workers | Log annual value added to total working hours operated by firm | first stage: Dep. var.: IRIC | second stage: Dep. var.: log annual value added to total working hours operated by firm |
| | (1) | (5) | (6) | (7) | (8) | (9) | (10) |
| IRIC | 0.667*** (0.182) | 0.743*** (0.182) | | | 0.693*** (0.177) | | |
| Instrument: Voter turnout | | | -0.00587*** (0.000902) | | | -0.00620*** (0.000911) | |
| Predicted IRIC | | | | 5.618*** (1.759) | | | 5.888*** (1.705) |
| Small firms | 0.403*** (0.0852) | 0.275*** (0.0867) | -0.0106 (0.00838) | 0.342*** (0.0987) | -2.287*** (0.0840) | -0.0113 (0.00847) | -2.212*** (0.101) |
| Medium-sized firms | 0.323*** (0.0798) | 0.230*** (0.0809) | -0.00970 (0.00740) | 0.277*** (0.0864) | -1.458*** (0.0838) | -0.0109 (0.00750) | -1.402*** (0.0890) |
| Firm age | -0.00259* (0.00152) | -0.00241 (0.00166) | 0.000769*** (0.000168) | -0.00594*** (0.00231) | 0.00260 (0.00172) | 0.000791*** (0.000170) | -0.00127 (0.00234) |
| Property & insurance | 0.272*** (0.0568) | 0.299*** (0.0585) | -0.00797 (0.00597) | 0.339*** (0.0698) | 0.333*** (0.0566) | -0.00870 (0.00603) | 0.379*** (0.0715) |
| Top manager's education | 0.0525** (0.0230) | 0.0528** (0.0221) | 0.00226 (0.00231) | 0.0414 (0.0267) | 0.0725*** (0.0223) | 0.00244 (0.00233) | 0.0595** (0.0274) |
| Workers' training | 0.142* (0.0849) | 0.102 (0.0847) | -0.0301*** (0.00726) | 0.235** (0.0958) | 0.314*** (0.0883) | -0.0295*** (0.00733) | 0.452*** (0.0962) |
| Financial statement checked | 0.123** (0.0597) | 0.108* (0.0657) | 0.0306*** (0.00698) | -0.0447 (0.0970) | 0.0166 (0.0678) | 0.0309*** (0.00706) | -0.147 (0.0979) |
| Factories & branches | 0.181** (0.0741) | 0.138* (0.0796) | 0.0101 (0.00678) | 0.0965 (0.0790) | 0.311*** (0.0783) | 0.0118* (0.00687) | 0.260*** (0.0813) |
| Industrial zone | 0.364*** (0.0689) | 0.370*** (0.0704) | -0.0335*** (0.00671) | 0.530*** (0.0960) | 0.373*** (0.0703) | -0.0333*** (0.00680) | 0.541*** (0.0963) |
| Ownership: private Arab | 0.523*** (0.155) | 0.564*** (0.160) | 0.0291* (0.0167) | 0.434** (0.197) | 0.460*** (0.172) | 0.0295* (0.0167) | 0.321 (0.199) |
| Ownership: private foreign | 0.553*** (0.178) | 0.504*** (0.190) | -0.0146 (0.0161) | 0.583*** (0.186) | 0.759*** (0.183) | -0.0142 (0.0164) | 0.840*** (0.192) |
| Ownership: government | -0.397 (0.243) | -0.373 (0.250) | -0.0531*** (0.0150) | -0.128 (0.193) | 0.602** (0.270) | -0.0560*** (0.0151) | 0.876*** (0.197) |
| Ownership: other | 0.281 (0.300) | 0.285 (0.315) | 0.00900 (0.0302) | 0.245 (0.346) | 0.804** (0.340) | 0.00786 (0.0303) | 0.767** (0.352) |
| Exports | 0.00148 (0.00135) | 0.000821 (0.00142) | 0.000146 (0.000120) | 0.000411 (0.00138) | 0.00645*** (0.00140) | 0.000134 (0.000121) | 0.00609*** (0.00141) |
| Year dummy | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Panel ID dummy | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry dummy | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Region dummy | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 9.440*** | 9.302*** | 1.150*** | 5.214*** | 6.676*** | 1.168*** | 2.320 |

| | | | | | | | |
|--------------|---------|---------|----------|---------|---------|----------|---------|
| | (0.215) | (0.218) | (0.0506) | (1.487) | (0.223) | (0.0511) | (1.443) |
| Observations | 3,062 | 3,063 | 3,063 | 3,063 | 3,019 | 3,019 | 3,019 |
| R-squared | 0.097 | 0.090 | 0.279 | 0.08 | 0.497 | 0.277 | 0.370 |

Notes: see note table (3). Instrument: voter turnout is the percentage of actual voters to registered voters in the 2012 presidential elections in Egypt. Predicted IRIC is the predicted value of the regional indicator of informal competition intensity instrumented using voter turnout. Robust standard errors are reported in brackets in all columns (standard errors are bootstrapped using 1000 replications in all OLS estimation) *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

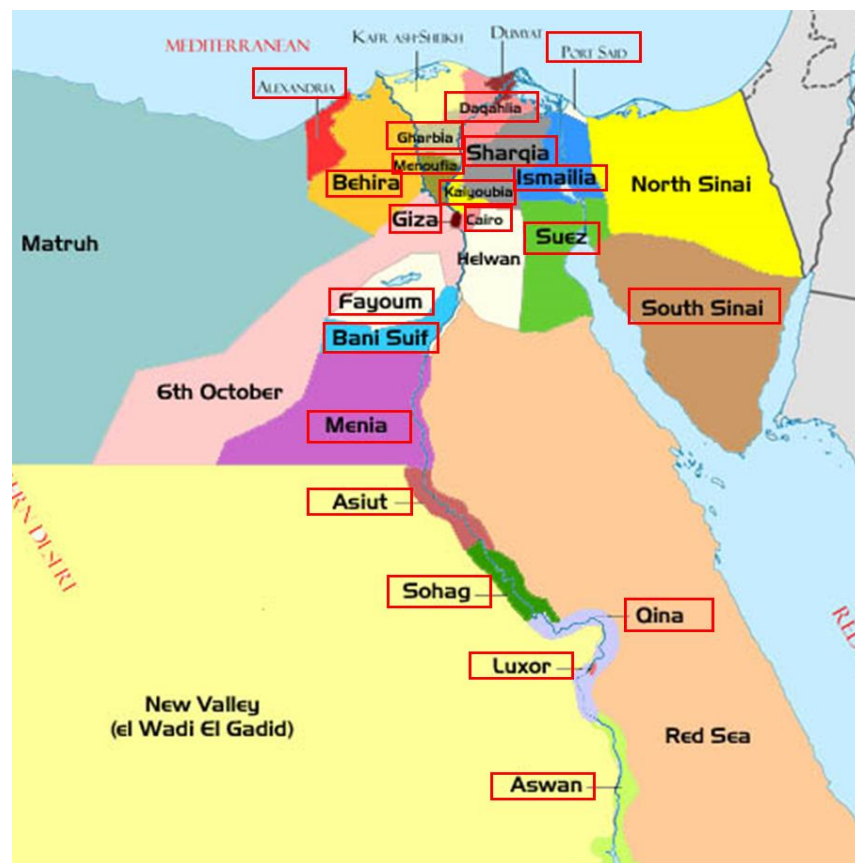
Table 5: Difference-in-Difference: The Effect of the 2005 New Tax Law on Formal Firms Located in Areas with High Informal Competition Intensity

| Variables | Dependent variable: log annual value added to total workers | | |
|------------------------------------|---|--------------------------|------------------------|
| | 1st quartile | 2 nd quartile | 3rd quartile |
| Treatment group | -0.140 (0.115) | -0.0749 (0.0793) | -0.239** (0.110) |
| Post intervention | -0.143 (0.102) | -0.0679 (0.0650) | -0.00638 (0.0706) |
| Treatment group* post intervention | 0.312** (0.134) | 0.281** (0.130) | 0.281*** (0.0892) |
| Small firms | 0.228** (0.107) | 0.228* (0.111) | 0.221* (0.109) |
| Medium-sized firms | 0.226** (0.0852) | 0.225** (0.0850) | 0.221** (0.0837) |
| Firm age | -0.00106 (0.00217) | -0.00132 (0.00210) | -0.000998 (0.00210) |
| Property & insurance | 0.307*** (0.0772) | 0.308*** (0.0761) | 0.303*** (0.0778) |
| Top manager's education | 0.0603* (0.0289) | 0.0602** (0.0280) | 0.0609** (0.0288) |
| Workers' training | 0.0880 (0.0901) | 0.0922 (0.0875) | 0.0874 (0.0920) |
| Financial statement checked | 0.0830 (0.0601) | 0.0791 (0.0632) | 0.0908 (0.0556) |
| Factories & branches | 0.0678 (0.0862) | 0.0717 (0.0870) | 0.0737 (0.0869) |
| Firm is located industrial zone | 0.432*** (0.0922) | 0.431*** (0.0975) | 0.423*** (0.0987) |
| Private Arab ownership | 0.563*** (0.171) | 0.564*** (0.162) | 0.569*** (0.172) |
| Private foreign ownership | 0.502** (0.214) | 0.503** (0.210) | 0.495** (0.216) |
| Governments ownership | -0.419 (0.308) | -0.417 (0.315) | -0.434 (0.299) |
| Other ownership | 0.313 (0.284) | 0.302 (0.279) | 0.313 (0.286) |
| Exports | 0.00108 (0.00159) | 0.00107 (0.00165) | 0.00110 (0.00158) |
| Year dummy | Yes | Yes | Yes |
| Panel ID dummy | Yes | Yes | Yes |
| Industry dummy | Yes | Yes | Yes |
| Region dummy | Yes | Yes | Yes |
| Constant | 9.990*** (0.200) | 9.937*** (0.212) | 9.993*** (0.209) |
| Observations | 3,067 | 3,067 | 3,067 |
| R-squared | 0.072 | 0.073 | 0.072 |
| cluster se level | Year-industry | Year-industry | Year-industry |

Notes: see note table (3). The dependent variable is the log of the annual value added to total workers in Egyptian pounds. Treatment group is a dummy variable taking the value of one for firms having a high level of informal competition intensity (predicted IRIC higher than its 1st quartile ≥ 0.74 , its 2nd quartile ≥ 0.83 and its 3rd quartile ≥ 0.88) and zero otherwise. Post intervention is a time dummy and refers to the post policy change period and gets the value of t=1 for 2007-2008 and t=0 for 2004. Robust standard errors are reported in brackets in all the columns. *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

Appendices

Appendix 1: List of Governorates

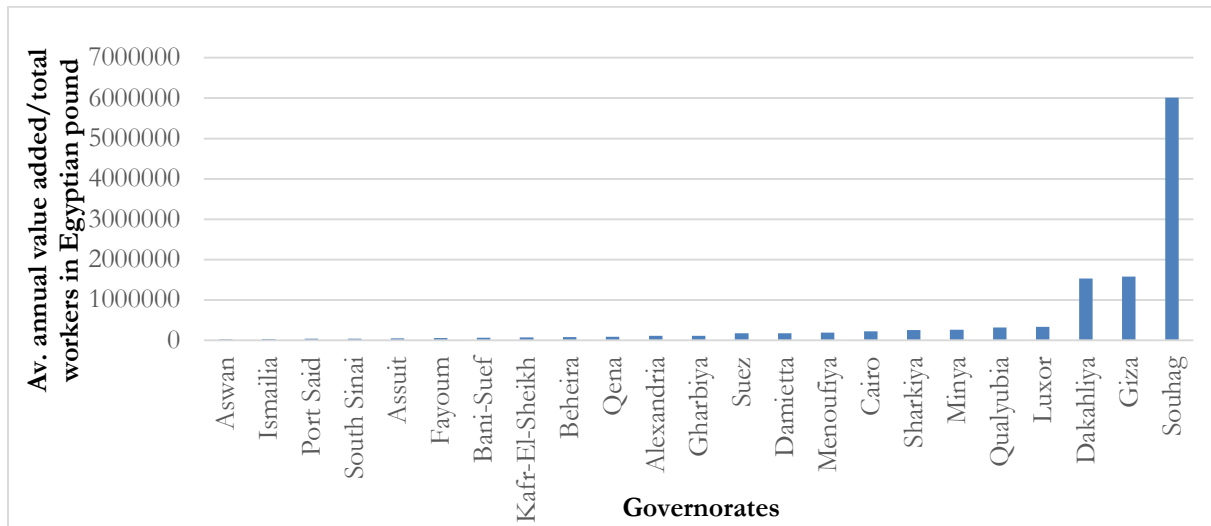


| | Governorates | Freq. | Percent | Cum. |
|----|---|-------|---------|--------|
| 1 | Cairo | 767 | 24.51 | 24.51 |
| 2 | Alexandria | 376 | 12.02 | 36.53 |
| 3 | Port Said | 33 | 1.05 | 37.58 |
| 4 | Dakahlia | 110 | 3.52 | 41.10 |
| 5 | Sharkiya | 446 | 14.25 | 55.35 |
| 6 | Qalyubia | 295 | 9.43 | 64.78 |
| 7 | Gharbiya | 242 | 7.73 | 72.52 |
| 8 | Menoufiya | 153 | 4.89 | 77.40 |
| 9 | Beheira | 54 | 1.73 | 79.13 |
| 10 | Giza | 335 | 10.71 | 89.84 |
| 11 | Minya | 60 | 1.92 | 91.75 |
| 12 | Assuit | 30 | 0.96 | 92.71 |
| 13 | Damietta & Kafr-El-Sheikh | 66 | 2.11 | 94.82 |
| 14 | Bani-Suef & Fayoum | 72 | 2.30 | 97.12 |
| 15 | South upper Egypt: Souhag, Qen, Aswan & Luxor | 55 | 1.76 | 98.88 |
| 16 | Ismailia, Suez & South Sinai | 35 | 1.12 | 100.00 |
| | Total | 3.129 | 100.00 | |

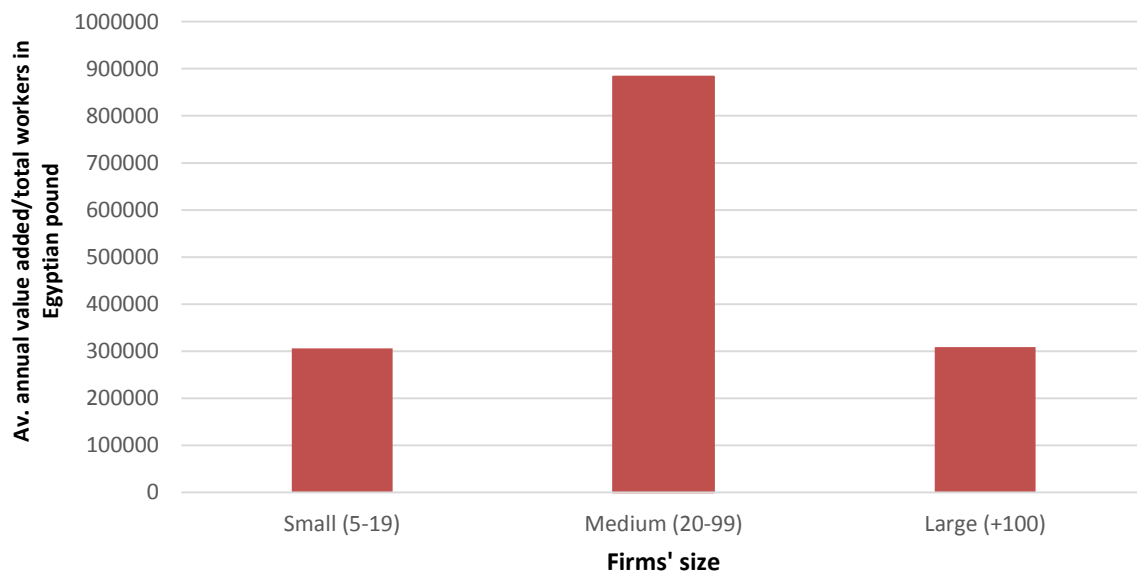
Sources: Enterprise Survey, author's computation based on the 2004, 2007 and 2008 Egyptian manufacturing World Bank enterprise survey

Appendix 2: Main Summary Statistics

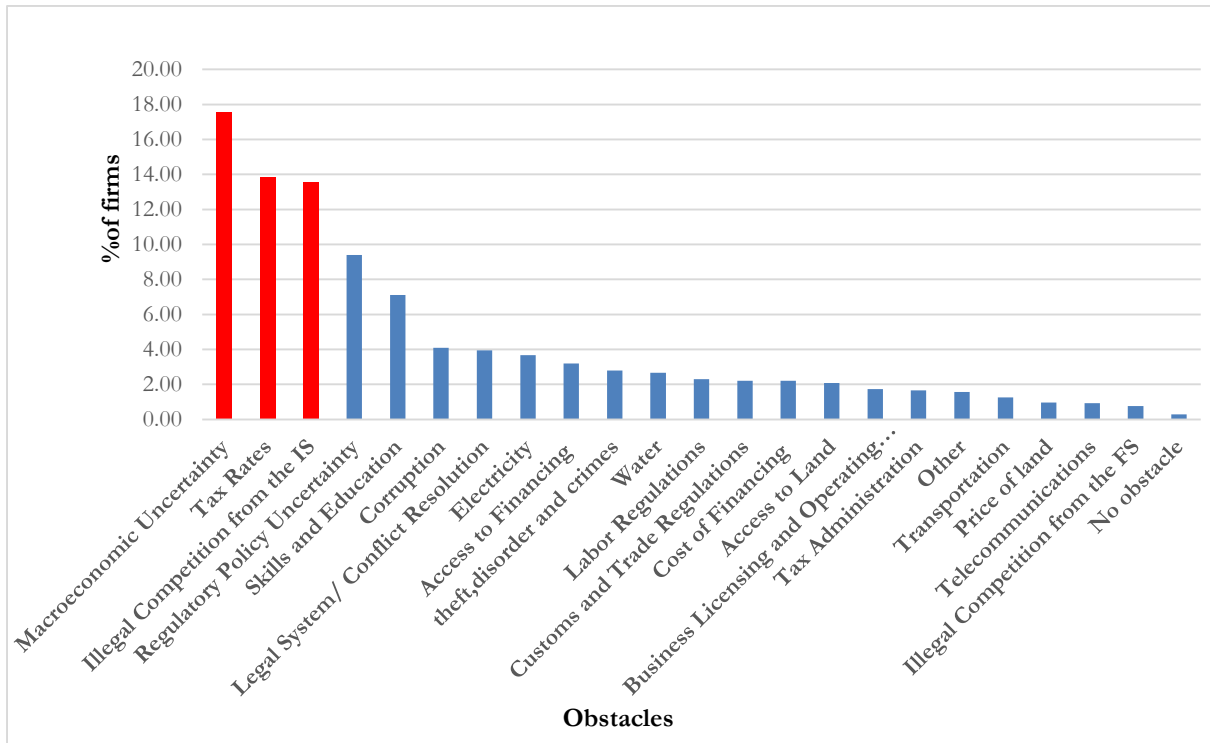
2.1 Governorates and formal firms' productivity



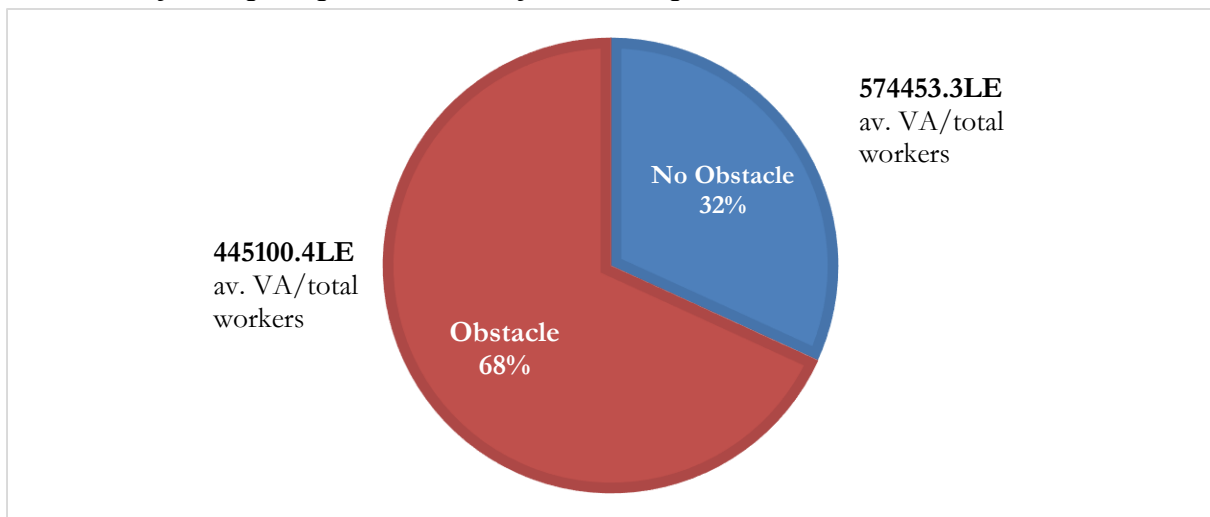
2.2 Formal firms' size and productivity



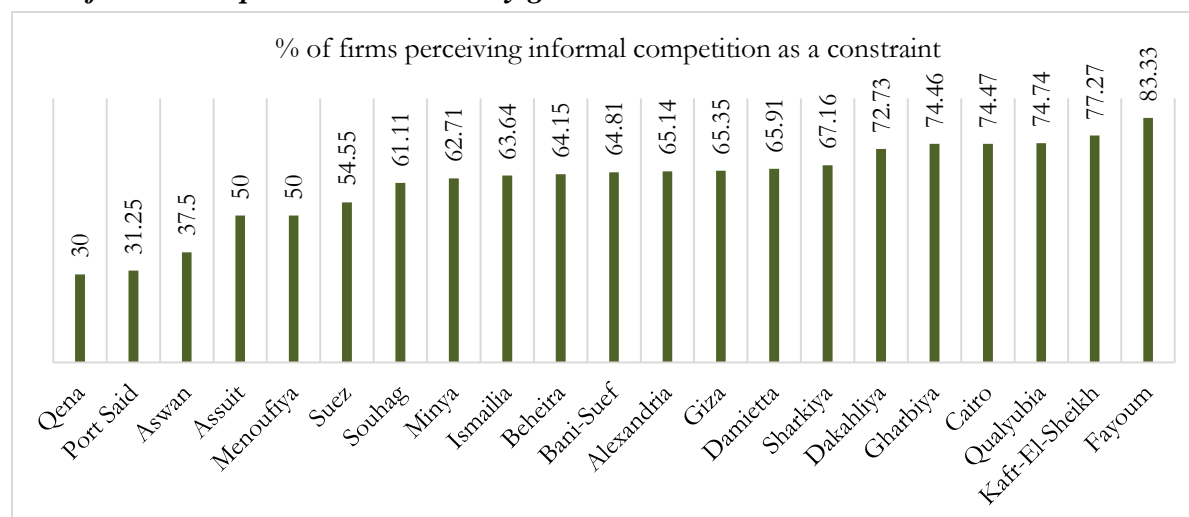
2.3 Formal firms' most important obstacle



2.4 Formal firms' perception toward informal competition



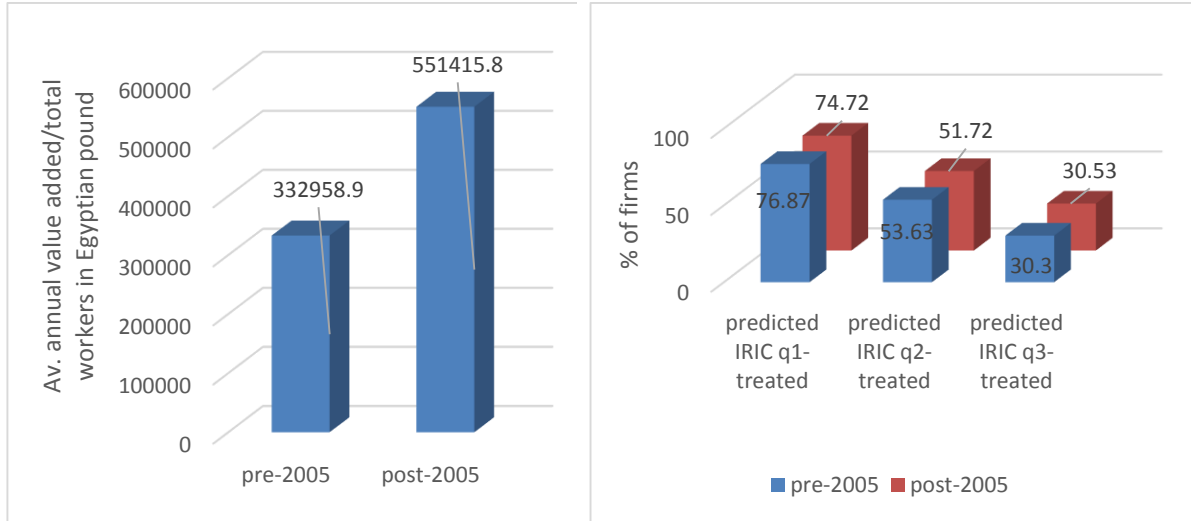
2.5 Informal competition constraint by governorate



2.6 Main variable included in the regressions

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|--|--------------|----------------|-----------|----------|----------|
| Value added to total full time permanent workers | 3096 | 565363.5 | 6779995 | 0.000308 | 2.00E+08 |
| Value added to total workers (fulltime permanent+ part-time permanent weighted+ temporary) | 3097 | 483840.2 | 6023660 | 0.00029 | 2.00E+08 |
| Value added to total hours operated by the firm | 3052 | 17235.13 | 202573.8 | 0.000114 | 9503114 |
| Total workers | 3128 | 501.7488 | 7405.567 | 0 | 375200 |
| Hours operated by the firm (week) | 3081 | 62.34372 | 33.1104 | 0 | 168 |
| Voter Turnout | 3129 | 51.20891 | 5.269647 | 28.65 | 60.1 |
| Firms' age | 3126 | 23.58381 | 17.21262 | 1 | 149 |
| Property and Insurance | 3116 | 0.583119 | 0.493122 | 0 | 1 |
| Capacity utilization | 3118 | 66.72415 | 22.72258 | 0 | 100 |
| Workers' training | 3121 | 0.186479 | 0.389555 | 0 | 1 |
| Financial statement checked | 3119 | 0.806669 | 0.394974 | 0 | 1 |
| Factories & branches | 3129 | 0.222435 | 0.415949 | 0 | 1 |
| Industrial Zone | 3125 | 0.34528 | 0.475536 | 0 | 1 |
| Technology | 2916 | 0.298011 | 0.457463 | 0 | 1 |
| Saving account | 3115 | 0.223114 | 0.416401 | 0 | 1 |
| Tax rates constraint | 3055 | 0.688052 | 0.463364 | 0 | 1 |
| Corruption constraint | 3085 | 0.686224 | 0.464102 | 0 | 1 |
| Skills and education constraint | 3116 | 0.520539 | 0.499658 | 0 | 1 |
| Workforce union | 3069 | 9.839296 | 26.02401 | 0 | 100 |
| Top manager education | Freq. | Percent | | | |
| Primary education | 179 | 5.73 | | | |
| did not complete secondary school | 119 | 3.81 | | | |
| Secondary School | 233 | 7.46 | | | |
| Vocational Training | 169 | 5.41 | | | |
| Some university degree | 2,089 | 66.87 | | | |
| Post graduate degree | 233 | 7.46 | | | |
| PhD degree | 102 | 3.27 | | | |
| Working capital source of finance | | | | | |
| More than 20% is financed by internal earnings | 2,551 | 84.03 | | | |
| More than 20% is financed by banks | 279 | 9.19 | | | |
| More than 20% is financed by family & friends | 206 | 6.79 | | | |

2.7 Informal competition intensity, firms' productivity and the 2005 tax law



Appendix 3: informal Competition and Formal Firms' Productivity Without Extreme Values

| Variables | Log annual value added to total full-time workers | Log annual value added to total workers | Log annual value added to total working hours operated by firm |
|---------------------------------|---|---|--|
| Small firms | 0.293*** (0.0982) | 0.182* (0.103) | -2.345*** (0.0941) |
| Medium-sized firms | 0.202*** (0.0718) | 0.109 (0.0677) | -1.491*** (0.0783) |
| IRIC | 0.747*** (0.210) | 0.828*** (0.202) | 0.735*** (0.209) |
| Firm age | -0.00326** (0.00155) | -0.00295* (0.00164) | 0.00134 (0.00144) |
| Property & insurance | 0.194*** (0.0522) | 0.225*** (0.0609) | 0.312*** (0.0579) |
| Top manager's education | 0.0539** (0.0217) | 0.0556** (0.0239) | 0.0762*** (0.0252) |
| Workers' training | 0.146* (0.0817) | 0.0888 (0.0861) | 0.324*** (0.0894) |
| Financial statement checked | 0.0611 (0.0436) | 0.0532 (0.0333) | 0.0128 (0.0611) |
| Factories & branches | 0.155** (0.0727) | 0.101* (0.0612) | 0.204*** (0.0682) |
| Firm is located industrial zone | 0.393*** (0.0492) | 0.401*** (0.0606) | 0.439*** (0.0679) |
| Ownership: private Arab | 0.417*** (0.159) | 0.493*** (0.174) | 0.445** (0.212) |
| Ownership: private foreign | 0.476*** (0.153) | 0.401** (0.181) | 0.808*** (0.156) |
| Ownership: government | -0.331 (0.281) | -0.320 (0.268) | 0.393 (0.348) |
| Ownership: other | 0.0726 (0.206) | 0.0652 (0.212) | 0.777*** (0.290) |
| Constant | 9.379*** (0.270) | 9.252*** (0.273) | 6.639*** (0.239) |
| Observations | 2,992 | 2,991 | 2,947 |
| R-squared | 0.101 | 0.095 | 0.508 |
| panel ID FE | YES | YES | YES |
| Industries FE | YES | YES | YES |
| year FE | YES | YES | YES |
| cluster se level | years-industry | years-industry | years-industry |

Notes: see note table (3). Column (1): the dependent variable is the log of the annual value added to total full-time permanent workers in Egyptian pounds. Column (2): the dependent variable is the log of the annual value added to total workers in Egyptian pounds. Column (3): The dependent variables is the log of the annual value added to total hours operated by the firm in Egyptian pounds. Extreme monetary values are excluded. Non-parametric robust bootstrapped standard errors (1000 replications) are reported in brackets in all the columns. *** Significant at 1 %, ** Significant at 5%, * Significant at 10%.

Appendix 4: The 2005 New Tax Based on Egypt Ministry of Finance (2007) and Ramalho (2007)

According to this law:

- The tariff on basic and essential goods was reduced from 14.6% to 8.9%,
- All company became equal under the law by paying a 20% tax on profit (instead of 32% or 40% depending on the activity),
- Income tax became closer to international practices,
- Tax officer received trainings to improve the collection of tax,
- Withholding tax on interest and royalties was reduced from 32% to 20% flat rate,
- The highest personal tax rate was reduced from 32% to 20%
- All individual tax payers got an annual tax exemption of 4000LE (500\$)
- Tax administration procedures was improved by replacing administrative assessment by self-assessment technics,
- A grace period exempted non-registered tax payers from old taxes due if they registered and pay tax under the new law
- Companies became able to submit computerized records.

Appendix 5: OLS Estimation vs. 2sls Estimation with Benchmark Regression:

| Variables | OLS estimation | | 2sls estimation |
|-----------------------------|---|----------------------------------|---|
| | Log annual value added to total full-time workers | First stage : Dep. var.: IRIC | Second stage: Dep. var.: log annual value added to total full-time workers |
| IRIC | 0.667*** (0.186) | | |
| Instrument: Voter turnout | | -0.00587*** (0.000902) | |
| Predicted IRIC | | | 5.639*** (1.704) |
| Small firms | 0.403*** (0.0805) | -0.0106 (0.00838) | 0.470*** (0.0957) |
| Medium-sized firms | 0.323*** (0.0768) | -0.00963 (0.00740) | 0.371*** (0.0838) |
| Firm age | -0.00259* (0.00156) | 0.000770*** (0.000168) | -0.00620*** (0.00224) |
| Property & insurance | 0.272*** (0.0551) | -0.00792 (0.00597) | 0.312*** (0.0676) |
| Top manager's education | 0.0525** (0.0220) | 0.00226 (0.00231) | 0.0409 (0.0259) |
| Workers' training | 0.142* (0.0824) | -0.0301*** (0.00726) | 0.277*** (0.0928) |
| Financial statement checked | 0.123** (0.0599) | 0.0306*** (0.00698) | -0.0327 (0.0940) |
| Factories & branches | 0.181** (0.0718) | 0.0101 (0.00679) | 0.139* (0.0766) |
| Industrial zone | 0.364*** (0.0675) | -0.0335*** (0.00672) | 0.527*** (0.0931) |
| Ownership: private Arab | 0.523*** (0.156) | 0.0291* (0.0167) | 0.391** (0.190) |
| Ownership: private foreign | 0.553*** (0.183) | -0.0146 (0.0161) | 0.633*** (0.181) |
| Ownership: government | -0.397 (0.244) | -0.0531*** (0.0150) | -0.147 (0.187) |
| Ownership: other | 0.281 (0.298) | 0.00900 (0.0302) | 0.241 (0.336) |
| Exports | 0.00148 (0.00135) | 0.000146 (0.000120) | 0.00107 (0.00133) |
| Year dummy | Yes | Yes | Yes |
| Panel ID dummy | Yes | Yes | Yes |
| Industry dummy | Yes | Yes | Yes |
| Region dummy | Yes | Yes | Yes |
| Constant | 9.440*** (0.213) | 1.150*** (0.0506) | 5.271*** (1.440) |
| Observations | 3,062 | 3,062 | 3,062 |
| R-squared | 0.097 | 0.279 | 0.0974 |

Notes: see note table (3). Instrument: voter turnout is the percentage of actual voters to registered voters in the 2012 presidential elections in Egypt. Predicted IRIC is the predicted value of the regional indicator of informal competition intensity instrumented using voter turnout. Non-parametric robust bootstrapped standard errors (1000 replications) are reported in brackets in all the columns. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.