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# Political Change and Informality: Evidence from the Arab Spring

**Ahmed Elsayed**
*IZA*

**Jackline Wahba**
*University of Southampton and IZA*

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**IZA – Institute of Labor Economics**

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

# ABSTRACT

## Political Change and Informality: Evidence from the Arab Spring[1]

This paper examines informality during the political and economic turmoil that accompanied the Arab Spring revolution in Egypt. The paper focuses on unprotected employment and the extent to which it changed by educational level right after the January Uprising of 2011. We find that over time and particularly after the revolution, informal employment has increased for both high- and low-educated workers however, through different paths: high educated were more likely to be stuck in informality, whilst low-educated formal workers were more likely to lose their contracts. The results suggest a high level of rigidity in the Egyptian labor market even in the wake of the Arab Spring.

**JEL Classification:** J21, J23, J24, J31, O17
**Keywords:** informal employment, job contracts, Arab Spring

**Corresponding author:**
Ahmed Elsayed
IZA
Schaumburg-Lippe-Strasse 5-9
53113 Bonn
Germany
E-mail: elsayed@iza.org

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## 1. Introduction

The Arab Spring in 2011 was perceived by many as an opportunity for change, a revolution against lack of good job opportunities, lack of economic and social justice and rising corruption. In particular, for many young people they felt excluded in accessing decent jobs and future higher living standards. Many workers have had to rely on low quality jobs in the informal sector to earn their living, with no job contracts and little stability and security. At the same time, without a job contract workers do not benefit from social security coverage as well as other rights and benefits such as paid holidays and health insurance and with little chance of moving to formal employment as those jobs have become scarcer.

We focus on the case of Egypt, where the aftermath of the 2011 Uprising is still ongoing. We aim to examine the effects of the Arab Spring on informality in the Egyptian labor market. We study the immediate/short-term impact in the wake of the Arab Spring, but also provide evidence on the development of informal employment over the previous two decades which has been on the rise absorbing substantial number of workers in the Egyptian labor market.

We ask to what extent informal employment cushioned workers during the political turmoil in Egypt. The previous literature shows that informality increases during economic slowdowns and business cycles (e.g., Elbahnasawy et al. 2016; Fiess et al. 2010), however, no much evidence exists on the responsiveness of labor informality to political turmoil. Political instability usually results in decline in physical and human capital investments, and therefore, leads to slowdown in economic growth, see for example, Aisen and Veiga 2013; Alesina and Perotti 1996. On one hand, informal employment could act as a buffer during downturns when people are laid off or looking for new jobs. However, given the rigidity of the Egyptian labor market, see Assaad (2014), whether informal employment absorb shed workers or shed workers itself is an empirical question. Thus, our paper is among the first that examine labor

market dynamics during political instability. We examine the impact of the recent political instability, experienced during the Arab Spring, on informality dynamics in Egypt.

The paper builds on a growing body of economic literature that studies informal employment in developing countries (e.g., Cunningham and Maloney 2001; Fields 1990; Gunther and Launov 2012; Magnac 1991; Maloney 1999; 2004; Patrap and Quintin 2006 among others). The literature adopts two opposing conceptual frameworks of how this type of employment and the labor market are intertwined (Lehmann 2015): (1) the labor market segmentation hypothesis adopts the dualistic view that sees informal segment as the inferior sector and as a strategy of last resort to escape involuntary unemployment (e.g., Fields 1975). Therefore, according to this hypothesis, informal segment is responsive to fluctuations of business cycle. (2) In contrast, the competitive labor market hypothesis sees informal employment as a voluntary choice based on income or utility maximization (Cunningham and Maloney 2001; Magnac 1991; Maloney 1999; 2004; Patrap and Quintin 2006) and therefore, contrary to the segmentation hypothesis, informal employment is not affected by business cycles. Other studies found that the two features could co-exist in in the same labor market, given the heterogeneity of the informal labor market in developing countries (Fields 1990; Gunther and Launov 2012).[2] Previous work on informal employment in Egypt has focused on transition but not on the Arab Spring impact, see e.g., Wahba 2009, Radchenko 2014, Tansel et al. 2015.

The paper looks separately at the labor markets of high and low educated workers to examine the extent to which the experience is different across the two groups, and the extent to which skilled and unskilled labor markets respond differently to unfavorable political conditions. It is well documented in the literature that the probability of formal employment

[2] See Khamis (2012) for a survey on informality.

increases with the education level, possibly in response to higher returns to education attached to formal jobs. Gong and van Soest (2002) confirm this view, suggesting that the dual structure is supported for highly educated workers but not for low-educated ones. Therefore, the response of the two markets to unfavorable economic conditions is expected to be different. Moreover, the distinction across education level is important for designing better, and more relevant, policies that address informal labor markets (Pages and Stampini 2009). If low educated workers encounter high barriers to enter formal employment, the policy should address improving mobility between formal and informal jobs to bring welfare gains to the poorest workers. However, if the unskilled labor market is not segmented (i.e., low educated could move freely across the two sectors), easing access to education and skill could be a more suitable policy to raising worker's living standards. These investments in education and training will not have an impact on workers' well-being if the labor market is segmented (Pages and Stampini 2009).

To understand the dynamics of informality in the wake of the Arab Spring in Egypt, we use a representative panel data that covers the period 1998-2012. One advantage of the dataset used in our analyses is the ability to give insights on long term labor market dynamics as it covers the period 1998-2012. The panel data are collected in three waves: 1998, 2006, and 2012. During the period 1998-2006, the Egyptian economy was in a good shape, and unemployment declined significantly (Assaad 2009), while over the period 2006-2012 employment growth and net job creation decreased and employment conditions deteriorated as a direct result of the political instability that followed the Arab Spring revolution (Assaad 2015a; 2015b). The 2012 wave of the dataset contains retrospective section that asks detailed questions about individual's labor market history during the Arab Spring. We make use of the panel aspect of the data as well as retrospective data to document changes in informal employment over time. In order to better estimate the effect of the Arab Spring revolution on

informality, we supplement that analysis by utilizing Egyptian Labor Force Survey (LFS) repeated cross section quarterly data between 2010 and 2014.

Our findings suggest that uncontracted work has increased over the last two decades, but through two mechanisms. First, this was driven by the increase in the share of highly-educated workers who were stuck in the informal employment, and secondly through the higher share of low-educated formal workers who lost their job contracts and became informally employed. We also find that informal employment particularly increased in the wake of the Arab Spring revolution for the two groups, but the increase is more pronounced for the highly educated. Those results suggest that the political instability harmed all educational groups but the educated were hurt more, compared to the low educated, ironically as they were the initiators of the recent political changes.

The structure of the paper is as follows: Section 2 reviews the previous related literature. Section 3 provides background information on the Egyptian labor market and the recent political changes in the country. Section 4 describes the data and the sample. Section 5 focuses on the data analyses through examining determinants and dynamics of informality, the impact of the Arab Spring, and potential mechanisms behind the findings. Section 6 concludes.

## 2. Related Literature

Despite the large body of economic literature on informality in developing countries, a generally accepted conceptual framework of how this type of employment and the labor market are intertwined does not exist (Lehmann 2015). Traditionally, informality was viewed as a stepping stone where workers wait for formal sector jobs- due to Fields (1975) seminal work. In this context, the informal sector is the less advantaged sector of a dualistic labor market, a marginal sector in its contribution to economic growth and the overall economy. Within this sector, informal workers are 'involuntary' employed as they are excluded from the benefits of

the formal sector and barriers to entry prevent them from moving to the formal labor market. However, others (e.g., Cunningham and Maloney 2001; Maloney 1999; 2004), have questioned this traditional view and argued that informal workers and the self-employed in particular are voluntarily employed in the informal labor market, which is not marginal, nor segmented but is integrated with the formal sector and contributes significantly to employment and output. Several empirical studies have embarked on investigating those opposing views by focusing on labor mobility or formal-informal wage gap. The argument being that if the labor market is not segmented then there will be mobility between informal and formal employment. Similarly, wage equalization between informal and formal sectors should occur.

Labor market dynamics have attracted a lot of attention in the informal employment literature; see for example, Maloney (1999), Maloney (2004), Gong et al. (2004), among others who have focused in particular on Mexico. Maloney (1999) offered one of the very early studies of worker transitions between sectors and found little evidence in support of the dualistic labor market view in Mexico. On the other hand, Bosch and Maloney (2010) find that in Argentina, Brazil and Mexico, the self-employed face voluntary entry into the informal sector, while informal salaried workers face a segmented market and queue in the informal sector. This is observed in particular during downturns when informality increases in periods of high unemployment suggesting a very traditional view of the role of the informal sector as a shock absorber. One of the few studies which distinguishes between the educational levels of workers, Gong and van Soest (2002) find that for the lower educated workers, the dualistic view of the labor market is not a good description, but for the higher educated, on the other hand, the urban labor market in Mexico has traditional dualistic features. Evidence for other developing countries and transitional economies also suggest mixed results, see for example Lehmann (2015) for a survey on informal employment in transitional economics. On the whole,

the dualistic nature of labor market is country specific and depends on its institutions, but also, and more importantly, on the definition of informality used (self-employed versus salaried workers).

There are a few studies on informality in Egypt. Wahba (2009) looks at whether the informal sector is a stepping stone or a dead end and finds that informal employment is a stepping-stone for highly educated men. However, for low-educated workers and women informal employment could be a dead end. Radchenko (2014) uses non-parametric techniques to estimate heterogeneity in the Egyptian labor market over the period 1998-2006, and shows evidence for triple heterogeneity, offering support to both segmented and competitive views on informal labor. More recently, Tansel and Ozdemir (2014) study labor market dynamics in the Egypt by examining transitional probability across eight labor market states and conclude that the labor market is highly static. Tansel et al. (2015) examine the wage gap, across the wage distribution, between informal and formal sector workers in Egypt, and adopting a similar methodology to Bargain and Kwenda (2015), namely Fixed Effects Quantile Regression, find a substantial gap in favor of formal sector workers. They also show that informal wage penalty increases with education and has increased over time across all quantiles.

Despite the growing economic literature that investigates the impact of economic downturns on informal employment cycles (e.g., Elbahnasawy et al. 2016; Fiess et al. 2010), there is hardly any evidence in the literature on the impact of political instability on informality. This paper is the first to exploits the political turmoil that accompanied the Arab Spring revolution to study the dynamics of informality in Egypt.

## 3. The Egyptian labor market

This section provides a brief background to the role played by the various labor market institutions and how they impact on the functioning of the labor market in Egypt. In the 1960s, the government passed a law that guaranteed employment to all secondary, technical institutes, and university, graduates to encourage education and to provide safety net. However, this has led to an overstaffed and inefficient public sector. From the 1960s to the 1980s, the Egyptian public sector was the main creator of employment opportunities and typically the preferred sector by most new entrants to the labor market. The economic reforms of the 1990s have curbed new employment opportunities in the public sector and initiated a privatization program of existing public enterprises, but the size of the private formal sector, although growing fairly rapidly, has continued to be small. As a result, unemployment rates among the new entrants to the labor market increased. At the same time, the growth of the private formal sector in job creation and absorption has been limited resulting in an increase in informal employment where jobs are not covered by social insurance or legal employment contracts.

Thus, labor market institutions in the form of guaranteed government employment has resulted in a segmented labor market. However, with the downsizing of the labor market, youth unemployment increased by more than 50 percent in the 1990s, and unemployment mostly affected the educated youth driven by the public sector hiring practices. The youth still expected the government to provide them with jobs and queue for public sector jobs. In addition, the private sector has been very slow in absorbing new workers which has exacerbated the problem. With the increase in (educated) labor supply, informality became the only resort for many new entrants.

Until July 2003, existing labor legislation had been rather stringent both for workers and for employers, leading to lack of enforcement. In 2003, the Egyptian government embarked

on various labor market reforms with the goal of increasing flexibility in hiring/firing in the private sector which went some way toward providing more flexibility (Wahba and Assaad 2017). However, with the onset of the financial crisis in 2008, employment growth and net job creation decreased and employment conditions deteriorated (Assaad and Krafft 2015b). Moreover, irregular wage work, the type of employment that is most closely associated with vulnerability and poverty, has risen substantially (Assaad and Krafft 2015b).

One defining problem for Egyptian labor market has been the lack of a dynamic private sector. Egypt has a very large small and medium (SME) sector that is heavily skewed towards small and very small companies: just 1.6 per cent of all enterprises have more than 10 employees and only 0.2 per cent have more than 50 employee (Loewe et al. 2013). As documented by Loewe et al. (2013), the main obstacle faced by SMEs is with regard to the regulatory environment, namely the unpredictability and arbitrariness of law enforcement rather than the cost and time needed for compliance.

In essence despite protective labor market regulation in Egypt which applies only to public sector and formal private employees, informal workers are not protected and their jobs are not regulated, most workers remain largely unprotected and work without a job contract. Law enforcement is rather weak, with no labor inspectorates that effectively enforce worker rights and supervise the implementation of labor regulations, see Angel-Urdinola and Kuddo (2010).

Another major trend in the Egyptian labor market has been the continued improvement in the educational composition of the working age population. However much of the investment in human capital has been in pursuit of the credentials needed to access public sector jobs rather than the skills demanded by the labor market. As such the public sector employment was used by the political regime as a tool to calm down politically salient groups mainly the educated middle class as part of the social contract they have struck with the citizens. As a

result, by using the labor market as means to distribute rents the government undermined the functioning of the labor market and its ability to efficiently allocate human capital to its most productive uses and to signal the kind of human capital investments that are needed, see Assaad (2014)).

Driven by the unfavorable economic situation and frustration among young people who received education but were unable to reap the requisite economic benefits from it (Campante and Chor 2012), young people from around the country took an active role in the January 25th revolution in 2011. Although there are debates about the main reasons behind the uprising, lack of formal jobs, equity and inclusion are prime contenders, see by for example, Devarajan and Ianchovichina (2017). Loosely organized through social media, young Egyptians poured onto Tahrir Square and other meeting points around the country to demand their human rights and a voice in their own futures. The riots succeeded in toppling a 30-year old regime. However, since then the country has undergone several political fluctuations and changes of power, with civil unrest, violence and continued protests. Assaad and Krafft (2015a; 2015b) showed that conditions in the Egyptian labor market have deteriorated markedly as a result of the economic crisis that accompanied the revolution.

In the wake of the revolution, there were attempts to introduce minimum wages, and increase workers' voice and trade union power all of which came to a halt with the intensive civil unrest and the political instability that dominated the 2-3 years afterwards. Although on one hand, one would have expected that with the uprising, there would have been the desire and opportunity for political reforms providing workers more rights and voice, those did not materialize and were accompanied by economic uncertainty and political instability. While the uprising was initiated by the breakdown of the social contract, the aftermath (at least in the short and medium term) did not mend or initiate a new social contract, leaving in particular the young educated middle classes unhappy due to their failure to change the political and social

environment in order to achieve a better life, see Silver et al. (2017). In the next sections, we examine the changes in informality over time and in particular in the aftermath of the Arab Spring to document the potential changes experienced in the labor market by unprotected workers.

## 4. Data and descriptive statistics:

### 4.1. Data

We use data from the Egypt Labor Market Panel Survey (ELMPS) which is a nationally-representative panel dataset that covers the Egyptian labor market and collected detailed information about demographic characteristics of the households and individuals interviewed. The survey was carried out three times in 1998, 2006, and 2012 by the Economic Research Forum (ERF) in cooperation with the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS), the Egyptian government's prime statistical agency.[3]

The ELMPS dataset contains detailed information about employment status, education levels, and individual and household background characteristics across the three waves, in addition to rich information about labor market outcomes over the life cycle using retrospective questions about labor market history. We make use of the panel aspect of the data as well as retrospective data to document changes in informal employment over time, particularly after the Arab Spring revolution in 2011, and estimate the probability of switching from/to informality over time and the wage implications of that transition.[4]

We use lack of job contract as our measure of informality, and focus our analysis on private non-agriculture waged workers (PNAW). Given the low female labor force

[3] For more details, see Assaad and Krafft (2013).

[4] We further use data from the annual Egypt Labor Force Survey (LFS) for the time period 2010-2014. See Section 5.2 and Appendix B for details.

participation in general and in the private sector in particular causing huge selectivity, we limit our analysis to men, aged 20 years or more in 1998 and less than 60 years in 2012.

Our total sample of interest is comprised of 6,787 observations for 5,575 individuals in non-agriculture waged employment for whom we have complete information about employment status, education levels, and individual characteristics. We distinguish between high and low educated workers and define high educated as those with secondary or higher education and low educated as those below secondary education.[5] Given the potential differences between the two groups in the pattern of informality, we examine them separately.

The share of informal employment has increased over time from 25% in 1998 to 30% in 2006 and then to 39% in 2012. Table A1 shows the change in the share of those employed without contracts (informal employment), relative to all other employment status, over the three waves of the survey. Figure 1 clearly shows the increase in the share of informal workers, those with no job contracts, over time especially between 2006 and 2012 by educational level. Both low- and high-educated workers witnessed increase in in their informal employment. However, high-educated workers witnessed almost a doubling of the share of informal employment between 1998 and 2012. Table A2 provides the characteristics of informal workers and their work compared to formal workers (contracted workers in private waged non-agriculture employment). A number of interesting features emerge. First, there is a positive wage premium for formal work relative to informal employment, an issue we will investigate further later. Also, the share of high-educated workers increased in both formal and informal workers between 1998 and 2012 reflecting the secular increase in educational attainment over the last few decades. This also shows that informal work is becoming more dominated by high

[5] As a robustness check, and since obtaining university education is the main marker of social prestige, we repeated all the analyses using an alternative breakdown between those who have a high school diploma or lower versus those who have university education or higher. The results are similar.

educated workers: 60% of informal workers were high educated in 2012 compared to only 40% in 1998. We investigate below the employment dynamics focusing on the difference between the high- and the low-educated.

## 5. Data analyses

In order to study informality in the aftermath of the Arab Spring in Egypt, we examine (i) the probability of holding an unprotected (informal) job over time, (ii) the probability of transitioning into and out of informal employment over time before examining both patterns and trends before and after the 2011 Revolution.

### 5.1 The Probability of Informal Employment

First, we examine the probability of informal employment over time. For this purpose, we estimate the following model:

$$INF_{it}^{*} = \alpha_i + \beta_1 T_t + \beta_2 X_{it} + \varepsilon_{it} \qquad (1)$$

Where $INF_{it}^{*}$ is a dummy variable that takes the value one if the individual is informally employed (i.e., uncontracted), and zero if he is formally employed (i.e., has a contract). $T_t$ is a dummy indicator for waves 2006 and 2012, relative to the baseline of 1998. $X_{it}$ is a vector of control variables including age, age squared, work experience, work experience squared, marital status, urban vs. rural area dummy, household size, education, firm size, and industry dummies. We use the three waves as repeated cross-sections.

Table 1 shows the coefficients of Equation 1. The table estimates three models: (1) a linear probability model (LPM) which ignores the panel aspect of the data, (2) a random effect model (RE) to take into account the panel features, and finally (3) a fixed effects panel model (FE) to control for unobserved heterogeneity for the overall sample (Columns 1-3), low educated (Columns 4-6), and high educated (Columns 7-9). Informality significantly increased between 2006 and 2012 for both low educated and high educated. However, using individual

FE model, the estimates show that for the same individual, the probability of informal employment has not changed over time.

### 5.2 Formal/informal employment transitions

Worker transitions between sectors provide evidence on the dualistic labor market, and on whether the informal sector is a stepping stone or a dead-end which could have been a cause of the increased frustration of the educated group if they were unable to move to better formal jobs. Table 2A shows the matrix of raw transition probabilities for the overall sample between 1998 and 2006 (Panel A) and between 2006 and 2012 (Panel B). The elements on the main diagonal of the matrix show the probability that an individual remains in a given state. The table shows that between 1998 and 2006, the probability to remain in formal employment (with contract) was about 64% and decreased to 43% between 2006 and 2012. The probability to remain in informal employment (without a contract) increased from 54% between 1998 and 2006 to 65% between 2006 and 2012. The share of workers who switched from informal to formal employment decreased from about 13% between 1998 and 2006 to 8% between 2006 and 2012. The share of workers who lost their contracts (i.e., moved from formal to informal employment) increased significantly from 14% between 1998 and 2006 to about 27% between 2006 and 2012 suggesting perhaps that the turmoil has had an impact.

Given that the pattern of informality is expected to be different between low educated and high educated workers, we show the transition matrix by education level. Tables 2B and 2C show the transition matrix for the low educated and high educated, respectively. For the low educated, the probability to remain in formal employment decreased substantially from 63% between 1998 and 2006 to only 27% between 2006 and 2012. About 17% only of the formal low educated switched to informal employment between 1998 and 2006. This increased to 49% between 2006 and 2012. The share of workers who remain in informal employment increased

from 67% to 74%, and the share of those who moved from informal to formal decreased from 6% to 3%. For the high educated, the share of those remaining in formal employment decreased from 67% to 47%. The share of those remained informal employment increased from 38 to 57 percent. The share of those graduating from informal to formal employment decreased from 23 percent to 13 percent. The share of switchers from informal to formal increased from 13% to 23%. The estimates of the raw transitions suggest that informality increased for low educated and high educated for different reasons. Low educated were more likely to lose their contracts, and move from formal to informal workers. However, high educated were more likely to be stuck in informal employment.

To account for observable characteristics when studying the dynamics of informal employment across the three waves of the survey, we estimate the likelihood of switching from (in)formal employment in one wave to different employment status in the next wave using Multinomial Logit (MNL) model:

$$\Pr\left(X_{i,t+n)} = j \,\middle|\, X_{i,t} = k\right) = \frac{\exp(Z_i \acute{\beta}_{j|k})}{\sum_{l=0}^{K} \exp(Z_i \acute{\beta}_{l|k})} \qquad (2)$$

where $X_i$ is the labor market state of individual *i* at time *t* (initial time) *or at t+n* (later time). *k* is the state of origin and *j* is the destination state. $Z_i$ is a vector of control variables for individual *i*. We are interested in mobility from the informal private employment to the other states as well as from the private formal employment to the other states. The MNL model is estimated by the maximum likelihood estimation method.

Table 3 shows the average predicted probabilities estimated from the MNL model above, adjusted by the number of years between each two waves. Columns 1-3 show the estimated for

the whole sample, Columns 4-6 show the estimates for the low-educated, and Columns 7-9 show the estimates for the high educated.

The table shows the same pattern as the transition matrices above, namely that for the period 2006-2012 compared to 1998-2006, the probability to remain in informal employment increased, and the probability to remain formally employed decreased. The probability to switch from informal to formal (from formal to informal) employment decreased (increased). Compared to the high-educated, the low educated witnessed a strong reduction in the probability to stay formally employed. The high-educated, however, were more likely to stay in informal employment. The table suggests that the probability to switch from formal to informal employment is a major reason for the increase in informality among the low-educated, while for the highly educated, the decline in the probability to stay in informal employment is the main driver of the increase in informal employment.

Interestingly, we find also some evidence on transitions from formal employment to self-employment over time. The literature shows that economies going through recessions are likely to experience a shift from tradable (i.e., salaried formal) to non-tradable (i.e., self-employment informal) sectors, which would strengthen informality (see, for example, Fiess et al. 2010)). Table 3 shows that while switching from formal employment to self-employment over the period 2006-2012, compared to 1998-2006, decreased for the low-educated, it significantly increased among high-educated workers. This could be explained by the difference between the two educational groups in the ability to accumulate financial capital during formal employment to start self-employment in periods of economic downturn.

To examine the determinants of transition from and to informality and whether this has changed over time for the two educational levels, Table 4 shows the marginal effects estimates of a probit model of the determinants of moving out of and into formal and informal employment. Column 1 and 2 show the estimates of the probability to move from informal to

formal employment between 1998 and 2006 (Column 1) and between 2006 and 2012 (Column 2) compared to stay in informality. Columns 3 and 4 show the estimates of moving from formal to informal employment compared to staying in formal employment. The table shows that between 1998 and 2006 highly educated were more likely than low educated to move from informal to formal employment. However, the two groups were not significantly different in the probability to escape informality between 2006 and 2012. Moreover, there was no significant difference between the low and high educated in moving from formal to informal employment between 1998 and 2006. However, the low educated were more likely to move from formal to informal employment between 2006 and 2012.

### 5.3 Informal Employment and the Arab Spring

An important aspect, which we need to delve further into, is whether the recent political changes that Egypt witnessed have had an impact on the labor market dynamics and in particular on movement out of informality. Given the long time frame between 2006 and 2012, we cannot claim that the findings we show above are solely due to the economic downturn that accompanied the Arab Spring revolution. To better investigate the impact of the revolution on informality, we use data from the retrospective section in the 2012 wave of the ELMPS data to examine three aspects: (i) the probability of starting an informal employment; (ii) the probability of moving from informal to formal employment, and (iii) the probability of moving from formal to informal employment.

Figure 2 shows the probability of starting informal employment over time. The figure clearly shows that informal employment has been continuously increasing over time.[6] However,

[6] This is in line with the findings shown in Section 5.1 using the panel data structure.

the increase has been much more pronounced after the revolution (i.e., in 2011 and 2012).[7] We focus on those who started employment two years before (i.e., in 2009 and 2010) and two years after the revolution (i.e., in 2011 and 2012).[8] As Table A3 shows, the share of those who started private informal employment increased significantly from 57% before the revolution to 66% after the revolution. The table shows no significant differences in background characteristics except work experience and age which are mechanically lower for the group after the revolution. Distinguishing between low- and high-educated individuals also shows an increase in starting informal jobs as opposed to formal ones after the revolution for both educational groups - Table A4. At the same time, the share of those who moved from informal to formal employment decreased from 44% to 37% and those who moved from formal to informal employment increased from 27% to 45% - Table A3. Similar patterns are observed for both educational groups (Table A4).

To estimate the probability of starting informal employment (i.e., employment without job contract) before and after the revolution, we estimate the probability of starting informal employment and capture the revolution using a dummy variable that takes the value 1 if employment started after the revolution (i.e., in 2011-2012), and 0 before the revolution (i.e., in 2009-2010) and control for relevant individual characteristics. Table 5 Panel A shows the estimates for the probability to start informal employment in general. The table shows that the Arab Spring revolution increased the probability to start informal employment for the two educational groups, and decreased the probability to switch from informal to formal employment. We then estimate the probability of moving from informal to formal employment before and after the revolution (Panel B), and likewise the probability of moving from formal

[7] The 2012 wave was conducted between March and June in 2012.

[8] As the Arab Spring revolution in Egypt took place early in 2011 between Jan.25 and Feb.11, we assume that the year 2011 is post-revolution.

to informal employment (Panel C). The estimates show that the probability of switching from informal to formal employment has decreased for both low-and high educated individuals, while the probability of moving from formal to informal has increased, but is not statistically significant.[9] Hence, the political turmoil seems to have increased informality through pushing more individuals to start informal rather than formal jobs and fewer workers were able to move out of informality in the period just after the revolution compared to that before.

In order to have a better picture of the possible effect of the Arab Spring in informality we use repeated cross-section waves of 2010-2014 from the Egyptian Labor Force Quarterly Data. See B1 for a description of the dataset and the descriptive statistics of our sample in Table B1. These data are nationally representative quarterly data (each three months). We adopt a regression discontinuity strategy and estimate the following model:

$$INF_i^* = \alpha_i + \beta_1 Rev_i + \beta_2 X_i + \gamma trend_t + \varepsilon_{it} \quad (3)$$

Where $INF_i^*$ is a dummy variable for informal employment, $Rev_i$ is a dummy variable for the revolution (i.e., 2011 or after), $X_i$ is a vector of individual observable characteristics, $trend_t$ is a vector for time trend polynomials (i.e., year quarters and year quarter squares), and $\varepsilon_{it}$ is the error term.

We again run the analysis separately for the high-educated (secondary and above) and the low-educated (below secondary). Figure 3 clearly shows a jump in private informal after the Arab Spring revolution for the two groups. Table 6 shows the regression discontinuity coefficients of equation 3. The table supports our previous findings that informality increased in the aftermath of the Arab Spring in Egypt. The increase is more pronounced for the highly educated relative to the low-educated.

[9] This is probably due to the few number of observations.

### 5.4 Possible Mechanisms

To explore the underlying factors behind our findings, we first examine the nature of formal-informal job transitions experienced to illicit whether such moves were voluntary or involuntary. For this purpose, we exploit the retrospective section of the Egypt Labor Market Panel Survey (ELMPS) which contains a set of detailed questions on the history of job statuses. The retrospective data shows that for those who switched from formal to informal employment, about 80% changed their occupations (defined by 2-digit categories), while among those who switched from informal to formal, 60% changed their occupations.[10]

The nature of occupational change associated with switching to/from informality could provide better picture about the mechanisms of change. If workers are switching to higher-quality jobs, this suggests that the switch is likely to be voluntary. If workers are switching to lower-quality jobs, this suggests that the change is demand driven and that workers have little impact on choosing it.

To capture the direction of the change we created an index of the occupational skills using occupations' median monthly wages from the Egyptian labor force survey 2010. We estimate the following two equation for the direction of change

$$\Delta occ\_skill_i = \gamma_0 + \gamma_2 Move\_f_i + \gamma_3 Z_i + \varepsilon_i \qquad (4)$$

$$\Delta occ\_skill_i = \theta_0 + \theta_2 Move\_inf_i + \theta_3 Z_i + \varepsilon_i \qquad (5)$$

Where $\Delta occ\_skill$ is the change in occupational skill (estimated by median log wage) when switching from one occupation to another in the retrospective data. $Move\_f_i$ is a dummy variable that takes the value 1 if the switch is from informal (uncontracted) employment to

[10] The data also shows that among those who switched from formal to informal employment, 70% switched industry, and among those who switched from informal to formal employment, 65% switched industries. This suggests a high degree of segmentation in the Egyptian labor market.

formal (contracted) employment, and 0 otherwise. $Move\_inf_i$ is a dummy variable that takes the value 1 if the switch is from formal (contracted) to informal (uncontracted) employment, and 0 otherwise. $Z_i$ is a vector of individual characteristics in the initial period, and $\varepsilon_i$ is the error term.

Table 7 shows the estimates of the regression. Column 1 shows the estimates for equation (4) and Column 2 shows the estimates for equation (5). The table shows that moving from informal to formal employment is associated with an increase in the job skill (measured by median wage), while moving to informality is associated with occupational downgrading in terms of skill. This suggests that moving to informality is involuntary.[11] These findings are in line with Yassin (2015) who documents a remarkable slowdown in the expansion of formal private jobs between 2010 and 2011, as well as a decrease in the hiring rate in the formal private wage employment, and an increased difficulty for a non-employed individual to find jobs during the period after the revolution.

The Arab Spring seems to have also a direct effect on the formality of firms. Using data from the Middle East and North Africa Enterprise Surveys (MENA ES), Figure 4 shows the share of firms formally registered over years. The share of firms formally registered decreased significantly after the revolution.[12]

Furthermore, Assaad et al. (2017) find that while the composition of labor supply is increasingly shifting toward more educated workers, this is not matched with the creation of jobs with greater human capital requirements. The private sector is creating jobs in a few

[11] Although this does not tell if occupational change take place within the same firm, the broader definition of occupational change suggests change of employers.

[12] Based on data from 2,897 firms in Egypt collected in 2014 (See: http://ebrd-beeps.com/data/mena-es-2013-2015/)

sectors that do not appeal to educated workers, namely construction, trade, and transport. These sectors offer mostly informal jobs and that are often precarious and intermittent.

Overall, the evidence suggests the Arab Spring has had a significant impact on the economy affecting in the short run certain sectors badly such as the tourism sector, and slowing down foreign investment. In addition, given the rigidity of the labor market, this has led to very little labor market mobility: no hiring but limited firing underscoring further the rigidity and lack of dynamism in the Egyptian labor market.

### 5.5 Benefits of formality

It is not surprising that having an unprotected job might entail a loss of several advantages compared to protected employment. Without a job contract workers do not benefit from social security coverage as well as other rights and benefits such as paid holidays and health insurance. Moreover, it is well documented in the literature that informal employment is associated with a pay penalty (e.g., Bargain and Kwenda 2015; Tansel et al. 2015; Elbadouai et al. 2008; Pagés and Stampini 2009). It is paramount to understand the benefits and costs of holding a protected job and how this changed over time. We first examine the wage differential between both types of employment to quantify the attractiveness of contracted private formal jobs. Wage is defined by log hourly net wage, as opposed to gross wage, which represents a major advantage of the ELMPS dataset over other data sources that have been used to investigate pay gaps between informal and formal employment using gross wages. This makes the analyses robust to the impact of taxes which could affect formal but not informal workers, without having to make extra calculations of taxes that may lead to measurement errors. Wages are only observed at the time of survey- 1998, 2006 and 2012- the three waves of the ELMPS. To investigate wage differentials between workers with contracts and those without over time, we estimate the following equation:

$$log\, W_{it} = \gamma_0 + \gamma_1 Inf_{it} + \gamma_2 Z_{it} + \varepsilon_{it} \quad (6)$$

Where $log\, W_{it}$ is the log hourly net wage, $Inf_{it}$ is a dummy variable for informal (uncontracted) employment, and $Z_{it}$ is a vector of control variables for individual demographic characteristics such as age, work experience, urban/rural residence, marital status and employment characteristics such as firm size and industry.

Table 8 examines the wage gap between informal and formal employment using pooled OLS regression across the three waves, RE and FE models. The table shows that informal employment is associated with a wage penalty of 22 log points in the OLS and RE models, and 13 percentage points in the FE model. The pay penalty is significant only for the high educated. Accounting for unobserved heterogeneity by using the FE model reduces the penalty but does not eliminate it.

To investigate changes in informal employment pay gap over time, we use the panel sample and estimate the following equation of log wages as a function of individual characteristics ($Z_{it}$), a dummy variable for informal jobs – work without contract -($Inf_{it}$), a dummy for the wave (1998, 2006, and 2012) and the interaction between informal work and Wave. The coefficient of interest is $\pi$.

$$\log W_{it} = \gamma\theta_0 + \theta_1 Z_{it} + \sigma Inf_{it} + \tau Wave_t + \pi[Inf_{it} * Wave_t] + \varepsilon_{it} \quad (7)$$

Controlling for individual fixed effects, Table 9 shows the FE model after controlling for the interaction between wave dummies and informal employment dummy. The table shows that informal pay penalty increased significantly over time for both low- and high-educated workers. In essence this underscores the monetary advantages of formal jobs, and moreover how the divergence between informal and formal wage gap increased in particular for the

educated, perhaps fueling the frustration of that group about their lack of decent formal job opportunities before the 2011 revolution and straight afterwards.

## 6. Conclusion

This paper focuses on the dynamics of informality and asks whether workers face more labor market barriers during political instability and whether low educated unprotected workers fare the same as high-educated unprotected workers during periods of political turmoil.

Using data from Egypt, our findings suggest that the incidence of working without job contract has increased over time for both groups, but for different reasons. In particular, the increase in informality between 2006 and 2012 was driven by the highly educated workers who remained in informal employment, and the low-educated formal workers who lost their job contracts and became informally employed.

Furthermore, the evidence seems to suggest that the Arab Spring has affected informality even more. The probability to start an informal employment increased after the revolution for both the educated and low educated workers. Conditional on being informally employed, the probability to move to formal employment decreased after the revolution.

Overall, our results show that during the political turmoil, informality has increased and the high educated workers were affected more than the low-educated. This suggests that the Revolution might have led to more frustration amongst the young educated workers at least in the short term, and possibly in the medium term given the continuation of unstable political and economic conditions in Egypt.

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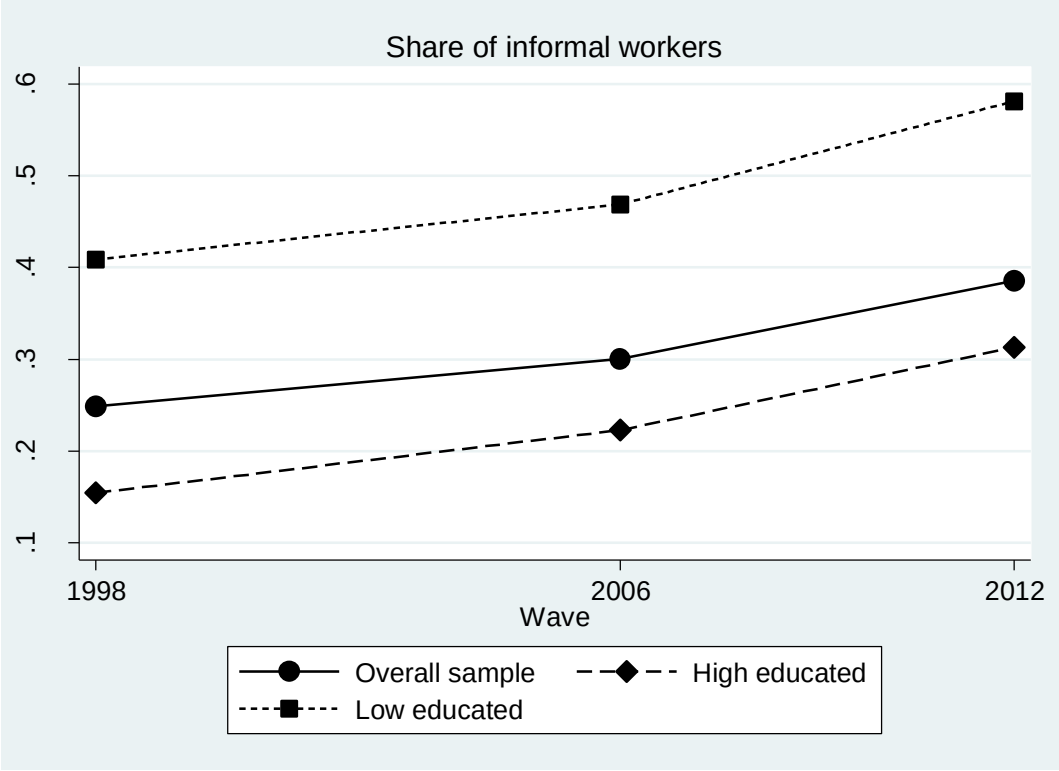
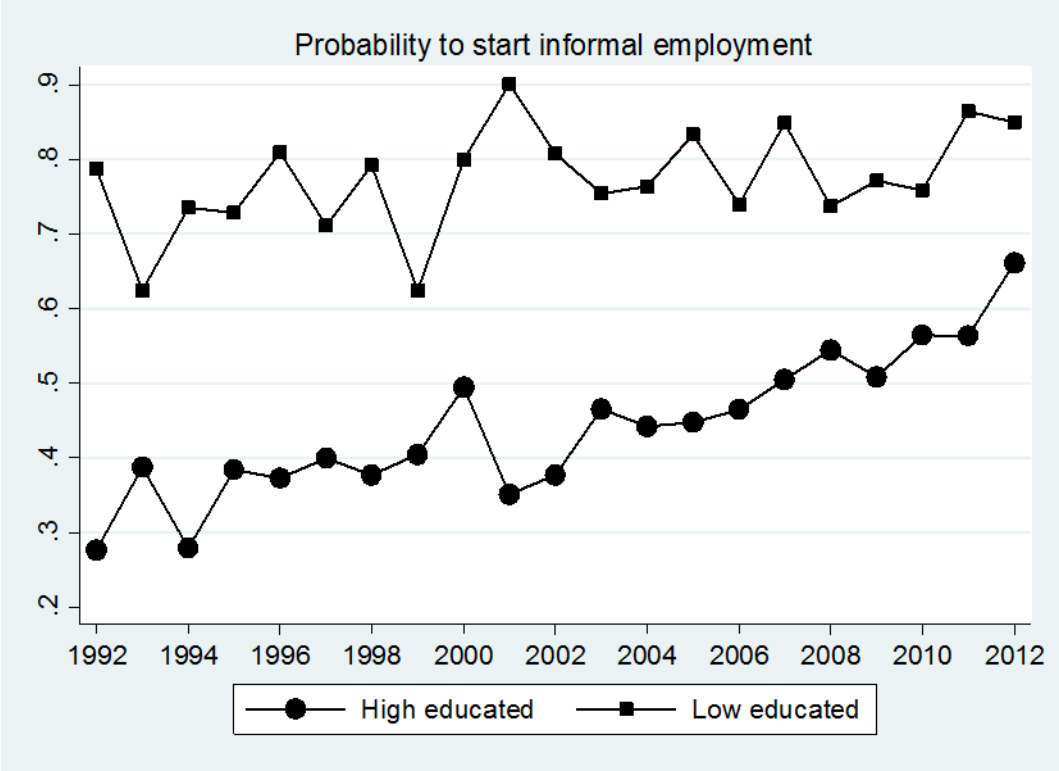
**Figure 1: Share of informal private employment in total employment over time**



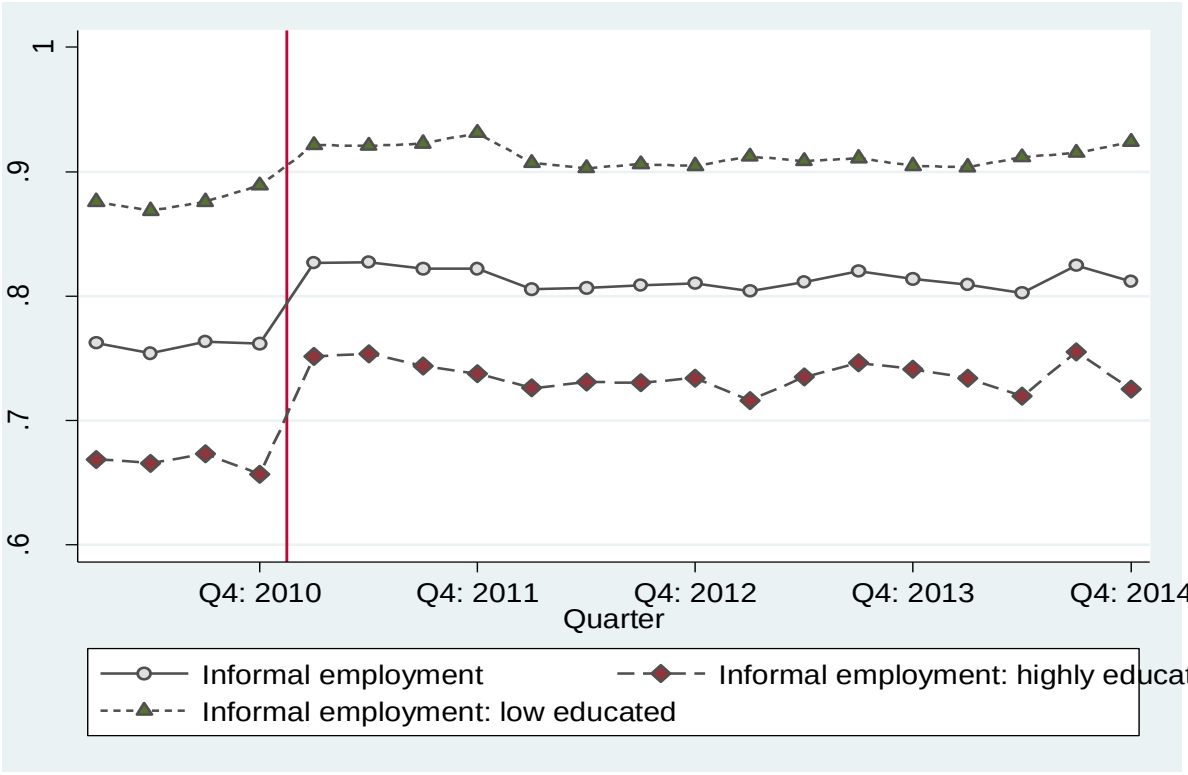

Note: Based on ELMPS 1998, 2006 and 2012. Sample for males. Informal work is non-contracted non-agriculture private waged employment.

**Figure 2: Probability of starting informal employment over time by educational level**



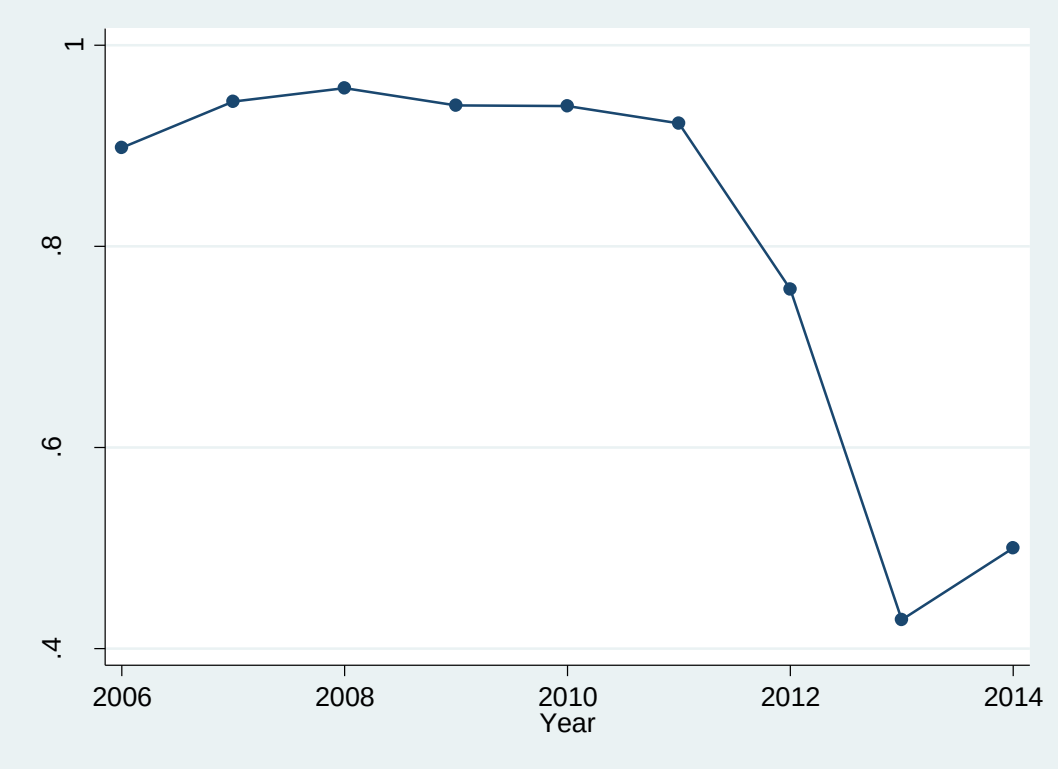

Source: ELMPS12.

**Figure 3: Share of informality 2010- 2014 by quarter in the Egyptian labor market, LFS**




Source: LFS.

**Figure 4: Share of firms formally registered by year**




Source: MENA Enterprise Survey, EBRD.

**Table 1: Probability of informal employment, LPM, RE, and FE models.**

| | Informal employment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Overall sample | | | Low educated | | | High educated | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| VARIABLES | LPM | RE | FE | LPM | RE | FE | LPM | RE | FE |
| *Ref: Wave 1998* | | | | | | | | | |
| Wave 2006 | -0.012 | -0.014 | -0.027 | 0.002 | 0.001 | -0.069 | -0.032* | -0.034* | 0.044 |
| | (0.011) | (0.011) | (0.061) | (0.012) | (0.012) | (0.062) | (0.018) | (0.018) | (0.119) |
| Wave 2012 | 0.062*** | 0.060*** | 0.053 | 0.041*** | 0.041*** | -0.059 | 0.064*** | 0.062*** | 0.230 |
| | (0.011) | (0.011) | (0.104) | (0.012) | (0.012) | (0.105) | (0.017) | (0.017) | (0.202) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 6,878 | 6,878 | 6,878 | 2,751 | 2,751 | 2,751 | 4,127 | 4,127 | 4,127 |
| R-squared | 0.481 | 0.482 | 0.168 | 0.336 | 0.332 | 0.085 | 0.493 | 0.492 | 0.244 |
| N. of individuals | | 5,575 | 5,575 | | 2,173 | 2,173 | | 3,428 | 3,428 |

Note: Low educated are the individuals with less than secondary education. High educated are the individuals with secondary education or higher. Control variables include age, age squares, work experience, work experience squared, marital status, urban vs. rural area, household size, firm size, and industry dummies. The regressions for the overall sample control for education. Standard errors clustered on individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

## Table 2A: Transition matrices 1998-2012, total sample

**A) Transition matrix between 1998 and 2006**

| | Employment status 2006 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Employment status 1998 | Formal private | informal | self-empl | Public | unpaid | Unemployed | OLF | Total |
| private formal | **64.44** | 14.07 | 5.93 | 12.59 | 0.00 | 2.22 | 0.74 | 100 |
| private informal | 12.83 | **53.91** | 13.91 | 13.04 | 0.65 | 3.04 | 2.61 | 100 |
| self-employed | 0.90 | 18.02 | **65.77** | 7.21 | 0.00 | 0.90 | 7.21 | 100 |
| Public | 3.72 | 2.40 | 1.08 | **90.53** | 0.00 | 0.12 | 2.16 | 100 |
| unpaid family worker | 2.63 | 34.21 | 28.95 | 7.89 | **21.05** | 2.63 | 2.63 | 100 |
| Unemployed | 9.60 | 41.24 | 16.38 | 18.08 | 1.13 | **11.30** | 2.26 | 100 |
| OLF | 14.40 | 28.53 | 9.51 | 28.26 | 2.99 | 10.87 | **5.43** | 100 |
| Total | 11.73 | 23.46 | 10.79 | 46.11 | 1.13 | 3.77 | 3.01 | 100 |

**B) Transition matrix between 2006 and 2012**

| | Employment status 2012 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Employment status 2006 | Formal private | Informal | self-empl | public | unpaid | unemployed | OLF | Total |
| private formal | **43.27** | 26.65 | 3.96 | 20.05 | 0.00 | 4.22 | 1.85 | 100 |
| private informal | 8.05 | **65.49** | 9.71 | 9.90 | 0.28 | 4.07 | 2.50 | 100 |
| self-employed | 3.79 | 38.28 | **43.45** | 7.93 | 0.34 | 4.14 | 2.07 | 100 |
| Public | 4.17 | 3.26 | 0.73 | **89.76** | 0.09 | 0.45 | 1.54 | 100 |
| unpaid family worker | 9.21 | 52.63 | 13.16 | 10.53 | **10.53** | 2.63 | 1.32 | 100 |
| Unemployed | 14.34 | 44.12 | 6.25 | 18.38 | 2.94 | **12.50** | 1.47 | 100 |
| OLF | 14.94 | 40.77 | 8.67 | 16.42 | 1.85 | 10.52 | **6.83** | 100 |
| Total | 11.62 | 35.72 | 8.76 | 35.88 | 0.83 | 4.54 | 2.64 | 100 |

## Table 2B: Transition matrices 1998-2012 for the low-educated

**A) Transition matrix between 1998 and 2006**

| | Employment status 2006 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Employment status 1998 | Formal private | informal | self-empl | Public | unpaid | Unemployed | OLF | Total |
| private formal | **63.33** | 16.67 | 13.33 | 6.67 | 0.00 | 0.00 | 0.00 | 100.00 |
| private informal | 5.58 | **66.53** | 14.74 | 7.57 | 0.00 | 3.19 | 2.39 | 100.00 |
| self-employed | 1.45 | 17.39 | **66.67** | 5.80 | 0.00 | 1.45 | 7.25 | 100.00 |
| Public | 3.09 | 5.56 | 0.00 | **84.57** | 0.00 | 0.62 | 6.17 | 100.00 |
| unpaid family worker | 0.00 | 35.71 | 35.71 | 7.14 | **21.43** | 0.00 | 0.00 | 100.00 |
| Unemployed | 3.03 | 69.70 | 12.12 | 6.06 | 3.03 | **0.00** | 6.06 | 100.00 |
| OLF | 3.80 | 54.43 | 15.19 | 15.19 | 2.53 | 6.33 | **2.53** | 100.00 |
| Total | 6.74 | 41.38 | 16.93 | 27.74 | 0.94 | 2.35 | 3.92 | 100.00 |

**B) Transition matrix between 2006 and 2012**

| | Employment status 2012 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Employment status 2006 | Formal private | Informal | self-empl | public | unpaid | unemployed | OLF | Total |
| private formal | **27.27** | 49.09 | 5.45 | 12.73 | 0.00 | 1.82 | 3.64 | 100.00 |
| private informal | 3.23 | **74.34** | 11.52 | 4.85 | 0.00 | 2.83 | 3.23 | 100.00 |
| self-employed | 2.54 | 39.83 | **49.15** | 5.08 | 0.00 | 2.54 | 0.85 | 100.00 |
| Public | 7.94 | 5.56 | 1.59 | **80.95** | 0.79 | 0.00 | 3.17 | 100.00 |
| unpaid family worker | 11.76 | 47.06 | 17.65 | 0.00 | **17.65** | 5.88 | 0.00 | 100.00 |
| Unemployed | 9.68 | 58.06 | 9.68 | 9.68 | 0.00 | **6.45** | 6.45 | 100.00 |
| OLF | 3.81 | 69.52 | 10.48 | 2.86 | 1.90 | 4.76 | **6.67** | 100.00 |
| Total | 5.60 | 57.87 | 14.47 | 15.31 | 0.63 | 2.75 | 3.38 | 100.00 |

## Table 2C: Transition matrices 1998-2012 for the high-educated

**A) Transition matrix between 1998 and 2006**

| | Employment status 2006 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Employment status 1998 | Formal private | informal | self-empl | Public | unpaid | Unemployed | OLF | Total |
| private formal | **67.01** | 13.40 | 2.06 | 13.40 | 0.00 | 3.09 | 1.03 | 100 |
| private informal | 22.91 | **37.99** | 12.85 | 20.11 | 1.68 | 3.35 | 1.12 | 100 |
| self-employed | 0.00 | 17.65 | **64.71** | 8.82 | 0.00 | 0.00 | 8.82 | 100 |
| Public | 3.35 | 1.12 | 1.12 | **93.30** | 0.00 | 0.00 | 1.12 | 100 |
| unpaid family worker | 4.55 | 31.82 | 22.73 | 9.09 | **22.73** | 4.55 | 4.55 | 100 |
| Unemployed | 10.64 | 35.46 | 17.73 | 21.28 | 0.71 | **13.48** | 0.71 | 100 |
| OLF | 18.25 | 20.53 | 7.98 | 33.46 | 1.90 | 11.79 | **6.08** | 100 |
| Total | 14.01 | 15.04 | 7.70 | 55.54 | 1.03 | 4.40 | 2.27 | 100 |

**B) Transition matrix between 2006 and 2012**

| | Employment status 2012 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Employment status 2006 | Formal private | Informal | self-empl | public | unpaid | unemployed | OLF | Total |
| private formal | **46.75** | 22.73 | 3.90 | 21.43 | 0.00 | 4.22 | 0.97 | 100 |
| private informal | 13.00 | **56.78** | 7.51 | 14.84 | 0.55 | 5.49 | 1.83 | 100 |
| self-employed | 4.90 | 39.16 | **35.66** | 11.89 | 0.70 | 5.59 | 2.10 | 100 |
| Public | 3.85 | 2.75 | 0.66 | **91.43** | 0.00 | 0.55 | 0.77 | 100 |
| unpaid family worker | 8.47 | 54.24 | 11.86 | 13.56 | **8.47** | 1.69 | 1.69 | 100 |
| Unemployed | 15.25 | 41.95 | 5.08 | 19.92 | 3.39 | **13.56** | 0.85 | 100 |
| OLF | 19.31 | 32.80 | 8.47 | 20.63 | 1.85 | 11.38 | **5.56** | 100 |
| Total | 14.38 | 27.75 | 6.24 | 43.76 | 0.93 | 5.12 | 1.82 | 100 |

**Table 3: Predicted probability of switching employment status between waves, based on Multinomial Logit Analysis**

| | Overall sample | | | Low educated | | | High educated | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| | 1998-2006 | 2006-2012 | P value | 1998-2006 | 2006-2012 | P value | 1998-2006 | 2006-2012 | P value |
| **1) Probability to stay in** | | | | | | | | | |
| Private informal | 0.068 | 0.109 | 0.000 | 0.090 | 0.129 | 0.000 | 0.044 | 0.094 | 0.000 |
| Private formal | 0.073 | 0.070 | 0.004 | 0.084 | 0.043 | 0.000 | 0.082 | 0.083 | 0.117 |
| **2) Probability to switch from private informal employment to** | | | | | | | | | |
| Private formal | 0.016 | 0.015 | 0.003 | 0.005 | 0.004 | 0.002 | 0.033 | 0.025 | 0.000 |
| Self-employed | 0.017 | 0.018 | 0.109 | 0.018 | 0.019 | 0.142 | 0.016 | 0.014 | 0.092 |
| Government/public enterprise | 0.017 | 0.019 | 0.000 | 0.009 | 0.008 | 0.005 | 0.029 | 0.027 | 0.034 |
| Unpaid family worker | 0.000 | 0.000 | 0.346 | 0.000 | 0.000 | 0.130 | 0.000 | 0.000 | 0.531 |
| Unemployed | 0.005 | 0.004 | 0.056 | 0.001 | 0.003 | 0.000 | 0.002 | 0.006 | 0.000 |
| OLF | 0.002 | 0.002 | 0.329 | 0.002 | 0.003 | 0.009 | 0.001 | 0.001 | 0.341 |
| **3) Probability to switch from private formal employment to** | | | | | | | | | |
| Private informal | 0.025 | 0.051 | 0.000 | 0.021 | 0.093 | 0.000 | 0.021 | 0.038 | 0.000 |
| Self-employed | 0.009 | 0.007 | 0.002 | 0.014 | 0.007 | 0.000 | 0.003 | 0.005 | 0.001 |
| Government/public enterprise | 0.015 | 0.033 | 0.000 | 0.006 | 0.015 | 0.000 | 0.017 | 0.036 | 0.000 |
| Unpaid family worker | 0.000 | 0.000 | 0.238 | 0.000 | 0.000 | 0.229 | 0.000 | 0.000 | 0.759 |
| Unemployed | 0.003 | 0.005 | 0.042 | 0.000 | 0.003 | 0.000 | 0.003 | 0.005 | 0.003 |
| OLF | 0.001 | 0.001 | 0.128 | 0.000 | 0.006 | 0.000 | 0.001 | 0.000 | 0.000 |

Note: Predicted probabilities are calculated from Multinomial Logit Analysis. The estimates are adjusted for the number of years between each two waves. Control variables include age, age squared, work experience, work experience squared, marital status, urban vs. rural area, household size, firm size, and industry dummies. The regressions for the overall sample control for education. Standard errors clustered on individual level in parentheses. P value is for t-test for whether the difference between col 1 and col 2 is significant. *** p<0.01, ** p<0.05, * p<0.1

**Table 4: Predicted probability of moving out of and into formal and informal employment between each two waves, based on a probit model**

| VARIABLES | Informal-formal | | Formal-informal | |
|---|---|---|---|---|
| | (1) 1998-2006 | (2) 2006-2012 | (3) 1998-2006 | (4) 2006-2012 |
| Highly educated | 0.209** | 0.039 | 0.007 | -0.286*** |
| | (0.087) | (0.034) | (0.078) | (0.069) |
| Urban | -0.092* | -0.064** | -0.096 | 0.018 |
| | (0.053) | (0.025) | (0.090) | (0.071) |
| Age | 0.049 | -0.005 | -0.100 | -0.024 |
| | (0.038) | (0.016) | (0.075) | (0.044) |
| Age square | -0.001 | 0.000 | 0.001 | 0.000 |
| | (0.001) | (0.000) | (0.001) | (0.001) |
| Work experience | -0.003 | -0.004 | 0.033 | -0.010 |
| | (0.011) | (0.006) | (0.026) | (0.020) |
| Work exp. square | -0.001 | -0.000 | -0.001 | 0.000 |
| | (0.000) | (0.000) | (0.001) | (0.001) |
| Married | 0.029 | -0.069** | 0.186* | 0.121 |
| | (0.057) | (0.029) | (0.096) | (0.090) |
| Household size | -0.001 | -0.006 | 0.031*** | 0.008 |
| | (0.008) | (0.005) | (0.011) | (0.013) |
| *Ref: Firm <10 workers* | | | | |
| Firm 10-99 workers | 0.110* | 0.160*** | -0.597 | -0.210** |
| | (0.067) | (0.044) | (75.775) | (0.096) |
| Firm>=100 workers | 0.440*** | 0.262*** | -0.844 | -0.302*** |
| | (0.158) | (0.093) | (75.775) | (0.092) |
| *Ref: Manufacturing* | | | | |
| Construction | 0.017 | -0.057* | -0.119 | 0.188 |
| | (0.064) | (0.030) | (5.804) | (0.144) |
| Trade | 0.008 | 0.019 | 0.233** | 0.049 |
| | (0.063) | (0.036) | (0.113) | (0.092) |
| Transportation | -0.091 | -0.046 | -0.125 | 0.055 |
| | (0.062) | (0.036) | (13.006) | (0.106) |
| Finance and services | -0.078 | 0.007 | -0.145 | 0.040 |
| | (0.080) | (0.043) | (14.854) | (0.088) |
| Observations | 265 | 675 | 89 | 223 |

Note: Balanced sample of observations. Control variables include age, age squared, work experience, work experience squared, marital status, urban vs. rural area, household size, education, firm size, and industry dummies. Standard errors clustered on individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

**Table 5: LPM of informality status before and after the Arab Spring revolution**

| VARIABLES | (1) Overall sample | (2) Low educated | (3) High educated |
|---|---|---|---|
| **A) The probability of informal employment** | | | |
| After revolution | 0.083*** | 0.082** | 0.081*** |
| | (0.023) | (0.040) | (0.027) |
| Controls | Yes | Yes | Yes |
| Observations | 1,147 | 229 | 918 |
| R-squared | 0.473 | 0.504 | 0.441 |
| **B) The probability of switching from informal to formal employment** | | | |
| After revolution | -0.123*** | -0.121* | -0.121** |
| | (0.040) | (0.062) | (0.051) |
| Controls | Yes | Yes | Yes |
| Observations | 561 | 169 | 392 |
| R-squared | 0.199 | 0.231 | 0.154 |
| **C) The probability of switching from formal to informal employment** | | | |
| After revolution | 0.076 | 0.375 | 0.038 |
| | (0.064) | (0.351) | (0.068) |
| Controls | Yes | Yes | Yes |
| Observations | 211 | 22 | 189 |
| R-squared | 0.239 | 0.484 | 0.211 |

Note: Using retrospective data in 2012 wave. Before the revolution is 2009-10 and after is (2011-2012). Low educated are the individuals with less than secondary education. High educated are the individuals with secondary education or higher. Control variables include age, age squared, work experience, work experience squared, marital status, urban vs. rural area, household size. The regressions for the overall sample control for education. Standard errors clustered on individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

**Table 6: Regression discontinuity estimates of the impact of the Arab Spring revolution on informal employment, LFS**

| | Informal employment | | |
|---|---|---|---|
| **VARIABLES** | **Overall (1)** | **Low-educated (2)** | **High-educated (3)** |
| Post-revolution dummy | 0.087*** | 0.042*** | 0.085*** |
| | (0.010) | (0.010) | (0.014) |
| Controls | Yes | Yes | Yes |
| Trend & trend square | Yes | Yes | Yes |
| Gov. dummies | Yes | Yes | Yes |
| Observations | 178,186 | 78,705 | 99,481 |
| R-squared | 0.329 | 0.204 | 0.318 |

Note: Using data from LFS waves 2010, 2011, 2012, 2013, and 2014. Standard errors are clustered on the gov*quarter level (299 clusters). Controls include age, age square, marital status, firm size, and industry dummies. The regression for the overall sample controls for level of education. *** p<0.01, ** p<0.05, * p<0.1

**Table 7: Occupational skill change associated with moving to/from formality**

| VARIABLES | Change in Occupational skill (1) | (2) |
|---|---|---|
| Moved to formal employment | 0.069* | |
| | (0.036) | |
| Moved to informal employment | | -0.157** |
| | | (0.061) |
| Controls | Yes | Yes |
| Observations | 405 | 187 |
| R-squared | 0.063 | 0.088 |

Source: ELMPS data. Control variables include age, age squared, work experience, work experience squared, marital status, urban vs. rural area, household size, and education. Standard errors clustered on individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

**Table 8: Informal employment pay penalty, OLS, RE and FE models**

| | Log wage | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Overall sample | | | Low educated | | | High-educated | | |
| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| | OLS | RE | FE | OLS | RE | FE | OLS | RE | FE |
| Informal | -0.228*** | -0.223*** | -0.134** | -0.048 | -0.055 | -0.150 | -0.246*** | -0.239*** | -0.147** |
| | (0.026) | (0.026) | (0.058) | (0.047) | (0.047) | (0.104) | (0.032) | (0.032) | (0.068) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 0.865*** | 0.835*** | 0.324 | 0.840*** | 0.801*** | -1.786*** | 0.978*** | 0.951*** | 1.955** |
| | (0.156) | (0.157) | (0.498) | (0.226) | (0.226) | (0.687) | (0.236) | (0.237) | (0.801) |
| Observations | 6,878 | 6,878 | 6,878 | 2,751 | 2,751 | 2,751 | 4,127 | 4,127 | 4,127 |
| R-squared | 0.084 | 0.086 | 0.116 | 0.044 | 0.043 | 0.090 | 0.114 | 0.113 | 0.157 |
| Number of id | | 5,575 | 5,575 | | 2,173 | 2,173 | | 3,428 | 3,428 |

Note: Log wage is the log of the net hourly wage. Low educated are the individuals with less than secondary education. High educated are the individuals with secondary education or higher. Control variables include age, age squares, work experience, work experience squared, marital status, urban vs. rural area, household size, firm size, and industry dummies. The regressions for the overall sample control for education. Standard errors clustered on individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

**Table 9: Informality pay penalty over time, FE model**

| VARIABLES | Log wage | | |
|---|---|---|---|
| | (1) Overall sample | (2) Low educated | (3) High educated |
| Informal | 0.198* | 0.125 | 0.149 |
| | (0.101) | (0.181) | (0.132) |
| *Ref: Wave 1998* | | | |
| Wave 2006 | 0.318** | -0.003 | 0.614** |
| | (0.150) | (0.219) | (0.251) |
| Wave 2012 | 0.345 | -0.090 | 0.865** |
| | (0.235) | (0.318) | (0.412) |
| Informal* Wave 2006 | -0.346*** | -0.225 | -0.339** |
| | (0.097) | (0.170) | (0.136) |
| Informal* Wave 2012 | -0.432*** | -0.440** | -0.361** |
| | (0.108) | (0.202) | (0.147) |
| Controls | Yes | Yes | Yes |
| Constant | -0.279 | -2.163*** | 1.503* |
| | (0.519) | (0.709) | (0.828) |
| Observations | 6,878 | 2,751 | 4,127 |
| R-squared | 0.128 | 0.097 | 0.165 |
| Number of id | 5,575 | 2,173 | 3,428 |

Note: Log wage is the log of the net hourly wage. Low educated are the individuals with less than secondary education. High educated are the individuals with secondary education or higher. Control variables include age, age squares, work experience, work experience squared, marital status, urban vs. rural area, household size, firm size, and industry dummies. The regression for the overall sample controls for education. Standard errors clustered on individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

# Appendix A

**Table A1: Share of individuals in different employment status over time, in percent**

| Employment status | Overall | 1998 | 2006 | 2012 | 2012-1998 |
|---|---|---|---|---|---|
| | % | % | % | % | P value |
| Private formal | 9.25 | 6.60 | 10.11 | 9.73 | 0.000 |
| Private informal | 32.75 | 24.91 | 30.07 | 38.55 | 0.000 |
| Self-employed | 7.94 | 6.20 | 8.70 | 8.09 | 0.000 |
| Government/Public Enterprise | 27.06 | 33.22 | 27.18 | 24.17 | 0.000 |
| Unpaid family worker | 1.68 | 2.11 | 2.02 | 1.19 | 0.000 |
| Unemployed | 6.81 | 8.94 | 6.90 | 5.77 | 0.000 |
| OLF | 14.51 | 18.02 | 15.02 | 12.50 | 0.000 |

Note: Based on ELMPS 1998, 2006 and 2012, sample for males. P value is for t-test for whether the difference between 1998 and 2012 is significant.

**Table A2: Characteristics of informal and formal private waged workers (1998-2012)**

| | Overall | | 1998 | | 2012 | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (4) | (5) | (7) | (8) |
| | **Informal** | **Formal** | **Informal** | **Formal** | **Informal** | **Formal** |
| Log hourly wage | 1.36 | 1.66 | 1.26 | 1.46 | 1.41 | 1.71 |
| High educated | 0.53 | 0.84 | 0.39 | 0.74 | 0.60 | 0.88 |
| Work experience | 13.05 | 11.88 | 13.42 | 11.92 | 12.96 | 11.70 |
| Age | 30.23 | 32.90 | 29.73 | 31.78 | 30.68 | 33.30 |
| Urban | 0.56 | 0.75 | 0.70 | 0.84 | 0.51 | 0.71 |
| Married | 0.58 | 0.70 | 0.49 | 0.58 | 0.64 | 0.75 |
| Household size | 5.02 | 4.29 | 5.93 | 5.10 | 4.62 | 3.89 |
| Firm Size | | | | | | |
| <10 workers | 0.81 | 0.12 | 0.83 | 0.08 | 0.80 | 0.08 |
| 10-99 workers | 0.15 | 0.37 | 0.15 | 0.45 | 0.15 | 0.31 |
| > 99 workers | 0.04 | 0.51 | 0.03 | 0.47 | 0.05 | 0.61 |
| Industry | | | | | | |
| Manufacturing | 0.22 | 0.43 | 0.28 | 0.54 | 0.19 | 0.41 |
| Construction | 0.29 | 0.08 | 0.22 | 0.07 | 0.32 | 0.08 |
| Trade | 0.21 | 0.16 | 0.23 | 0.17 | 0.20 | 0.17 |
| Transportation | 0.16 | 0.09 | 0.17 | 0.11 | 0.16 | 0.05 |
| Finance and service | 0.13 | 0.24 | 0.10 | 0.10 | 0.13 | 0.29 |
| Num. of observations | 5,393 | 1,483 | 806 | 219 | 2,787 | 688 |

Note: Based on ELMPS 1998, 2006 and 2012. Sample for males.

**Table A3: Informal employment and background characteristics before and after the revolution**

| | (1) Before (2009-2010) | (2) After (2011-2012) | (3) After-before |
|---|---|---|---|
| A) Informal employment measures | | | |
| Informal employment | 0.57 | 0.66 | 0.08** |
| Moved from informal to formal | 0.44 | 0.37 | -0.07* |
| Moved from formal to informal | 0.27 | 0.45 | 0.18** |
| | | | |
| B) Background information | | | |
| High educated | 0.80 | 0.79 | -0.01 |
| Work experience | 8.24 | 7.09 | -1.15** |
| Age | 28.57 | 27.40 | -1.17*** |
| Urban | 0.54 | 0.55 | 0.01 |
| Married | 0.49 | 0.43 | -0.07** |
| Household size | 4.36 | 4.33 | -0.03 |
| | | | |
| Firm size | | | |
| <10 workers | 0.48 | 0.50 | 0.02 |
| 10-99 workers | 0.24 | 0.25 | 0.01 |
| > 99 workers | 0.28 | 0.26 | -0.03 |
| | | | |
| Industry | | | |
| Manufacturing | 0.22 | 0.18 | -0.04 |
| Construction | 0.21 | 0.19 | -0.02 |
| Trade | 0.18 | 0.18 | 0.00 |
| Transportation | 0.11 | 0.10 | -0.02 |
| Finance and service | 0.28 | 0.35 | 0.07** |
| Number of observations | 766 | 381 | |

**Table A4: Informal employment and background characteristics before and after the revolution for low- and high-educated**

| | Low educated | | | High educated | | | |
|---|---|---|---|---|---|---|---|
| | Before | After | After-Before | Before | After | After-Before | Diff in diff |
| *Informal employment measures* | | | | | | | |
| Informal employment | 0.77 | 0.91 | 0.14** | 0.53 | 0.59 | 0.06* | -0.08 |
| Moved from informal to formal | 0.27 | 0.15 | -0.12* | 0.51 | 0.48 | -0.03 | 0.09 |
| Moved from formal to informal | 0.45 | 0.88 | 0.43* | 0.26 | 0.39 | 0.13* | -0.30 |
| *Background information* | | | | | | | |
| Work experience | 13.09 | 12.70 | -0.39 | 7.06 | 5.62 | -1.44** | -1.05 |
| Age | 28.48 | 27.35 | -1.13* | 28.60 | 27.41 | -1.19** | -0.06 |
| Urban | 0.47 | 0.53 | 0.06 | 0.56 | 0.56 | 0.00 | -0.06 |
| Married | 0.51 | 0.49 | -0.02 | 0.49 | 0.41 | -0.08* | -0.06 |
| Household size | 4.70 | 4.54 | -0.16 | 4.28 | 4.27 | -0.01 | 0.15 |
| *Firm size* | | | | | | | |
| <10 workers | 0.62 | 0.73 | 0.11* | 0.44 | 0.43 | -0.01 | -0.12 |
| 10-99 workers | 0.17 | 0.18 | 0.01 | 0.25 | 0.26 | 0.01 | 0.00 |
| > 99 workers | 0.21 | 0.09 | -0.12* | 0.30 | 0.30 | 0.00 | 0.12* |
| *Industry* | | | | | | | |
| Manufacturing | 0.27 | 0.20 | -0.07 | 0.20 | 0.17 | -0.03 | 0.04 |
| Construction | 0.27 | 0.20 | -0.07 | 0.20 | 0.19 | -0.01 | 0.06 |
| Trade | 0.16 | 0.29 | 0.13* | 0.19 | 0.16 | -0.03 | -0.16** |
| Transportation | 0.15 | 0.14 | -0.01 | 0.10 | 0.09 | -0.01 | 0.00 |
| Finance and service | 0.15 | 0.16 | 0.01 | 0.31 | 0.40 | 0.09** | 0.08 |
| Number of observations | 150 | 79 | | 616 | 302 | | |

## Table A5: Propensity score matching first stage estimates

| | Probability to switch from informal to formal employment | | | | | |
|---|---|---|---|---|---|---|
| | 1998-2006 | | | 2006-2012 | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Variables | Whole sample | Low educated | High educated | Whole sample | Low educated | High educated |
| High educated | 0.609** | | | 0.656*** | | |
| | (0.261) | | | (0.136) | | |
| Work experience | -0.071** | -0.054 | -0.060 | -0.013 | -0.024 | -0.015 |
| | (0.026) | (0.039) | (0.042) | (0.014) | (0.025) | (0.018) |
| Age | 0.054* | -0.035 | 0.093** | 0.012 | 0.039 | 0.011 |
| | (0.028) | (0.054) | (0.037) | (0.015) | (0.027) | (0.019) |
| Urban | 0.465* | 0.468 | 0.602* | 0.527*** | 0.913*** | 0.436*** |
| | (0.248) | (0.364) | (0.358) | (0.113) | (0.281) | (0.130) |
| Married | 0.243 | 0.808* | (-0.006 | -0.401** | -0.462** | -0.358** |
| | (0.268) | (0.474) | (0.358) | (0.128) | (0.218) | (0.160) |
| Household size | -0.012 | -0.029 | 0.003 | -0.047* | -0.001 | -0.073** |
| | (0.035) | (0.055) | (0.049) | (0.024) | (0.042) | (0.029) |
| Number of Observations | 286 | 164 | 101 | 675 | 341 | 334 |

# Appendix B

## Egypt Labor Force Survey

We further use data from the annual Egypt Labor Force Survey (LFS) for the time period 2010-2014. The LFS is administered by the Central Agency for Public Mobilization and Statistics (CAPMAS) and aims to collect representative annual data on the Egyptian labor market. While the data does not have a longitudinal aspect, it is collected four times within each wave which gives a good chance to follow the changes in the labor market outcomes on a timely basis. LFS involves gathering detailed information on demographic characteristics (e.g. gender, age, education, etc.). More importantly, for the purpose of the study, it contains detailed information on employment status including information on informality (i.e., lack of contract). Following the same sample constraints as above (i.e., only males employed in non-agriculture sector, and aged between 20 and 60, etc.), we end up with a sample of 178,186 across the five waves. Table A1 in the Appendix shows the descriptive statistics.

**Table B1: Descriptive statistics, LFS**

| | (1) Overall Sample | | (2) Informal | | (3) Formal | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| Highly educated | 0.56 | 0.50 | 0.50 | 0.50 | 0.79 | 0.41 |
| Age | 34.97 | 10.16 | 34.83 | 10.25 | 35.59 | 9.74 |
| Urban | 0.52 | 0.50 | 0.49 | 0.50 | 0.65 | 0.48 |
| Married | 0.68 | 0.47 | 0.68 | 0.47 | 0.69 | 0.46 |
| Firm size | | | | | | |
| <10 workers | 0.87 | 0.47 | 0.94 | 0.49 | 0.59 | 0.27 |
| 10-99 workers | 0.08 | 0.27 | 0.05 | 0.23 | 0.18 | 0.39 |
| > 99 workers | 0.05 | 0.22 | 0.01 | 0.09 | 0.23 | 0.42 |
| Industry | | | | | | |
| Mining | 0.02 | 0.12 | 0.01 | 0.10 | 0.04 | 0.19 |
| Manufacturing | 0.18 | 0.38 | 0.13 | 0.34 | 0.36 | 0.48 |
| Electricity, gas and water supply | 0.08 | 0.28 | 0.09 | 0.29 | 0.06 | 0.24 |
| Construction | 0.24 | 0.43 | 0.28 | 0.45 | 0.08 | 0.27 |
| Wholesale and retail trade | 0.19 | 0.39 | 0.21 | 0.41 | 0.12 | 0.33 |
| Transportation and storage | 0.13 | 0.33 | 0.15 | 0.35 | 0.03 | 0.18 |
| Accommodation and food service | 0.05 | 0.21 | 0.04 | 0.19 | 0.07 | 0.26 |
| Information and communication | 0.01 | 0.11 | 0.01 | 0.09 | 0.03 | 0.17 |
| Financial and insurance activities | 0.00 | 0.06 | 0.00 | 0.02 | 0.02 | 0.12 |
| Real estate | 0.04 | 0.19 | 0.03 | 0.17 | 0.06 | 0.25 |
| Public administration and defense | 0.00 | 0.03 | 0.00 | 0.02 | 0.00 | 0.06 |
| Education | 0.01 | 0.08 | 0.00 | 0.04 | 0.03 | 0.16 |
| Health | 0.00 | 0.07 | 0.00 | 0.05 | 0.01 | 0.11 |
| Other | 0.05 | 0.19 | 0.04 | 0.20 | 0.05 | 0.16 |
| Num. of observations | 178,186 | | 143,770 | | 34,416 | |