

Women and political change: Evidence from the Egyptian revolution

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Abstract

We analyze the effects of the 2011 Egyptian revolution on the relative labor market conditions of women and men using panel information from the Egypt Labor Market Panel Survey (ELMPS). We construct our measure of intensity of the revolution – the governorate-level number of martyrs, i.e. demonstrators who died during the protests – using unique information from the Statistical Database of the Egyptian Revolution. We find that the revolution has reduced the gender gap in labor force participation, employment, and probability of working in the private sector, and it has caused an increase in women's probability of working in the informal sector. The political change has affected mostly the relative labor market outcomes of women in households at the bottom of the pre-revolution income distribution. We link these findings to the literature showing how a relevant temporary shock to the labor division between women and men can have long run consequences on the role of women in society.

Keywords: women empowerment, Egyptian revolution, labor market outcomes, martyrs

JEL codes: J16, J21, J22, J30.

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1. Introduction

Women empowerment has been central in the policy and academic debates in recent years. There is now a large consensus that empowering women may benefit economic development and is highly desirable for efficiency (see for instance Duflo, 2012 and United Nations, 2005). In the academic literature, a growing number of randomized experiments allow to shed light on the effects of programs that aim at improving the status of women in several domains (see Beaman, Duflo, Pande and Topalova, 2012; Duflo, Dupas and Kremer, 2012; Jensen, 2012; Beath, Christia and Enikopolov, 2013; Bandiera, Buehren, Burgess, Goldstein, Gulesci, Rasul and Sulaiman, 2014).

Still, in many countries in the world, women lag behind men for several education and labor market outcomes. This is particularly true in the Arab world, where several countries are also experiencing in recent years a wave of protests and revolution driven by the educated youth, known as the “Arab Spring”. In this paper, we focus on Egypt, where former presidents Hosni Mubarak and Mohamed Morsi were removed from power in February 2011 and July 2013, respectively. Egypt is also a country with a large segregation by gender. In the 1990s, with support of the IMF and the World Bank, Egypt implemented the Economic Reform and Structural adjustment Program, which has led to growing gender gaps partly because of the contraction of opportunities in the public sector, without concurrently providing opportunities for female new entrants in the non-governmental sectors (Assaad and Arntz, 2005). The United Nations (2013) documents that Egypt is ranked 77 out of 80 countries on the Gender Empowerment Measure and according to the World Economic Forum - Global Gender Gap Report (2013), 125 among 136 countries.

In this paper, we provide an empirical analysis of how the important and recent political changes in the Arab world are shaping the gender gap in labor market outcomes. To construct a measure of intensity of the Egyptian revolution, we exploit unique information on the number of martyrs, *i.e.* demonstrators who died during the protests. We also use data on labor market outcomes before and during the political unrest, from two waves (2006 and 2012) of the Egypt Labor Market Panel Survey (ELMPS). The panel structure of the data allows us to condition on unobserved heterogeneity.

In addition, our empirical strategy aims to address the possible endogeneity of the revolution variable, which arises because unobserved labor market shocks are likely to impact simultaneously the intensity of the revolution and individual labor market outcomes. Along these lines, Campante and Chor (2012) suggest, as important determinants of the instability of the Arab regimes, the combination of poor labor market prospects and recent expansion of education. To address the endogeneity of the revolution variable, we rely on the Instrumental Variable estimator, using the distance to Cairo City, Egypt’s capital, as an instrument for the number of martyrs during the revolution. Cairo, and in particular its well-known Tahrir Square, was the main center of mobilization of demonstrators and protesters during the revolution. The closer to the capital, the

greater was the mobilization and the higher was the probability of participation in demonstrations. This argument is in line with literature recognizing that participation in political activities is spatially or geographically clustered (Mutz, 2002; McClurg, 2003; Cho and Rudolph, 2008). We also conduct several checks of the validity of our instrument in terms of the exclusion restriction. Our first- and second-stage results hold and remain robust to the different checks.

Why do we expect the Arab Spring to change the relative position of women and men? There are several potential mechanisms through which the Egyptian revolution may affect women's labor market conditions and empowerment.

A first channel relates to one of the main determinants of the revolt: the increase in the unemployment of educated youth (see Campante and Chor, 2012), which implies a change in the importance of human capital in the economy. Related to this point, Doepke and Tertilt (2009) show theoretically that, when the importance of human capital in the economy increases – for instance as a consequence of technological progress - men might be willing to give more rights to women to ensure that their children's level of education is higher. In the context of the Arab world - which is different from the context that motivates the analysis of Doepke and Tertilt (2009) - there is evidence of a deterioration of the importance of human capital and, for Egypt, a decline in social mobility among educated youth, which started in the mid 1980s and is linked to a contraction in public sector employment (Binzel and Carvalho, 2013). This decrease in the importance of human capital might imply a larger gender gap if men consider their children's level of schooling less relevant and consequently are less likely to support women's empowerment.

A second channel may be related to the idea that political instability may negatively affect growth (see Alesina, Özler, Roubini and Swagel, 1996). If political turnover represents at least in the short run a negative income shock, then for the households that are close to the subsistence level, the negative shock would probably undermine the importance of cultural factors and attitudes towards female work: *i.e.*, in periods of recessions, the work of women might be encouraged if the households are close to the subsistence level, even if in normal economic conditions the labor market is highly segregated by gender. Were the households close to the subsistence level before the beginning of the political unrest? Campante and Chor (2012) present the results of a poll conducted by the International Republican Institute in Egypt shortly after the resignation of Hosni Mubarak: 64 percent of respondents who claimed that they had taken part in the recent protests cited "low living standards/lack of jobs" as their main motivation and 41 percent of the respondents answered that they "have trouble feeding [themselves] and [their] family and buying even the most essential things for survival" (see also International Republican Institute, 2011 and Campante and Chor, 2012 for more results of this poll).

A third channel might go through migration. Herbst (1990) highlights how in most areas in Africa, in the beginning of the 20th century, migration was the easiest option to express discontent with deteriorating economic and political conditions. Migration might influence the relative position of women and men in the labor market, for several reasons: having a household member who resides

in another country is associated to changes in the household size (Gibson, McKenzie and Stillman, 2011), in the relative number of women and men within a household, in foregone earnings of the family members who emigrated, and in the amount of remittances received by the members who are left behind (Sjaastad, 1962).

Finally, political unrest might change women's empowerment through changes in religious participation. For instance, Binzel and Carvalho (2013) theoretically present religion as a coping mechanism for unfulfilled aspirations and show how an unexpected decline in social mobility combined with inequality can produce a religious revival led by the educated middle class. Using data on the 1997 and 1998 Indonesian financial crisis, Chen (2010) demonstrates a causal effect of economic distress on religious intensity, measured using information on Koran study and Islamic school attendance. Chaney (2013) uses centuries of Nile flood data and shows an increase in the political power of religious leaders during periods of economic downturn. These three papers thus confirm that political unrest and the business cycle may affect religious participation, which in turn can influence women's empowerment. This is in line with the literature showing the relationship between religion and religious rules, on the one hand, and gender inequalities in several outcomes of interest, on the other hand (see Becker and Woessmann, 2008; Norton and Tomal, 2009; Cooray and Potrafke, 2011; Meyersson, 2014).

Our paper contributes to a growing literature on female labor force participation, most of it using data from the United States. Recent works document significant persistence over time of women's labor supply. This inertia may depend on the persistent nature of cultural beliefs and on historical determinants of social norms (see for instance, Alesina, Giuliano, and Nunn, 2013)

Despite this persistence, women labor supply can react to technological, economic, demographic and political shocks. From a conceptual point of view, in the presence of multiple labor market outcomes equilibria, these shocks may imply a shift from an equilibrium to another. With regard to the role of technological and medical changes, Greenwood, Seshadri and Yorukoglu (2005) analyze the role of the introduction of labor saving consumer durables - such as washing machines and vacuum cleaners - in the rise in married female labor force participation that occurred in the last century in the US. Albanesi and Olivetti (2014) show how several medical advances between 1930 and 1960 were essential for the rise in married women's labor force participation over this period, by enabling women to reconcile work and motherhood¹. Goldin and Katz (2002) present evidence for the impact of the birth control pill on young women's career decisions and on marriage rates in the US in the 1970s.

Economic changes as well play an important role in shaping the role of women in society. Fogli and Veldkamp (2011) document a gradual increase in female labor force, after that the shift from an agricultural to an industrial economy separated the location of home and work. Ager, Brückner and

¹ Among the main medical advances of the period of their study, Albanesi and Olivetti (2014) list the introduction of sulfonamides, medicalization and hospitalization of childbirth, availability of pre-natal care and the introduction of blood banking.

Herz (2014) analyze the role of negative agricultural shocks on labor supply by gender, in the beginning of the 1890s in counties located in the Cotton Belt of the American South.

Other related literature investigates how demographic shocks can shape women's participation in the labor force. Within the African continent, Teso (2014) exploits the demographic shock caused by the trans-Atlantic slave trade between the fifteenth and the nineteenth century. This shock led to a shortage of men, to the emergence of abnormal sex ratios in the remaining African population, and a change in the role of women in these regions. Given the shortage of men, women substituted them in the activities men used to perform. Grosjean and Khattar (2014) analyze the long-term consequences of a British policy to send convicts to Australia in the late 18th and 19th century. Among convicts, men far outnumbered women by a ratio of 6 to 1. Today, people living in areas with high past gender imbalances associated to this policy have more conservative attitudes towards women working. Moreover, women residing in these areas are less likely to have high-ranking occupations.

In several contexts, demographic imbalances may arise from political shocks. Goldin (1991) analyzes the impact of World War II on women's labor force participation. A husband's absence during the war implied that his wife had less to do at home and that their household experienced a considerable drop in labor income. Goldin's (1991) estimates suggest that a little over half of the women who entered the labor market during the war years exited by 1950. Acemoglu, Autor and Lyle (2004) use World War II as a source of exogenous variation in female labor supply to study its effects on the wage structure.

We complement this literature on shocks and female labor force participation by analyzing the effect of a recent and very relevant political shock, the Arab Spring, on the relative position of women in the labor market. Even if the available data on Egypt allow to analyze the short-term labor market impacts only, the implicit mechanism at play in several works we cite above is likely to be present in the context of today's wave of protests in the Arab world: a relevant temporary shock to the labor division between men and women can have long run consequences as cultural norms about the appropriate role of women vary. Related to this point, Goldin and Olivetti (2013) show that the shock associated to World War II had a persistent impact on labor market outcomes of higher educated women in the US. These findings are also consistent with a dynamic pattern proposed theoretically by Hazan and Maoz (2002). In their model, a woman's employment outside her home may initially have a direct negative effect on her household's utility. An increase in women's labor force participation in a certain period decreases the utility loss for women who work outside the household in the following period. This brings a virtuous cycle of increases in women's labor force participation.

Our estimates show that women's labor force participation in the aftermath of the Egyptian revolution has increased, especially for those households belonging to the lowest two quartiles of the pre-revolution distribution of income per capita. This increase in labor force participation is partly explained by an increase in women's unemployment, with the most educated women being

more likely to fall in the unemployment category. Our results also show a reduction of the gender gap in labor force participation, employment and probability of working in the private sector. Furthermore, the revolution increases women's probability of working in the informal sector. Our estimates suggest that the recent waves of protests have negatively affected men's remuneration, both the level and the volatility of the income flows. In other words, the revolution has been associated with a reduction in men's hourly wages as well as an increase in income volatility, using a conventional risk measure. These findings are compatible with a framework of intra-household risk sharing where women tend to increase their labor force participation to face the increased risk and the instability of men's income flows.

The rest of this paper is organized as follows. Section 2 presents information on the Egyptian revolution and martyrs. Section 3 provides a description of the data. Section 4 presents the empirical strategy. Section 5 presents the results and discusses the mechanisms. Section 6 presents some robustness checks. Section 7 briefly concludes.

2. Information background: The Egyptian revolution and the martyrs

The first wave of the Egyptian revolution began on the 25th of January 2011. Youth activists, workers and football fans rallied against Mubarak government, participating to a protest that represents one of the biggest revolutionary movements in recent years (The Guardian, 2011). The Egyptian revolution was a people-led political mobilization, positioned among a series of Arab Spring uprisings that started in Tunisia and spread rapidly to the Middle East. Protests in Egypt unfolded in the country's two major cities Cairo and Alexandria, with millions rushing to the streets after a few days of the first protest (Beissinger, Jamal, and Mazur, 2012). Crowds filled Tahrir, or Liberation, Square, and spilled into nearby streets. Protestors also came from rural provinces in the Nile Delta (CNN, 2011).

Demonstrators were taking to the streets in several countries in the Arab World, to protest against their respective authoritarian regimes. After a few weeks of mass demonstrations, Ben Ali in Tunisia and Mubarak in Egypt were forced to resign, putting an end to two longstanding autocratic regimes in the region. Inspired by the Tunisian and Egyptian revolutions, several Arab countries, Jordan, Bahrain, Libya, Syria, Iraq, Lebanon, Morocco and Saudi Arabia, have witnessed similar revolutionary movements with varying levels of intensity (Beissinger, Jamal, and Mazur, 2012; Moaddel, 2012).

Egyptian protests' participants tended to be overwhelming male, composed disproportionately from the middle class, with above average educational levels, drawn from middle occupational and income profiles and heavily networked. More precisely, according to the Arab Barometer Study conducted in Egypt in July 2011, 77% of demonstrators were male, 46% had the highest level of education (university and above) and 49% were internet users as opposed to only 18% for the population as a whole. These revolutionaries were motivated primarily by economic reasons and to a lesser extent by political and civil freedoms (Beissinger, Jamal, and Mazur, 2012).

The spark that ignited the Egyptian revolution was mainly the death of a 28 years old man, called Khalid Said, who died after an encounter with the Egyptian Police in Alexandria (New York Times, 2010). Shortly after his death, his story was spread all over blogs, websites and social media, evidencing the major role played by the internet as medium of communication and a coordination tool used by protestors during the revolution (Beissinger, Jamal, and Mazur, 2012; Moaddel, 2012). The representation of Khalid Said as a victim of the regime did not last long. All at once, he became a hero and an incubator of the Egyptian revolution. The public protests started in the aftermath of his murder in Egypt's streets, where people were holding posters and banners with Khalid Said photographs. These events built up to trigger the Egyptian revolution in January 2011 (Buckner and Khatib, 2014).

Many more Egyptian demonstrators died during the protests. These "martyrs" played a central role and were an indisputable catalyst in the onset of the Egyptian revolution, invoking moral outrage and creating a self-fulfilling movement of mobilization against the government. This is similar to what happened in Tunisia and Syria, with Mohamed Bouazizi and Hamza Al-Khatib being examples of demonstrators who died during the protests, and whose deaths became a catalyst for the revolution in their countries (Buckner and Khatib, 2014).

It is important to mention that this portrayal of the martyrs in the Arab Spring uprisings is very different from the standard definition of martyrs who self-sacrifice themselves for their religious beliefs and faith. As Buckner and Khatib (2014) argument, the martyr in the context of the Arab Spring has been attached not only to those who chose martyrdom, or those who were victims of larger quasi-religious political battles, but also to those who died at the hands of their own states in pursuit of universal human values, such as the right to work and freedom of expression.

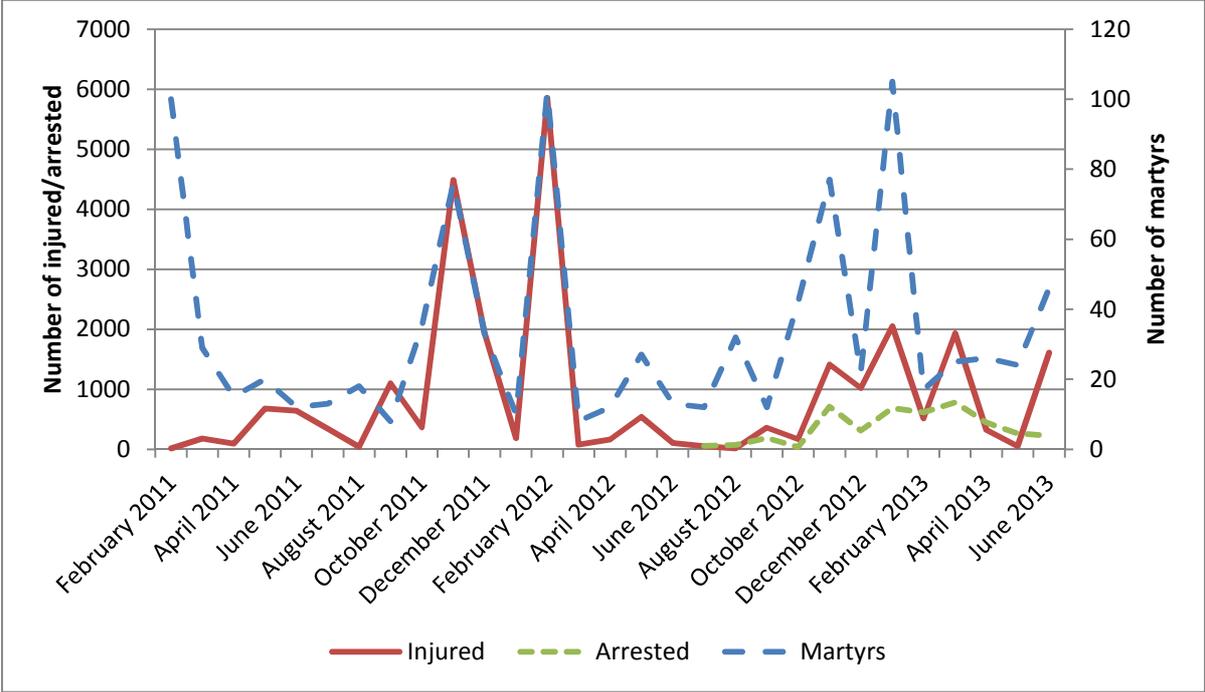
2.1 Stylized facts on the intensity of the revolution

Protestors engaging in a revolutionary movement are not only committed in terms of time and resources, but they also acknowledge the probability of occurrence of certain risks, including arrest, injury or even death (Moaddel, 2012). Hence, the number of "martyrs" – *i.e.* demonstrators who died during the protests - represents a central measure of the intensity of the revolution and is quite correlated with a number of other indicators of the revolution.

Figure 1 displays the number of martyrs and injured from February 2011, after Mubarak stepped down and the Supreme Council of the Armed Forces (SCAF) took power in Egypt in the name of the military on the 11th of February 2011, till June 2013, the end of former president Mohamed Morsi's one year of rule. The number of arrested is also displayed during Mohamed Morsi's rule, from July 2012 till June 2013. As shown, these measures of the intensity of the revolution are closely correlated and follow the same patterns. The first sharp trend shift in November 2011 corresponds to Mohamed Mahmoud Street's deadly clashes, which lasted for 5 days from 19th of November to the 24th of November. It was a street massacre that broke out between protesters and Central Security Forces (CSF), as protests took place in Mohamed Mahmoud Street in response to CSF's attack on a sit-in in Tahrir Square. The CSF dispersed demonstrators using birdshot, tear gas, rubber

and live bullets. A concrete wall was installed in the street to prevent the protesters from reaching the Ministry of Interior building (Le Monde, 2011). The second sharp shift in February 2012 corresponds to a street battle between protesters and the police, near Egypt’s Ministry of Interior, triggered by the deaths in Port Said Stadium riot, the country’s worst soccer disaster. Demonstrators were condemning the death of soccer fans at the Port Said Stadium and were holding the military-led authorities accountable for the deaths (The Guardian, 2012). Trend shifts in November 2012 and January 2013 correspond to clashes between civilians and the police in the anniversaries of Mohamed Mahmoud Street’s massacre and the 25th of January revolution, respectively.

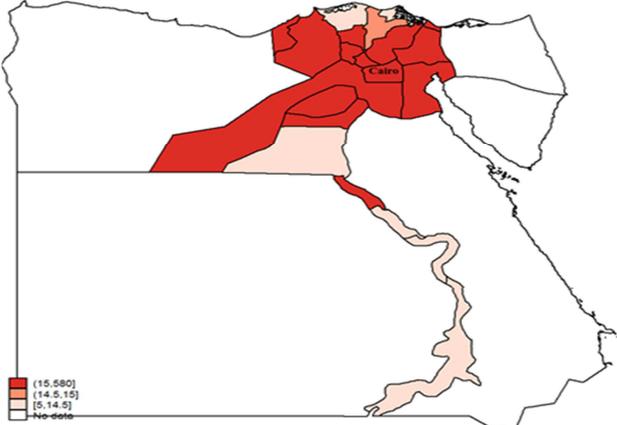
Figure 1. The numbers of martyrs, injured and arrested from February 2011 to June 2013



Notes: Data source is the Statistical Database of the Egyptian Revolution.

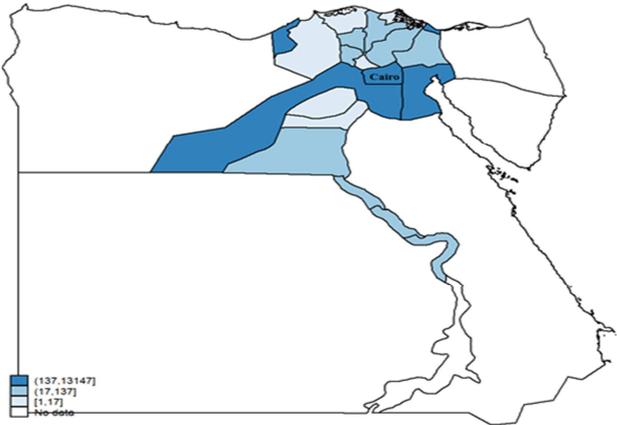
Figures 2, 3 and 4, display the geographical distribution of the martyrs from January 2011 to June 2012, the injured from February 2011 to June 2012 and the arrested from July 2013 to May 2014. Cairo - in particular Tahrir Square - was the main center of mobilization of demonstrators and protesters during the first 18 days of the revolution and the second wave of revolution. The figures show a greater number of martyrs, injured and arrested in Cairo and its neighboring governorates.

Figure 2. Geographical distribution of martyrs from January 2011 till June 2012



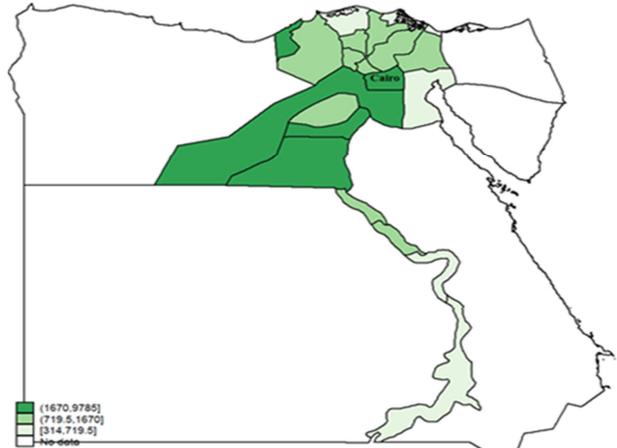
Notes: Data source is the Statistical Database of the Egyptian Revolution.²

Figure 3. Geographical distribution of the injured from February 2011 till June 2012



Notes: Data Source is the Statistical Database of the Egyptian Revolution.

Figure 4. Geographical distribution of the arrested from July 2013 to May 2014



Notes: Data source is the Statistical Database of the Egyptian Revolution

² The five Border Governorates are Matruh, New Valley, Red Sea, North and South Sinai. They are not included in our sample since they are not covered by the Egypt Labor Market Panel Survey we are using in the empirical analysis. According to Minnesota Population Center, 2011, these border governorates, contain no more that 2% of the Egyptian population in 2006.

3. Data

The empirical analysis relies on data from the Egypt Labor Market Panel Survey (ELMPS), a nationally representative panel survey. The ELMPS, as a typical labor force survey covers topics such as employment, unemployment and earnings. Additionally, it provides very rich information on job dynamics, saving and borrowing behavior, migration, remittance-recipient, parental background, education, entrepreneurial activities, fertility choices, women's status and decision-making (Assaad and Krafft, 2013).

The ELMPS is carried out by the Economic Research Forum (ERF) in cooperation with Egypt's Central Agency for Public Mobilization and Statistics (CAPMAS) since 1998. It has been administered to nationally representative samples in 1998, 2006 and 2012.³ Hence, the ELMPS 2012 is the third round of this periodic longitudinal survey.

We take advantage of an important feature of the Egypt Labor Market Panel Survey (ELMPS), the fact of being carried out before and after the revolution. At the time we write, there is no available information on labor market outcomes after the revolution for the other countries that participated to the Arab Spring. We use the panel dimension and mainly focus on the 2006 and 2012 rounds, allowing us to observe individuals' labor market outcomes before and after the revolution, as the fieldwork of the 2012 round took place from March 1, 2012 to June 10, 2012, more than a year after the revolution. Of the total 37,140 individuals interviewed in 2006, 28,679 individuals were successfully re-interviewed in 2012. We particularly focus on working-age individuals in the two-rounds, aged 15 to 64 years old. Descriptive statistics on individuals' and households' pre and post revolution characteristics are reported in Table 1.

Given that we are matching households and individuals across survey rounds, two types of attrition can potentially arise: the first one is linked to the inability to track an entire household interviewed in 2006 while the second one is linked to the inability to track a split household (a single or multiple individuals who left the original household either alone or with additional individuals who may have joined them later), when the original household can be tracked. Type-1 attrition rates are 17.3% at the household level and 14.2% at the individual level, while type-2 attrition rate is 30.3%. To correct for the possible biases that could result from these two types of attrition, we use panel weights between 2006 and 2012.⁴

One of the main novelties of this paper is the use of a unique dataset that to our knowledge has not been exploited in economic research yet: the Statistical Database of the Egyptian Revolution, administered by the Egyptian Center for Economic and Social Rights. This dataset documents all the events, including fatalities, injured, arrested and prosecuted during the period of the Egyptian revolution as a result of political and social changes. The data is collected during the first eighteen days of the revolution from 25th of January 2011 to the 11th of February 2011, during the rule of

³ See Assaad and Barsoum (2000), Assaad (2002), Barsoum (2009) and Assaad (2009) for additional information on the survey.

⁴ See Assaad and Krafft (2013) for a detailed discussion on sample attrition and the construction of the panel weights.

Supreme Council of the Armed Forces (SCAF) from the 11th of February 2011 to June 2012, during former president Mohamed Morsi's rule from July?

Table 1: Descriptive statistics on individuals' and households' characteristics

VARIABLES	Observations	2006		Observations	2012	
		Mean	St. Dev.		Mean	St. Dev.
<i>Individual level controls</i>						
Ever-married	12,434	0.727	0.445	12,434	0.831	0.375
No educational degree	12,434	0.311	0.463	12,434	0.305	0.460
Primary/preparatory education	12,434	0.193	0.395	12,434	0.151	0.358
Secondary education	12,434	0.338	0.473	12,434	0.340	0.474
Above secondary education	12,434	0.158	0.364	12,434	0.204	0.403
<i>Household level controls</i>						
Rural	4,870	0.488	0.500	5,953	0.505	0.500
Male headed	4,870	0.882	0.323	5,953	0.889	0.314
Log of per capita hh income	4,870	3.673	2.991	5,953	3.380	3.067
Household size	4,870	4.836	2.173	5,953	4.449	1.843
Number of adults 15-64 years old	4,870	2.916	1.433	5,953	2.535	1.394
Land ownership	4,870	0.174	0.379	5,953	0.113	0.316
<i>Household head characteristics</i>						
Single indicator	4,870	0.0183	0.134	5,953	0.007	0.085
No educational degree	4,870	0.387	0.487	5,953	0.317	0.465
Primary/preparatory education	4,870	0.160	0.366	5,953	0.169	0.375
Secondary education	4,870	0.260	0.439	5,953	0.305	0.460
Above secondary education	4,870	0.194	0.395	5,953	0.209	0.407
Not working	4,870	0.093	0.290	5,953	0.145	0.352
Low skilled blue collar occupation	4,870	0.099	0.299	5,953	0.158	0.365
High skilled blue collar occupation	4,870	0.340	0.474	5,953	0.295	0.456
Low skilled white collar occupation	4,870	0.156	0.363	5,953	0.111	0.314
High skilled white collar occupation	4,870	0.311	0.463	5,953	0.291	0.454
<i>Measures of the intensity of the revolution</i>						
Number of martyrs	22	0.627	1.196			
Number of injured	21	7.946	28.54			
Number of arrested	22	2.234	5.935			
<i>Pre-revolution governorate controls</i>						
Share of public sector	22	0.161	0.037			
Number of police stations	22	0.061	0.045			
Mean youth education	22	10.330	0.848			
Population density	22	0.815	0.885			
Log of real GDP per capita	22	8.669	0.111			
Fully urban governorate	22	0.182	0.395			

Notes. All reported descriptive statistics refer to sample individuals' and households' pre-revolution characteristics in 2006 as well in 2012. Different number of households in 2006 and 2012, emerge from the fact we have a number of split households in 2012. A split household is composed from a single or multiple individuals who left the original household either alone or with additional individuals who may have joined them later. Individual level controls include a dummy

variable for ever-married status, four dummies for educational attainment: no education either illiterate or literate without any diploma, primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. Household level controls include a rural dummy, an indicator for male headed households, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership. Household head characteristics include: an indicator for the head's marital status is single, four dummies for the head of the household's educational attainment and five dummies for the head of the household's occupation according to the ISCO-88 occupation classification, not working, low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). Governorate level controls are summarized by governorate. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. The number of injured during the revolution is from the 11th of February 2011 to the end of June 2012, by governorate and is expressed in hundreds. The number of arrested is reported from July 2012 to June 2013, by governorate and is expressed in hundreds. Share of public sector represents the share of public sector employment by governorate in 2006. Police stations represent the number of police stations by governorate per 10,000 inhabitants. Mean youth education represents the average number of years of schooling for individuals aged 15-30, by governorate in 2006. Population density is equal to the total population by governorate divided by the total land area in km², divided by 1000. The log of real GDP per capita is reported for 2005/2006 by governorate. Fully urban governorate is a dummy variable for the following governorates: Cairo, Alexandria, Suez and Port Said.

2012 till June 2013 and lastly, most recent data covers the period from July 2013 to May 2014. These individual level data were collected on a daily basis. They document the names of the martyrs, the injured and the arrested, their place of residence, their occupation, their marital status, their date of birth, the type of incident leading to the death, injury or arrest, the governorate where the incident took place, as well as other relevant data for documentation purposes.

Descriptive statistics for all outcome variables are provided for the estimation sample and by gender in Table 2. One important aspect is that female labor force participation has remained low in Egypt, around 30% in 2006 for the working-age women in our sample. This reflects the fact that even though women have become much more educated over the past decades, relatively few engage in any kind of market work. In addition, the descriptive statistics show higher incidence of unemployment and non-wage work in 2006 among females compared to males. To a large extent, this segregation of the labor market by gender was due to the decline in government sector employment over the past two decades (Assaad and Barsoum, 2009). In line with the shrinking of the public sector, in 2006, women engage more in the private sector employment compared to the public sector. Interestingly, women in our sample work in both formal and informal sectors, with similar incidences. By contrast, men seem to undertake more jobs in the informal sector compared to the formal sector. In terms of weekly working hours, conditional on being employed, Table 2 shows greater labor supply for men compared to women. However, it seems that between the two rounds of the survey women who are employed tend to increase their labor supply, while men decrease the hours of work per week.

4. Empirics

4.1. Empirical strategy and regression specification

We investigate the impact of the Egyptian revolution on the relative position of women in the labor market by estimating the following Difference-In-Differences specification, where we allow gender to be an important dimension of heterogeneity of the treatment effect⁵:

$$1. Y_{igt} = \alpha_1 \text{martyrs}_g \times 2012_t \times \text{female}_i + \alpha_2 \text{martyrs}_g \times 2012_t + \alpha_3 \text{martyrs}_g \times \text{female}_i + \alpha_4 2012_t \times \text{female}_i + \alpha_5 X_{it} + \beta_i + \beta_g + 2012_t + \varepsilon_{igt}$$

where *martyrs* - our treatment variable - is a measure of the intensity of the revolution: the governorate-level number of martyrs from January 2011 to June 2012; *2012* is a dummy variable equal to 1 in 2012 (after the beginning of the revolution), 0 in 2006 (before revolution). To answer our research question, we compare the outcomes of women with those of men, by including interaction terms with the *female* dummy variable. β_i , β_g and 2012_t are respectively individual, district and year fixed effects. The two first fixed effects absorb the non-interacted terms *female* and *martyrs*. The identifying assumption is that unobserved differences between governorates with varying levels of intensity of the revolution are the same over time, the parallel trend assumption. Descriptive statistics on the spatial distribution of the martyrs during the Egyptian revolution are presented in the Online Appendix Table 1, for the first eighteen days of the revolution and for the subsequent period, from the 12th of February 2011 till the end of June 2012.

The vector X contains individual and household variables⁶. Individual controls include a dummy variable for ever-married status, three dummies for educational attainment: primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no-educational degree either illiterate or literate without any diploma. Household controls include a rural dummy, an indicator for male headed households, the natural log of per capita household income, a dummy variable for land ownership, household size, number of adults who are 15-64 years old, an indicator for the head's marital status being single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification, low-skilled blue collar, high skilled blue collar, low skilled white collar, high skilled white collar. The reference category is the not working category.

The coefficient of interest is the parameter α_1 : it allows identifying the differential effect of the revolution by gender, *i.e.* how the Arab Spring in Egypt affects the gender gap for several outcomes

⁵ We do not denote Equation 1 as a Difference-in-Difference-in-Differences specification, because we expect the revolution to affect the labor market outcomes of men as well.

⁶ For sake of brevity, in the notation of Equations 1 and 2 we only include individual controls (X_i), while in the regressions we also condition on household controls (X_j) and pre-revolution governorate characteristics.

of interest. α_2 quantifies the effect of the revolution on men's labor market outcomes, while $\alpha_1 + \alpha_2$ represents the effect on women's outcomes.

For each individual in the sample, we have information for two time periods, $t=2006$ and 2012 . Taking the first difference of both left and right-hand side, we can transform Equation 1 as follows⁷:

$$2. \Delta Y_{ig} = \alpha_1 \text{martyrs}_g \times \text{female}_i + \alpha_2 \text{martyrs}_g + \alpha_4 \text{female}_i + \alpha_5 \Delta X_i + \beta_0 + u_{ig}$$

The dependent variable in Equation 2 represents the change in an outcome of interest between 2012 and 2006.⁸ Similarly to Equation 1, the specification in Equation 2 allows to control for all time-invariant individual characteristics. While estimating the latter equation it is not possible to identify the coefficient α_3 , we can still estimate the coefficient of interest - α_1 - which is the parameter associated to the variable $\text{martyrs}_g \times 2012_t \times \text{female}_i$ in Equation 1 and to $\text{martyrs}_g \times \text{female}_i$ in Equation 2. β_0 is the constant term: it accounts for the average change in outcomes between the two waves of the survey across all individuals in the sample. Including β_0 is equivalent to add a year fixed effect in a regression where the dependent variables are expressed in levels⁹.

⁷ The advantage of estimating Equation 2 is that it allows identifying the coefficient of interest α_1 , with a more parsimonious specification for the IV regressions, with two endogenous regressors rather than three. The Online Appendix Table 2 shows that results are qualitatively similar when we estimate Equation 1 using OLS specification, for labor force participation, unemployment and employment. Because the time periods are 2 (2006 and 2012), the first-difference transformation does not create issues of serial correlation of the error term.

⁸ Outcomes of interest are either categorical or continuous variables. Some dependent variables takes the values -1, 0, 1, from first differencing dummy variables like labor force participation, employment and unemployment. For these categorical variables, we have also tried to estimate equation (2) using IV Ordered Probit model by fitting an observed recursive mixed process model (cmp command in STATA developed by Roodman, 2011). The results are consistent with the 2SLS estimations (See the Online Appendix Table 3).

⁹ In Equation 1, the year fixed effect is 2012.

Table 2: Descriptive statistics on outcome variables (estimation sample)

VARIABLES	All sample				Females				Males			
	<i>Initial mean of outcome</i>	<i>Std. Dev.</i>	<i>Mean of change in outcome</i>	<i>Std. Dev.</i>	<i>Initial mean of outcome</i>	<i>Std. Dev.</i>	<i>Mean of change in outcome</i>	<i>Std. Dev.</i>	<i>Initial mean of outcome</i>	<i>Std. Dev.</i>	<i>Mean of change in outcome</i>	<i>Std. Dev.</i>
Labor force participation	0.583	0.493	0.048	0.459	0.293	0.455	0.000	0.498	0.817	0.386	0.086	0.420
Unemployment	0.041	0.198	0.005	0.273	0.051	0.219	0.014	0.306	0.033	0.178	-0.002	0.243
Employment	0.542	0.498	0.043	0.443	0.243	0.429	-0.013	0.428	0.785	0.411	0.088	0.449
Wage work	0.348	0.476	0.070	0.449	0.129	0.335	0.026	0.271	0.525	0.499	0.106	0.551
Employer/ Self-employed	0.134	0.340	-0.004	0.338	0.043	0.203	-0.016	0.229	0.207	0.405	0.005	0.406
Unpaid family work	0.154	0.361	-0.060	0.372	0.273	0.446	-0.101	0.475	0.057	0.233	-0.027	0.256
Formal sector employment	0.221	0.415	0.023	0.317	0.111	0.315	0.016	0.217	0.321	0.467	0.032	0.402
Informal sector employment	0.274	0.446	-0.008	0.399	0.107	0.309	-0.058	0.306	0.427	0.495	0.048	0.478
Public sector employment	0.182	0.386	0.0113	0.287	0.108	0.311	0.014	0.212	0.241	0.428	0.009	0.336
Private sector employment	0.360	0.480	0.031	0.441	0.134	0.341	-0.029	0.385	0.543	0.498	0.079	0.476
Log of real hourly wage	0.829	0.791	0.188	0.896	1.041	1.030	0.012	1.070	0.787	0.727	0.223	0.853
Log of real monthly wage	3.889	2.980	1.111	2.318	3.133	3.021	0.350	1.137	4.078	2.939	1.240	2.440
Hours of work/week	46.640	18.030	-1.370	19.630	30.120	17.750	4.323	18.550	50.790	15.560	-2.290	19.650

Notes. Labor force participation, unemployment and employment are defined according to the current work status, reference 3 months, excluding subsistence workers (market definition). Wage work, employer, self-employed and unpaid family work are defined according to the current work status in primary job, reference 3 months. Formal and informal sectors employment are defined according to the incidence of work contract and social security in primary job, reference 3 months. Public and private sectors employment are defined according to the economic sector of primary job, reference 1 week. Monthly and hourly wages are calculated in constant 2006 Egyptian Pounds and refer to the monthly/hourly wage in primary job, conditional on being employed, in log specification. The hours of work refers to the current number of work hours per week, excluding subsistence work (market definition) and conditional on being employed. Initial mean of outcome refers to the mean in 2006. Mean of change in outcome refers to the mean of the first-differenced variable between 2012 & 2006. Descriptive statistics reported are calculated from the estimation sample of individuals.

4.2. IV approach: Check of the validity of the instruments

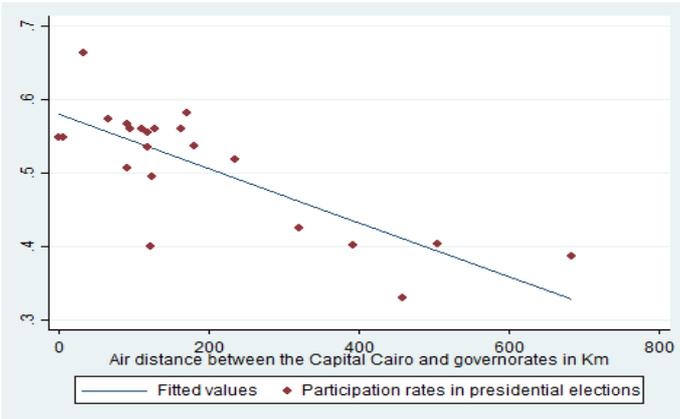
Our empirical strategy (see equation 1 and its first-differenced equivalent equation 2) relies on Difference-in-Differences estimation, which we combine to an IV approach. The specification allows for heterogeneity of the treatment effects by gender. There are several reasons why in Equation 2 the intensity of revolution (and therefore the interaction term *martyrs x female*) is endogenous. First, the number of martyrs might provide a measure with error of the intensity of revolution, implying attenuation bias for the estimated coefficient of interest α_1 . Second, unobserved time-varying labor market shocks at the governorate-level might influence simultaneously individual labor market outcomes and the intensity of the revolution, which was mainly driven by poor labor market prospects for the educated youth (Campante and Chor, 2012). To address the potential endogeneity of the revolution variable, we use the distance to Cairo City, Egypt's capital, as an instrument for the number of martyrs during the revolution. More precisely, we interact the distance to the capital with the *female* dummy variable, and use *distance to Cairo* and the interaction term *distance to Cairo x female* as instruments for *martyrs* and *martyrs x female* in Equation 2. Cairo, and in particular its well-known Tahrir Square, was the main center of mobilization of demonstrators and protesters during the revolution. The closer to the capital, the greater was the mobilization and the higher was the probability of participation in demonstrations.

Apart from the role of individual-level attributes, such as education, income, gender, civic associations' engagement, identified in the literature as determinants of political participation (Rosenstone and Hansen, 1993), a growing literature recognizes that political participation is spatially or geographically clustered (Mutz, 2002; McClurg, 2003; Cho and Rudolph, 2008). Individuals are more likely to participate in political activities if people around them are likely to participate. The literature provides various explanations and channels underlying these effects but, despite the growing recognition of the hypothesis of spatial clustering, lacks consensus regarding the specific mechanism operating. The literature suggests four alternative theoretical mechanisms to explain the geographical clustering of political participation: self-selection, elite-driven processes, social interaction and casual observation (Cho and Rudolph, 2008). The first channel relates to the fact that people make residential choices based on individual-level criteria. In other words, similar like-minded individuals choose to live next to each other. Hence, the spatial clustering observed is influenced by personal traits of similar individuals. The second mechanism suggests that political elites target certain geographical region to mobilize the mass. Accordingly, observed spatial patterns might simply be driven by elite-driven mobilization processes. The third channel operates through social interaction; individuals value political information that they seem to acquire through social networks and interactions within their social environment. Thus, as this social learning process diffuses similar patterns of political engagement arise within an individual's social environment. The last mechanism operates through casual observation. According to Cho and Rudolph (2008), individuals detect signals about the prevailing norms and political preferences of the local community by observation and subsequently, spatial proximity shapes their political participation through this channel, even if all the contextual effects are controlled for.

Following these theoretical works, the distance to the Capital Cairo is meant to capture this geographical/spatial clustering in political participation. Our identification strategy therefore relies on a theory of diffusion or contagion, as the one proposed by Cho and Rudolph (2008) who examine the spatial structure of political participation in the US. They suggest a diffusion process that begins at a core and spreads to neighboring areas. This approach fits perfectly the participation patterns of the demonstrations observed during the Egyptian revolution; protests starting at a core, the Capital Cairo, unfold and propagate gradually to the other governorates. We report two extracts from an international press article, which describe the effects of spatial clustering and diffusion of political activities: "Authorities shut down all roads and public transportation to Cairo, security officials said. Train services nationwide were suspended for a second day and all bus services between cities were halted"; "The crowds - determined but peaceful - filled Tahrir, or Liberation, Square and spilled into nearby streets, among them people defying a government transportation shutdown to make their way from rural provinces in the Nile Delta" (see CNN, 2011).

To provide additional evidence on the reason why our instrumental variable is correlated with the endogenous regressor, in Figure 5, we present a two-way scatter plot between the participation rates in the second round of the Presidential elections of June 2012 and the distance to the Capital Cairo. The participation rates in the presidential elections are negatively correlated with the distance to the Capital Cairo. Our instrumental variable, the distance to the Capital Cairo, is negatively correlated with the political mobilization. Residents in Cairo and neighboring governorates are more likely to participate in the demonstrations and to participate in elections. For all IV specifications, we report the first stage Kleibergen-Paap rk Wald F-statistics, which show that in all instrumental variables regressions our instruments are well correlated with the endogenous regressors.

Figure 5. Participation in the presidential elections and the distance to the Capital Cairo.



Notes. Data source is the official website of the Egyptian Presidential elections. On the vertical axis, we plot the participation rates in the second round of Presidential elections between Mohamed Morsi and Ahmed Shafik, in June 2012. Participation rates are calculated as the ratio between the numbers of valid and invalid/spoilt votes with respect to the total number of enrolled voters by governorate. On the horizontal axis, we plot the air distance between the Capital Cairo and Egyptian governorates in Km. We show a scatter plot for the 22 Egyptian governorates in our dataset as well as a fitted line from regressing the participation rates in the Presidential elections of June 2012 on the distance to the Capital Cairo.

To ensure that the distance to the capital only affects labor market outcomes through its impact on the political shock, we condition on several pre-revolution (2006) governorate characteristics. For instance, a potential threat to the validity of our instrumental variable strategy is that most public employment opportunities are in (or close to) Cairo city. This may represent a problem because in Egypt the contraction in public sector employment over the past two decades is associated to the decline in social mobility among educated Egyptian youth (Binzel and Carvalho, 2013), and therefore is a potential determinant of our main explanatory variable, *i.e.* political unrest. To avoid that our IV findings are simply driven by distance to the capital proxying public sector employment opportunities, in some specifications we condition on the share of public sector employment in 2006 by governorate and its interaction term with the *female* dummy variable.

Another potential concern of the IV strategy is that the capital represents the area with the highest number of police stations. This implies a higher probability for a protester to have a clash with the police. Moreover, the police stations might be located in areas where public sector employment opportunities are relatively higher. As additional control in some regressions, we include the number of police stations at the governorate level per 10,000 inhabitants and its interaction with *female*.

The capital might as well attract the educated youth. As advocated by Lipset (1959), education is also a key determinant of democratic values. In this context, the most educated are believed to be more concerned about politics, to have greater capabilities to understand societal issues and hence, to be more likely to participate in protest activism. Inglehart (1990) also highlights cohort shifts in societies undergoing modernization. Explicitly, the youth will hold more modern, democratic and universal worldviews. Therefore we have also checked the robustness of our results to the addition of the average level of education for individuals aged 15 to 30 years old, by governorate and for the year 2006, and its interaction term with *female*. This is important because the average education level of young people might simultaneously affect the intensity of the revolution – most of the protesters being young and relatively well educated – and individual labor market outcomes, through human capital externalities and the association between average education and returns to human capital.

Moreover, distance to Cairo might simply capture the degree of centrality and closeness to the core of the Egyptian economy. This represents an additional potential threat to the validity of the instrumental variable because distance to the capital could therefore explain the overall dynamics of the labor market and population. To address this potential issue, in some specifications we add as controls the log of GDP per capita in 2006 and the total population density in 2006 and their interaction terms with *female*.

In addition, distance to Cairo might encompass rural and urban dynamics. Living in urban areas promotes political participation as it captures access to more resources and information compared to remote or rural areas (Moaddel, 1993). One could also expect it to be correlated with labor

market dynamics. Therefore, we also include in some specifications, a fully urban governorate dummy and its interaction term with *female*.

In Table 3, we report first stage regressions where we use the distance to the Capital Cairo and its interaction term with the female dummy to instrument the governorate level number of martyrs and its interaction term with the female dummy. In columns 1 and 2, we condition on individual and household characteristics, while in columns 3 and 4, we also include the pre-revolution governorate controls discussed earlier. As we might expect, the distance to the Capital Cairo is highly correlated with the intensity of the revolution, proxied by the governorate level number of martyrs. The greater the distance to the Capital, the less is the number of martyrs. Relying on the estimated coefficient in column 3, when we condition on individual, household and pre-revolution governorate controls, we find that a 3 km increase in the distance to the Capital Cairo reduces the number of martyrs by one martyr.¹⁰

In Table 4, we present Egyptian governorates characteristics by the intensity of the revolution. An identifying assumption for the difference-in-difference approach is the parallel trend assumption. It states that governorates exposed to a higher intensity of the revolution would follow the same trend over time as governorates witnessing a lower intensity of the revolution, in the absence of the treatment. We check whether governorates with above median number of martyrs differ along a number of pre-revolution characteristics from governorates with below median number of martyrs. Governorates exposed to a higher intensity of the revolution are found to have a higher share of public sector employment and are more likely to be urban, compared to governorates exposed to a lower intensity of the revolution. Apart from these two characteristics, the two groups do not exert any significant differences along the other dimensions such as population density, real GDP/capita, the average number of years of schooling for the youth population and the number of police stations. We capture these differences in governorates' characteristics by conditioning on these pre-revolution governorate controls.

Governorates with high intensity of the revolution differ from governorates with low intensity of the revolution along some pre-revolution characteristics. This may represent a violation of the parallel trends assumption if labor market outcomes vary according to these pre-revolution differences, unconditional on the occurrence of the revolution. In other words, this correlation between pre-revolution governorate characteristics and the intensity of the revolution is only problematic if they are also associated with differential changes in labor market outcomes. Hence, we present estimates with and without the inclusion of these pre-revolution governorate controls. The inclusion of these additional variables makes little difference to the estimated coefficient of interest or makes it larger in magnitude (in absolute terms), suggesting that the correlation between labor market outcomes and pre-revolution governorate characteristics bias the effect of the revolution on labor market outcomes towards zero.

¹⁰ The distance to the Capital Cairo is expressed in Km, while the governorate-level number of martyrs is expressed in hundreds.

Table 3: First stage regressions

VARIABLES	(1) Martyrs	(2) Martyrs × female	(3) Martyrs	(4) Martyrs × female
Distance to the Capital	-0.005*** [0.001]	0.000 [0.000]	-0.003*** [0.000]	0.000 [0.000]
Distance to the Capital × female	-0.000 [0.000]	-0.005*** [0.001]	-0.000** [0.000]	-0.003*** [0.000]
Observations	12,434	12,434	12,434	12,434
R-squared	0.194	0.318	0.794	0.829
Individual Controls	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES
Pre-revolution Governorate controls			YES	YES
First stage F-statistic	27.090	27.890	57.840	57.730

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using OLS estimation. The reported results correspond to the first stage regressions of 2SLS estimation approach, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values for single endogenous regressor are the following 16.38, 8.96, 6.66 and 5.53 at the 10%, 15%, 20% and 25% maximal IV size respectively.

Table 4: Governorate characteristics by the intensity of the revolution

VARIABLES	Low intensity	High intensity
	Mean	Mean
<i>Governorate controls</i>		
Share of public sector	0.147	0.174*
Number of police stations	0.058	0.064
Mean youth education	10.190	10.460
Population density	0.512	1.118
Log of real GDP per capita	8.643	8.696
Fully urban governorate	0.000	0.364**

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

Notes. All variables are pre-revolution governorate controls and are reported for two groups of governorates based on the median number of martyrs, from the 25th of January 2011 to the end of June 2012. The median number of martyrs, fatalities during the Egyptian revolution is 23 martyrs. Low intensity are the governorates witnessing a number of martyrs below the median, while high intensity refers to governorates witnessing a number of martyrs above the median. Governorate controls are the following: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). Means of these variables are reported for governorates with a number of martyrs below the median and governorates with a number of martyrs above the median. A t-test is performed to test the equality of the mean between the two groups of governorates.

5. Results

5.1. The impact of the revolution on women's labor market outcomes

Table 5 presents estimates of the effect of the revolution on women's labor force participation decision, unemployment and employment. Our dependent variables are the changes between 2012 and 2006 in labor force participation, unemployment and employment. We report both OLS and IV estimates, where we use the distance to the Capital Cairo and its interaction term with the female dummy to instrument the governorate level number of martyrs and its interaction term with the female dummy. In some specifications, we only condition on individual and household controls, while in other specifications, we also include the pre-revolution governorate controls discussed earlier.¹¹ Our preferred specification is the IV-specification while conditioning on individual, household and pre-revolution governorate controls. The two estimated coefficients of interest are the interaction term between the number of martyrs and the female dummy (α_1 in Equation 2) and the number of martyrs (α_2 in Equation 2). The former captures the differential effect of the revolution on labor market outcomes of women relative to men, *i.e.* how the revolution affects the gender gap in labor force participation, employment and unemployment, while the latter coefficient captures the effect of the revolution on men's labor market outcomes.

¹¹ In unreported regressions, we have included the pre-revolution governorate controls gradually, that is to each regression we have added each of these variables and their interaction terms with the *female* dummy one at a time. Results are qualitatively very similar.

Table 5: Labor Force Participation, Unemployment and Employment

VARIABLES	Labor Force Participation					Unemployment				Employment		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Martyrs × female	0.018*** [0.006]	0.094*** [0.022]	0.005 [0.011]	0.121*** [0.038]	0.002 [0.004]	0.021*** [0.007]	0.012 [0.007]	0.063*** [0.017]	0.016*** [0.005]	0.073*** [0.021]	-0.007 [0.009]	0.058* [0.034]
Martyrs	-0.010*** [0.002]	-0.018*** [0.007]	-0.002 [0.005]	-0.026* [0.015]	-0.004** [0.002]	-0.003 [0.004]	-0.008** [0.004]	-0.011 [0.010]	-0.006** [0.003]	-0.015** [0.007]	0.007 [0.005]	-0.014 [0.017]
Observations	12,434	12,434	12,434	12,434	12,434	12,434	12,434	12,434	12,434	12,434	12,434	12,434
R-squared	0.161	0.130	0.170	0.156	0.053	0.045	0.055	0.045	0.149	0.132	0.158	0.154
Individual Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pre-revolution governorate controls			YES	YES			YES	YES			YES	YES
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.127	0.000	0.775	0.005	0.482	0.004	0.541	0.000	0.013	0.002	0.914	0.138
Kleibergen-Paap rk Wald F statistic		26.283		50.642		26.283		50.642		26.283		50.642
Robust standard errors in brackets												

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

Notes. Each cell represents coefficient estimate using OLS or IV regressions, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Labor force participation, unemployment and employment are defined according to the current work status, reference 3 months, excluding subsistence workers (market definition). Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment: primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α₁ and α₂ in each column.

We find that the estimated coefficient on the interaction term between the female dummy and the number of martyrs is always positive and statistically different from zero. This is an interesting finding, because it implies that the revolution is reducing the gender gap in labor force participation. In other words, relative to men, women have become more likely to participate in the Egyptian labor market due to the revolution. To quantify the effect of the revolution on women's labor force participation, we sum the two estimated coefficients α_1 and α_2 . If we consider its mean value (0.627)¹², the revolution increases women's labor force participation by 6 percentage points ($0.627*(-0.026+0.121)$). This finding is interesting as women's labor force participation in Egypt has remained very low despite the substantial increase in their educational attainment (Binzel and Assaad, 2011). As Table 2 shows, women's labor force participation is strikingly lower to their male peers. In our estimation sample, women's labor force participation is only 29% as opposed to 82% for men's labor force participation in 2006. Therefore, in percent terms, the impact of the revolution on women's labor force participation is large, about 21% of the 2006 mean value of this labor market outcome. Also, our results show that the revolution has reduced about 12% of the gender gap in labor force participation (6 over 50 percentage points).

It's interesting to analyze whether the relative increase in women's labor force participation is due to a rise in employment or unemployment. We find that because of the revolution women's unemployment and employment both increase at the mean value of the number of martyrs, the increases are about 3 percentage points ($0.627*(\alpha_1+\alpha_2)$), even if the increase in employment is imprecisely estimated (see in Table 3 the test with null hypothesis $\alpha_1+\alpha_2=0$).¹³ The revolution has encouraged women to engage in the Egyptian labor market by actively searching for employment, providing a leeway to increase women's labor force participation that has remained very low.

We further investigate the effect of the revolution on the different types of employment by distinguishing between wage work, employer/self-employment and unpaid family work in Table A1 in the Appendix. Estimates do not show any significant effect of the revolution on women's wage work or on the probability of being employer/ self-employed, as we fail to reject the null hypothesis that the sum of the two estimated coefficients ($\alpha_1+\alpha_2$) is statistically different from zero. However, we find a statistically significant effect of the revolution on unpaid family work for women. The revolution increases the probability of being an unpaid family worker for women by 7 percentage points, in governorates with a number of martyrs equal to the mean value (about 63). Apart from actively searching for employment, the revolution has intensified women's effort deployed in home production and unpaid labor. The straightforward interpretation is that with the worsening conditions due to the Egyptian revolution, women tend to increase their time

¹² Mean values for the different measures of the intensity of the revolution are summarized at the governorate level in Table 1. The average number of martyrs in the Egyptian governorates from the 25th of January 2011 till June 2012, is 0.627.

¹³ We also investigated the effect of the revolution on couples sample only. We consider the head of the household and his spouse (for male headed households). They are married in the two years and in the working age category. The results on this subsample are consistent with our results on the sample of all working age males and females. The revolution increases women's participation by 6 percentage points, unemployment by 2 percentage points and employment by 4 percentage points, when these effects are computed at the average value of the number of martyrs. See the Online Appendix Table 4.

allocation to home production, while also actively searching for paid employment. This is in line with several works examining the differential effects of economic crises on women's work. For instance, scholars examined the differential effect of cutbacks in public services or food subsidies, forcing women to seek paid employment as well as exerting pressure on women to allocate more time to household production and unpaid work (Elson, 1992a; Stewart, 1992). By contrast, we find that the revolution has reduced men's wage work and has pushed men to engage in non-wage work such as being employer or self-employed. Namely, at the average value of *martyrs*, the revolution has led to a reduction in men's wage work by 4 percentage points, whereas they witness a 3 percentage points increase in the probability of being either employer or self-employed.

With the unabated increase in the size of the shadow sector in the Egyptian labor market since the 1990s, it is important to estimate the impact of the revolution by distinguishing between the formal and informal sector's employment. The informal sector employment in Egypt, like in other MENA countries undergoing structural and economic reforms, has played a major role in employment especially in periods of economic adjustment and transition (Wahba, 2009). Estimates in Table A2 in the Appendix show that the differential effect of the revolution on informal and formal sectors employment by gender is statistically different from zero. More precisely, in governorates with average intensity, the revolution led to an increase in women's employment in the informal sector by 5 percentage points compared to men, whereas it reduces females' employment in the formal sector by 4 percentage points compared to men. However, the sum of the two estimated coefficients α_1 and α_2 is not statistically different from zero (see in Table A2 the test with null hypothesis $\alpha_1 + \alpha_2 = 0$). These results go hand in hand with the hypothesis of necessity for women to participate in the labor market in the context of the revolution. Hence, the informal sector is more likely to meet those needs in the short term, as opposed to the formal sector. This has also been true during the period of economic reform in the late 1990s, where the informal sector provided work opportunities for the growing labor force, leading to increased informalization of the labor market (El Mahdi, 2000). Wahba (2009) stresses the importance of the informal sector earnings for Egyptian households alongside with the formal sector earnings in response to inflation, cutbacks in public services and public sector downsizing. The revolution seems to break the dominant gender roles conceiving the man as breadwinners and women as homemakers confined to domestic chores. As presented earlier, according to Table 2, in 2006, men in our estimation sample had higher employment rates in the informal sector, 43% compared to 32% of employment rate in the formal sector. By contrast, women had the same incidences of employment in the formal and informal sectors, 11% in 2006. The revolution might suggest an increase in the involvement of women in the informal sector to face the burden implied by the revolution and to substantially contribute to the income generation for the household.

The Egyptian labor market is characterized by a distinctive divide between the public and private sectors (El-Haddad, 2009). For many years, the public sector dominated employment in Egypt and was particularly the targeted employment destination for women because of the shorter hours and

the lower effort requirements, giving room for women to take care of domestic chores and home responsibilities. However, with the public sector downsizing since the 1980s and the Economic Reform and Structural Adjustment Program implemented in Egypt in the 1991, women witnessed a substantial reduction in the employment opportunities in the Egyptian labor market (Assaad and Arntz, 2005). In Table A3 in the Appendix, we investigate the impact of the 2011 revolution on public and private sectors employment. We don't find any significant effect of the revolution on women's employment in the public sector, which has already slowed down since the 1990s. Interestingly, we find that the revolution has reduced the gender gap in the private sector employment; leading to a 4 percentage points increase in women's probability of being employed in the private sector, when the effect is computed at the average value of the martyrs.

5.2. Heterogeneity of the effects

To understand whether the effects of the revolution differ according to important household and individual-level characteristics, we divide our estimation sample by quartiles of the per capita household income distribution and by their educational attainment¹⁴ (four educational categories) in 2006. Tables 6, 7 and 8 report the corresponding estimates, where we consider, as dependent variables, labor force participation decision, unemployment and employment respectively. We estimate Equation 2 by conditioning on individual, household and pre-revolution governorate controls and report IV estimates for the different quartiles of pre-revolution income distribution and for the four levels of educational attainment. Interestingly, we find suggestive evidence that our results are mainly driven by the 1st and 2nd quartiles of the sample distribution of pre-revolution per capita household income and by the highest two levels of educational attainment (secondary education and above secondary education). We only observe an increase in women's labor force participation for those who belong to the lowest two quartiles of the sample distribution of pre-revolution per capita household income.

According to Table 6, women living in the poorest households (1st and 2nd quartiles) respond to the average intensity of the revolution by increasing their labor force participation by 6 and 13 percentage points respectively (see columns 1 and 2). Dividing the sample in subgroups by the individual's educational attainment, we find that, at the mean value of the number of martyrs, the revolution increases women's labor force participation by 9 percentage points for those who held a secondary degree. To better understand the effect of the revolution on women's labor force participation, we also look at unemployment and employment patterns by sample distribution of pre-revolution per capita household income and educational attainment (Tables 7 and 8). Results show that the increase in women's labor force participation witnessed by the lowest two quartiles is driven by a similar increase in unemployment by 4 and 9 percentage points for the 1st and 2nd quartiles, respectively, when we consider an increase in the intensity of the revolution by its mean value, about 63 martyrs. We also find that a similar increase in the revolution raises unemployment

¹⁴ We consider four educational categories: no educational degree (either illiterate or literate without any diploma), primary and preparatory education, secondary education (either general or vocational) and above secondary education (either post-secondary institute or university education and above).

mainly for the most educated women, those who held a secondary or above secondary degrees, by 8 and 5 percentage points respectively. However, we do not find suggestive evidence on the effect of the revolution on employment, neither by quartiles of per capita household income, nor by educational attainment. Our estimates show that women's labor force participation in the aftermath of the revolution has increased especially for those who live in poor households : those who belong to the lowest two quartiles of pre-revolution distribution of per capita household income, shedding light on the added-worker effect mentioned earlier, as women who live in the poorest households are more likely feel the need to enter the paid labor force. We also find an increase in women's unemployment with the most educated women being more likely to fall in the unemployment category. This result is in line with the findings of Assaad (2008) who documents the higher unemployment rates among the most educated youth who have high levels of expectations that are not easily met in the Egyptian labor market (Assaad, 2008).

Table 6: Labor Force Participation decision

Panel A: By sample distribution of per capita household income				
VARIABLES	(1) 1st quartile	(2) 2nd quartile	(3) 3rd quartile	(4) 4th quartile
Martyrs × female	0.118** [0.058]	0.238** [0.099]	0.058 [0.058]	0.024 [0.040]
Martyrs	-0.029 [0.027]	-0.025 [0.046]	0.014 [0.024]	-0.034* [0.020]
Observations	4,486	2,623	2,624	2,701
R-squared	0.158	0.111	0.148	0.292
Individual Controls	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES
Pre-revolution Governorate Controls	YES	YES	YES	YES
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.092	0.014	0.158	0.761
Kleibergen-Paap rk Wald F statistic	31.195	18.139	47.679	34.287
Panel B: By educational attainment				
VARIABLES	(1) No educ.	(2) Prim/Prep	(3) Secondary	(4) Above sec.
Martyrs × female	0.125 [0.080]	0.098* [0.052]	0.177*** [0.053]	0.045 [0.050]
Martyrs	-0.023 [0.026]	-0.038 [0.039]	-0.037 [0.027]	-0.008 [0.015]
Observations	3,868	2,404	4,201	1,961
R-squared	0.104	0.230	0.182	0.183
Individual Controls	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES
Pre-revolution Governorate Controls	YES	YES	YES	YES
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.145	0.107	0.001	0.440
Kleibergen-Paap rk Wald F statistic	25.210	48.492	36.209	39.345

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using IV regression, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by

governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Labor force participation is defined according to the current work status, reference 3 months, excluding subsistence workers (market definition). Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment (only included in Panel A): primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α_1 and α_2 in each column.

Table 7: Unemployment

Panel A: By sample distribution of per capita household income				
VARIABLES	(1) 1st quartile	(2) 2nd quartile	(3) 3rd quartile	(4) 4th quartile
Martyrs × female	0.082*** [0.029]	0.145*** [0.055]	0.029 [0.031]	0.030 [0.026]
Martyrs	-0.018 [0.019]	-0.000 [0.021]	-0.007 [0.021]	-0.016 [0.015]
Observations	4,486	2,623	2,624	2,701
R-squared	0.054	-0.010	0.075	0.068
Individual Controls	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES
Pre-revolution Governorate Controls	YES	YES	YES	YES
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.007	0.003	0.281	0.553
Kleibergen-Paap rk Wald F statistic	31.195	18.139	47.679	34.287
Panel B: By educational attainment				
VARIABLES	(1) No educ.	(2) Prim/Prep	(3) Sec.	(4) Above Sec.
Martyrs × female	0.015 [0.014]	0.045* [0.027]	0.133*** [0.038]	0.074* [0.040]
Martyrs	-0.008 [0.012]	-0.016 [0.021]	-0.010 [0.022]	-0.002 [0.017]
Observations	3,868	2,404	4,201	1,961
R-squared	0.020	0.107	0.033	0.045
Individual Controls	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES
Pre-revolution Governorate Controls	YES	YES	YES	YES
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.121	0.108	0.000	0.062
Kleibergen-Paap rk Wald F statistic	25.210	48.492	36.209	39.345

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using IV regression, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Unemployment is defined according to the current work status, reference 3 months, excluding subsistence workers (market definition). Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment (only included in Panel A): primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000

inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α_1 and α_2 in each column.

Table 8: Employment

Panel A: By sample distribution of per capita household income				
VARIABLES	(1)	(2)	(3)	(4)
	1st quartile	2nd quartile	3rd quartile	4th quartile
Martyrs × female	0.036 [0.059]	0.093 [0.082]	0.028 [0.056]	-0.006 [0.033]
Martyrs	-0.011 [0.030]	-0.025 [0.049]	0.022 [0.031]	-0.018 [0.022]
Observations	4,486	2,623	2,624	2,701
R-squared	0.191	0.135	0.134	0.226
Individual Controls	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES
Pre-revolution Governorate Controls	YES	YES	YES	YES
$H_0 : \alpha_1 + \alpha_2 = 0$ (P-value)	0.617	0.309	0.286	0.346
Kleibergen-Paap rk Wald F statistic	31.195	18.139	47.679	34.287
Panel B: By educational attainment				
VARIABLES	(1)	(2)	(3)	(4)
	No educ.	Prim/Prep.	Sec.	Above sec.
Martyrs × female	0.110 [0.079]	0.053 [0.054]	0.045 [0.045]	-0.029 [0.048]
Martyrs	-0.015 [0.028]	-0.023 [0.038]	-0.026 [0.036]	-0.007 [0.021]
Observations	3,868	2,404	4,201	1,961
R-squared	0.110	0.196	0.176	0.275
Individual Controls	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES
Pre-revolution Governorate Controls	YES	YES	YES	YES
$H_0 : \alpha_1 + \alpha_2 = 0$ (P-value)	0.177	0.374	0.507	0.383
Kleibergen-Paap rk Wald F statistic	25.210	48.492	36.209	39.345

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using IV regression, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Employment is defined according to the current work status, reference 3 months, excluding subsistence workers (market definition). Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment (only included in Panel A): primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land

ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α_1 and α_2 in each column.

In the Table A4 in the Appendix, we also split our estimation sample of individuals into two religious groups and investigate the effect of the revolution on labor force participation, unemployment and employment for the two religious groups. Results concerning Christian working aged individuals should be considered with caution because the sample size is small and for this estimation sample, the instruments are weakly correlated with the endogenous regressors (see the value of the Kleibergen-Paap rk Wald Test and the Stock-Yogo weak identification test critical values in the notes of the table). The results we present in Section 5.1 apply qualitatively to our subsample of Muslim individuals: an increase in the intensity of the revolution by its mean value raises Muslim women's labor force participation by 12 percentage points, unemployment by 5 percentage points and employment by 7 percentage points. Therefore the estimates using the subsample of Muslim individuals show a greater increase in employment compared to unemployment.

5.3. Mechanisms

To explore the mechanisms through which the revolution affects labor market outcomes, we investigate the effect of the revolution on monthly, hourly wages and the number of weekly working hours, conditional on employment (Table 9). We find that an increase in the intensity of the revolution by its mean value has affected men's remuneration, by reducing the real monthly wage by 7 percent. This reduction in men's real monthly wage is explained by a decrease in the real hourly wage as well as by a reduction in labor supply (number of weekly working hours). Instead, we don't find any suggestive evidence of a negative effect of the revolution on women's remuneration (see in Table 9 the test of the null hypothesis $\alpha_1 + \alpha_2 = 0$). By contrast, we find a differential effect of the revolution by gender, the revolution increases women's labor supply by 3 hours/week (α_1), for those who are employed. According to ELMPS 2012, individuals were asked whether they have witnessed any changes in employment conditions in the past three months due to the revolution. Interestingly, we find striking differences when we compare the answers of men and women in our estimation sample, 55% of women report an improvement in the working conditions opposed to only 29% of men. In addition, in line with the results presented earlier, 8% of men report a decrease in the number of working hours compared to only 1% of women and 9% of men report a decrease in wages compared to 2% of women. 16% of women also reported pay

increases or incentives as the change they witnessed in their job compared to only 5% of men. Assaad and Krafft (2013) investigate those questions by looking at workers in the public and private sectors. They highlight the fact the workers in the public sector were more likely to report improvement in the working conditions, whereas, workers in the private sector reported deterioration in the working conditions. This may reflect the willingness of the post-revolutionary government to improve the working conditions in the public sector to meet the demands of the workers. Reconciled with the striking differences reported by men and women, the interpretation is that share of women employed in the public sector is greater than the share of men, in relative terms. Hence, employed women are faring better than their male peers in terms of working conditions and remuneration. Hence, we can infer that our results are in line with a large strand in the literature emphasizing the increased feminization of the workforce during periods of crisis and structural adjustment, highlighting the so-called “added-worker effect” where women are forced to participate in the labor market to compensate for falling male incomes (Lundberg, 1985; Cullen and Gruber, 2000; Hyslop, 2001; Stephens, 2002).

Table 9: Monthly, Hourly wages and hours worked per week

VARIABLES	Log of monthly wage		Log of hourly wage		Hours worked/week	
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
Martyrs × female	-0.035 [0.029]	0.169** [0.085]	0.011 [0.043]	0.150 [0.111]	-0.044 [0.785]	3.343** [1.638]
Martyrs	0.004 [0.016]	-0.118** [0.055]	-0.002 [0.021]	-0.149** [0.069]	-0.883** [0.436]	-3.444*** [1.274]
Observations	3,409	3,409	3,409	3,409	3,409	3,409
R-squared	0.152	0.125	0.105	0.088	0.048	0.034
Individual Controls	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES
Pre-revolution governorate controls	YES	YES	YES	YES	YES	YES
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.213	0.462	0.826	0.987	0.168	0.938
Kleibergen-Paap rk Wald F statistic		46.190		46.190		46.190

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using OLS or IV regressions, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Monthly and hourly wages are calculated in constant 2006 Egyptian Pounds and refer to the monthly/hourly wage in primary job, conditional on being employed, in log specification. The hours of work refers to the current number of work hours per week, excluding subsistence work (market definition) and conditional on being employed. Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head’s marital status is single,

three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α_1 and α_2 in each column.

To further analyze the mechanisms behind the effects of the revolution on labor market outcomes, we present results relying on a conventional risk measure used in the literature (Table 10). We compute the same risk measure used by Fuchs-Schündeln and Schündeln (2005), the logarithm of the variance of the logarithm of monthly wage.¹⁵ We construct this risk measure using 3 definitions: the first one is based on the individuals' occupation, the second definition is based on sixteen occupational and educational groups, and the third definition is based on the individuals' occupation and gender.¹⁶ Interestingly, we find that the revolution increases the variance of monthly wage for the employed men in our sample, according to the three definitions of risk measure, by 1 to 2.5 percentage points (α_1), when we compute this effect at the mean value of martyrs. However, the revolution did not imply any negative effect on the variance of monthly wage for women, as we fail to reject the null hypothesis that the sum of the two estimated coefficients ($\alpha_1 + \alpha_2$) is statistically different from zero. Our results are in line with Assaad and Krafft (2013) who advocate that men have been increasingly employed in riskier and marginal forms of employment in the period of 2006 to 2012 compared to the period of 1998 to 2006: a substantial rise in irregular wage work that is closely associated with poverty and vulnerability.

Hence, we can infer that the increased women's labor force participation, in the aftermath of the revolution, should be placed within a framework of intra-household risk sharing. In other words, as a household risk coping strategy, women tend to increase their labor force participation and those employed tend to increase their labor supply in order to face the increased risk and the instability of men's income flows.

Additionally, in Table A5 in the Appendix, we present OLS and IV regressions for the following outcomes at the household level: share of households who report having a household member

¹⁵ Fuchs-Schündeln and Schündeln (2005) compute this risk measure, the logarithm of the variance of the logarithm of income for sixteen occupational and educational groups. They use three occupations (civil servants, white-collar workers and blue-collar workers) and five education levels (college, vocational training, intermediate/technical schooling, secondary schooling, secondary schooling not completed). See also Carroll and Samwick (1998) who additionally consider sector groups.

¹⁶ Occupations are defined according to the ISCO-88 occupation classification (low-skilled blue collar, high-skilled blue collar, low skilled white collar and high-skilled white collar) for the longest job during past 3 months. Educational levels are the following: no educational degree, primary/preparatory education, secondary education and above secondary education.

living or working abroad, log of remittances received, log of per capita household income (excluding remittances), log of per capita household income (including remittances) and the ratio of pupils enrolled in religious (*azhari*) schools to the total number of individuals currently studying at the time of the survey (at the household level).¹⁷ The theoretical rationale for investigating the effects of the revolution on these variables is in the introduction. The unit of observation is the household, we only focus on households that did not split and have the same structure between 2006 and 2012, to have comparable figures for our dependent variables. We only find a slight reduction in migration in the aftermath of the revolution, by 1 percentage point, for an increase in the number of martyrs by 100. According to the Arab Barometer Study conducted in Egypt in July 2011, 89% of the Egyptians surveyed reported not considering migration, which might be due to the optimistic expectations Egyptians had with respect to economic and political conditions. Furthermore, we do not find any suggestive evidence on remittance-recipientcy, household income (including/excluding remittances) or on religious education.

Table 10: Variance of monthly wage

VARIABLES	Log variance of log monthly wage (occupation)		Log variance of log monthly wage (occupation & education)		Log variance of log monthly wage (occupation & gender)	
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
Martyrs × female	0.013*** [0.005]	-0.032** [0.015]	0.010 [0.014]	-0.069* [0.038]	-0.048*** [0.018]	-0.011 [0.047]
Martyrs	0.008*** [0.003]	0.019** [0.007]	0.026*** [0.007]	0.041** [0.018]	0.005** [0.002]	0.017** [0.007]
Observations	5,774	5,774	5,774	5,774	5,774	5,774
R-squared	0.228	0.208	0.120	0.110	0.703	0.699
Individual Controls	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES
Pre-revolution governorate controls	YES	YES	YES	YES	YES	YES
$H_0 : \alpha_1 + \alpha_2 = 0$ (P-value)	0.000	0.384	0.009	0.491	0.014	0.900
Kleibergen-Paap rk Wald F statistic		50.829		50.829		50.829

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using OLS or IV regressions, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. We use a conventional risk measure: the logarithm of the variance of the logarithm of wage. The monthly wage is expressed in constant 2006 Egyptian Pounds and refers to the monthly wage in primary job. We construct this measure by occupation using 4 occupational groups, by occupation and education using 4 occupational groups and 4 educational levels and by occupation and gender, using the same occupational groups. The occupational groups are defined according to the ISCO-88 occupation classification, low-skilled blue collar, high-skilled blue collar, low-skilled white collar and high-skilled

¹⁷ We also investigated the impact of the revolution on the gender gap in children's education in the Online Appendix Table 5; considering the probability of going to school and the probability of going to religious school (Azhari). We don't find any suggestive effect of the revolution on the gender gap in children's education.

white collar. The educational levels are the following: no education, primary/preparatory education, secondary education and above secondary education. Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α_1 and α_2 in each column.

6. Robustness checks

We have checked the robustness of our results by estimating similar sets of regressions for labor force participation decision, unemployment and employment decisions. In Table 11, rather than using the governorate-level number of martyrs (demonstrators who died during the protests) as a measure of the intensity of the revolution, we consider the number of injured (Panel A) and the number of arrested (Panel B).

We find the same patterns we describe in Section 5.1. In Panel A, the interaction term between the number of injured and the female dummy is always positive and statistically different from zero. As expected, the order of magnitude of the estimated coefficients is smaller. The estimates provide confirmation of our results in Section 5.1, namely a reduction in the gender gap in labor force participation, which is explained by a reduction in the gender gap in employment and unemployment. We also find that the sum of the two estimated coefficients α_1 and α_2 is statistically different from zero (see in Table 11 the test with null hypothesis $\alpha_1 + \alpha_2 = 0$). In Panel B, we consider the number of arrested by governorate. The interaction term between the number of arrested and the female dummy is positive and statistically different from zero. Namely, if we consider governorates with number of martyrs equal to the mean value (about 63), the revolution increases women's labor force participation by 2 percentage points and raises unemployment by 1 percentage points, as women start to actively search for employment. Table 11 also provides additional evidence on the relevance of our instrumental variable, which is correlated with these two measures of the intensity of the revolution. The Kleibergen-Paap rk Wald F statistic is always greater than the Stock-Yogo weak identification reported in the notes of the table.

Table 11: Robustness checks using other measures of the revolution

Panel A: Using the number of injured by governorate						
	Labor Force Participation		Unemployment		Employment	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	OLS	IV	OLS	IV
Injured × female	0.000	0.008***	0.000*	0.004***		0.005**
	[0.000]	[0.003]	[0.000]	[0.001]	[0.000]	[0.002]
Injured	-0.000	-0.001	-0.000***	-0.001	0.000	-0.000
	[0.000]	[0.001]	[0.000]	[0.001]	[0.000]	[0.001]
Observations	11,913	11,913	11,913	11,913	11,913	11,913
R-squared	0.169	0.115	0.055	0.028	0.159	0.138
Individual Controls	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES
Pre-revolution Governorate Controls	YES	YES	YES	YES	YES	YES
$H_0 : \alpha_1 + \alpha_2 = 0$ (P-value)	0.927	0.002	0.785	0.000	0.921	0.043
Kleibergen-Paap rk Wald F statistic		17.478		17.478		17.478
Panel B: Using the number of arrested by governorate						
	Labor Force Participation		Unemployment		Employment	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	OLS	IV	OLS	IV
Arrested × female	-0.001	0.044**	0.002	0.023***	-0.003*	0.021
	[0.002]	[0.018]	[0.001]	[0.008]	[0.002]	[0.015]
Arrested	0.000	-0.010	-0.001*	-0.005	0.002**	-0.006
	[0.001]	[0.007]	[0.001]	[0.004]	[0.001]	[0.007]
Observations	12,434	12,434	12,434	12,434	12,434	12,434
R-squared	0.170	0.113	0.055	0.014	0.158	0.142
Individual Controls	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES
Pre-revolution Governorate Controls	YES	YES	YES	YES	YES	YES
$H_0 : \alpha_1 + \alpha_2 = 0$ (P-value)	0.807	0.024	0.543	0.003	0.444	0.183
Kleibergen-Paap rk Wald F statistic		7.877		7.877		7.877

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using OLS or IV regressions, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of injured/arrested by governorate and the interaction term between the number of injured/arrested by governorate and the female dummy. The number of injured is expressed in hundreds and is equal to the number of injured by governorate from the 11th of February 2011 to the end of June 2012. Standard errors in parentheses are clustered at the community level. The number of arrested is expressed in hundreds and is equal to the number of arrested by governorate from July 2012 to June 2013. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Labor force participation, unemployment and employment are defined according to the current work status, reference 3 months, excluding subsistence workers (market definition). Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables

in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α_1 and α_2 in each column.

In Table 12, we present additional robustness checks using the number of martyrs during the first eighteen days of the revolution (Panel A), the number of martyrs in the subsequent period from the 12th of February 2011 till the end of June 2012, after Mubarak stepped down and the Supreme Council of the Armed Forces took power in Egypt in the name of the military (Panel B) and by eliminating the Capital Cairo (Panel C). Our results remain robust to the different checks. The interaction term between the numbers of martyrs, whatever the definition (Panel A or Panel B) and the female dummy is always positive and statistically different from zero. The estimated coefficient is positive but imprecisely estimated when we consider employment as dependent variable. By eliminating the Capital Cairo in Panel C, we also find the same patterns described in Section 5.1 and the order of magnitude of the estimated coefficients is larger. This exercise provides additional evidence on the relevance of our instrumental variable and checks whether the results we find on labor market outcomes are only driven by the inclusion of the Capital Cairo. Interestingly, we find that our instrumental variable captures the spatial clustering effect of political participation, even after omitting Cairo: the distance to Cairo is quite correlated with our endogenous variable, the governorate level number of martyrs; which proxies the intensity of the revolution. The Kleibergen-Paap rk Wald F statistic provides additional confirmation that the instruments are highly correlated with the endogenous regressors. Regarding the effects of the revolution on labor market outcomes, our results remain robust after eliminating Cairo. These effects are not driven by the Capital Cairo, since by eliminating the Capital we still find a significant effect of the revolution on women's labor market outcomes. The magnitude of this effect in Panel C is even larger than the one presented in previous tables.

Table 12: Other Robustness checks

Panel A: Using the number of martyrs during first 18 days of revolution						
VARIABLES	Labor Force Participation		Unemployment		Employment	
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	OLS	IV	OLS	IV
Martyrs (period1) × female	0.016 [0.017]	0.173*** [0.052]	0.020* [0.011]	0.090*** [0.024]	-0.004 [0.013]	0.083* [0.048]
Martyrs (period1)	-0.001 [0.007]	-0.036* [0.021]	-0.011* [0.006]	-0.016 [0.015]	0.010 [0.008]	-0.020 [0.024]
Observations	12,434	12,434	12,434	12,434	12,434	12,434
R-squared	0.170	0.158	0.055	0.046	0.158	0.155
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.288	0.004	0.296	0.000	0.550	0.132
Kleibergen-Paap rk Wald F statistic		48.791		48.791		48.791
Panel B: Using the number of martyrs from February 2011 to June 2012						
Martyrs (period2) × female	-0.028 [0.033]	0.406*** [0.138]	0.021 [0.022]	0.211*** [0.062]	-0.049* [0.027]	0.195 [0.120]
Martyrs (period2)	-0.011 [0.014]	-0.088* [0.050]	-0.026** [0.012]	-0.039 [0.036]	0.016 [0.016]	-0.049 [0.057]
Observations	12,434	12,434	12,434	12,434	12,434	12,434
R-squared	0.170	0.147	0.055	0.039	0.158	0.151
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.182	0.010	0.768	0.001	0.115	0.154
Kleibergen-Paap rk Wald F statistic		31.912		31.912		31.912
Panel C: Eliminating Cairo						
Martyrs × female	0.054 [0.040]	0.263*** [0.080]	0.012 [0.015]	0.120*** [0.041]	0.042 [0.036]	0.143** [0.070]
Martyrs	-0.003 [0.015]	-0.048 [0.030]	0.000 [0.008]	-0.009 [0.021]	-0.003 [0.015]	-0.038 [0.034]
Observations	11,428	11,428	11,428	11,428	11,428	11,428
R-squared	0.155	0.149	0.050	0.043	0.150	0.149
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.131	0.003	0.357	0.002	0.186	0.096
Kleibergen-Paap rk Wald F statistic		19.341		19.341		19.341
Individual Controls	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES
Pre-revolution governorate controls	YES	YES	YES	YES	YES	YES

Robust standards errors in brackets

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

Notes. Each cell represents coefficient estimate using OLS or IV regressions, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. In Panel A, we use the number of martyrs by governorate during the first 18 days of the revolution, from 25th of January to the 11th of February 2011, expressed in hundreds. In Panel B, we use the number of martyrs by governorate, the 12th of February 2011 to the end of June 2012, expressed in hundreds. In Panel C, we eliminate the Capital Cairo and use the standard definition of martyrs, fatalities from the 25th of January 2011 till the end of June 2012. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Labor force participation, unemployment and employment are defined according to the current work status, reference 3 months, excluding subsistence workers (market definition). Individual controls include the following variables

in first-difference: a dummy variable for ever-married status, three dummies for educational attainment primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α_1 and α_2 in each column.

In Table 13, we perform a formal test of the parallel trend assumption. We conduct a false experiment, a placebo difference-in-difference regression by predicting the impact of the subsequent revolution on individuals' labor market outcomes using information from 1998 and 2006 ELMPS waves. We test whether changes in individuals' labor market outcomes between 1998 and 2006 are associated with the future revolution in 2011, a false experiment.¹⁸ The results confirm that the pre-revolution labor market outcomes are not correlated with the current number of martyrs. All coefficient estimates are insignificant, not statistically different from zero except the coefficient estimate in column 2. Insignificant coefficients provide support for the validity of the parallel trend assumption. Hence, we can infer that our results are not biased by pre-existing trends in labor market outcomes across individuals who reside in governorates exposed differently to the revolution.

¹⁸ We track the same individuals we have in our estimation sample in the 1998 wave of the ELMPS and look at changes in labor market outcomes between 2006 and 1998, instead of changes between 2012 and 2006.

Table 13: Placebo regression-The impact of future revolution on individuals' labor market outcomes in 1998-2006

	Labor Force participation	Unemployment	Employment	Wage work	Employer/Self-employed	Unpaid family work	Formal sector emp.	Informal sector emp.	Public Sector emp.	Private sector emp.	Log of monthly wage	Log of hourly wage	Hours worked/ week
VARIABLES	(1) IV	(2) IV	(3) IV	(4) IV	(5) IV	(6) IV	(7) IV	(8) IV	(9) IV	(10) IV	(11) IV	(12) IV	(13) IV
Martyrs × female	-0.024 [0.064]	-0.065** [0.029]	0.041 [0.069]	-0.020 [0.036]	0.036 [0.031]	0.120 [0.094]	0.017 [0.044]	-0.045 [0.043]	0.031 [0.034]	0.024 [0.069]	-0.193 [0.148]	-0.137 [0.132]	-2.747 [1.930]
Martyrs	0.021 [0.023]	0.028 [0.017]	-0.006 [0.030]	0.015 [0.027]	-0.015 [0.019]	-0.009 [0.020]	-0.026 [0.033]	0.055 [0.041]	-0.040 [0.028]	0.018 [0.036]	0.004 [0.085]	-0.036 [0.053]	1.468 [1.502]
Observations	5,355	5,355	5,355	5,355	5,355	5,355	3,855	3,855	5,339	5,339	1,517	1,517	1,517
R-squared	0.241	0.109	0.171	0.207	0.079	0.018	0.162	0.061	0.125	0.081	0.144	0.106	0.046
Individual Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pre-revolution gov. Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.966	0.089	0.560	0.815	0.285	0.200	0.575	0.436	0.583	0.454	0.188	0.204	0.407
Kleibergen-Paap rk Wald F stat.	21.699	21.699	21.699	21.699	21.699	21.699	20.915	20.915	21.428	21.428	20.754	20.754	20.754

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using IV regression, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Labor force participation, unemployment and employment are defined according to the current work status, reference 3 months, excluding subsistence workers (market definition). Wage work, employer, self-employed and unpaid family work are defined according to the current work status in primary job, reference 3 months. Informal sector employment is defined as having neither a legal work contract nor social security in primary job, reference 3 months, whereas, formal sector employment is defined as having a legal work contract and social security in primary job, reference 3 months. Private and public sectors employment are defined according to the economic sector of primary job, reference 3 months. Monthly and hourly wages are calculated in constant 1998 Egyptian Pounds and refer to the monthly/hourly wage in primary job, conditional on being employed, in log specification. The hours of work refers to the current number of work hours per week, excluding subsistence work (market definition) and conditional on being employed. Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α₁ and α₂ in each column.

7. Concluding remarks

Are the Arab Spring uprisings affecting the relative position of women and men in the labor market? We have answered this research question using data from Egypt and a unique dataset that provides information on the governorate-level number of “martyrs” – demonstrators who died during the protests. We have used the latter variable as a proxy for the intensity of political unrest.

Our estimates show that the 2011 Egyptian revolution has reduced the gender gap in labor force participation, employment and the probability of working in the private sector. We also find an increase in women’s unemployment with the most educated women being more likely to fall in the unemployment category, suggesting that the revolution leads women to be actively searching for employment. The effects mainly concern households at the bottom of the pre-revolution income distribution. Our results also show that the revolution has negatively affected men’s remuneration and has led to an increase in men’s income volatility. The most vulnerable households being more likely to bear the burden of men’s increased income volatility induced by the revolution, we find that women who belong to the poorest households tend to increase their labor force participation and those employed tend to increase their labor supply as a household risk coping strategy.

Egyptian women’s labor force participation has always remained very low compared to their male peers even though women have become much more educated, a structural distortion acquiring the attention of scholars working on Egypt and the Middle East. Our results suggest that the revolution might provide a leeway to break the longstanding prevailing social and cultural norms towards females’ work by increasing their labor force participation in the Egyptian labor market.

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Appendix

Tables A1, A2 and A3, we investigate the effects of the revolution on several labor market outcomes. In Table A1, we investigate the effect of the revolution on the different types of employment by distinguishing between wage work, employer/self-employment and unpaid family work. Estimates do not show any significant effect of the revolution on women's wage work or on the probability of being employer/ self-employed, as we fail to reject the null hypothesis that the sum of the two estimated coefficients ($\alpha_1 + \alpha_2$) is statistically different from zero. However, we find a statistically significant effect of the revolution on unpaid family work for women. The revolution increases the probability of being an unpaid family worker for women by 7 percentage points, in governorates with a number of martyrs equal to the mean value (about 63). Egyptian women also find themselves responsible to increase their time allocation for home production, while also actively searching for paid employment. By contrast, we find that the revolution has reduced men's wage work and has pushed men to engage in non-wage work such as being employer or self-employed. Namely, at the average value of *martyrs*, the revolution has led to a reduction in men's wage work by 4 percentage points, whereas they witness a 3 percentage points increase in the probability of being either employer or self-employed.

In Table A2, we estimate the impact of the revolution by distinguishing between the formal and informal sector's employment. Estimates show that the differential effect of the revolution on informal and formal sectors employment by gender is statistically different from zero. Explicitly, the revolution had led to an increase in women's employment in the informal sector by 5 percentage points compared to men, whereas it reduces females' employment in the formal sector by 4 percentage points compared to men, when the effect is computed at the average value of the martyrs. However, the sum of the two estimated coefficients α_1 and α_2 is not statistically different from zero (see in Table A2 the test with the null hypothesis $\alpha_1 + \alpha_2 = 0$). These results go hand in hand with the hypothesis of necessity of women's participation in the labor market in the context of the revolution and hence, the informal sector is more likely to meet those needs in the short term as opposed to the formal sector as it has always been the informal sector providing more opportunities during periods of transition.

In Table A3, we investigate the impact of the 2011 revolution on public and private sectors employment, as there is a distinctive divide between the two sectors in the Egyptian labor market. We don't find any significant effect of the revolution on women's employment in the public sector, which has already slowed down since the 1990s with the downsizing of the public sector. Interestingly, we find that the revolution has reduced the gender gap in the private sector employment; leading to a 4 percentage point increase in women's the probability of being employed in the private sector, when the effect is computed at the average value of the martyrs.

In Table A4, we investigate the heterogeneity of the effects of the Egyptian revolution on individuals' labor market outcomes, by religious groups. We split our estimation sample of individuals into two religious groups and investigate the effect of the revolution on labor force

participation, unemployment and employment for the two religious groups. Results concerning Christian working aged individuals should be considered with caution because the sample size is small and the instruments are weakly correlated with the endogenous regressors (see the value of the Kleibergen-Paap rk Wald Test and the Stock-Yogo weak identification test critical values). Our results on our subsample of Muslim individuals are consistent with the results we presented on the whole estimation sample in Section 5.1: an increase in the intensity of the revolution by its mean value raises Muslim women's labor force participation by 12 percentage points, unemployment by 5 percentage points and employment by 7 percentage points..

In Table A5, we investigate several potential mechanisms. We present OLS and IV regressions for the following outcomes at the household level: share of households who report having a household member living or working abroad, log of remittances received, log of per capita household income (excluding remittances), log of per capita household income (including remittances) and the ratio of pupils enrolled in religious (*azhari*) schools to the total number of individuals currently studying at the time of the survey (at the household level). We only find a slight reduction in migration in the aftermath of the revolution by 1 percentage point, for an increase in the number of martyrs by 100. However, we don't find any suggestive evidence on remittance-recipientcy, household income (including/excluding remittances) or on religious education.

Table A1: Wage work, self-employment and unpaid family work

VARIABLES	Wage work				Employer/Self-employed				Unpaid family work			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Martyrs × female	0.011** [0.005]	0.047*** [0.012]	-0.001 [0.009]	0.069** [0.028]	0.005 [0.004]	-0.009 [0.008]	-0.002 [0.007]	-0.037 [0.023]	0.019*** [0.004]	0.052*** [0.013]	0.003 [0.008]	0.097*** [0.032]
Martyrs	-0.009** [0.004]	-0.048*** [0.011]	-0.001 [0.007]	-0.069*** [0.024]	-0.000 [0.003]	0.023*** [0.007]	0.005 [0.006]	0.049*** [0.018]	0.004*** [0.001]	0.012** [0.005]	0.003 [0.003]	0.009 [0.010]
Observations	12,434	12,434	12,434	12,434	12,434	12,434	12,434	12,434	12,434	12,434	12,434	12,434
R-squared	0.192	0.180	0.195	0.186	0.082	0.072	0.086	0.079	0.052	0.035	0.056	0.034
Individual Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pre-revolution governorate controls			YES	YES			YES	YES			YES	YES
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.590	0.861	0.769	0.992	0.031	0.002	0.319	0.295	0.000	0.000	0.468	0.001
Kleibergen-Paap rk Wald F statistic		26.283		50.642		26.283		50.642		26.283		50.642

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using OLS or IV regressions, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Wage work, employer, self-employed and unpaid family work are defined according to the current work status in primary job, reference 3 months. Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment: primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α₁ and α₂ in each column.

Table A2: Informal and formal sectors employment

VARIABLES	Informal sector employment				Formal sector employment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Martyrs × female	0.016*** [0.005]	0.071*** [0.019]	-0.012 [0.010]	0.087** [0.034]	0.004 [0.004]	-0.013* [0.008]	-0.001 [0.008]	-0.056*** [0.021]
Martyrs	-0.000 [0.004]	-0.020** [0.010]	0.014* [0.008]	-0.052** [0.023]	-0.004 [0.004]	0.009 [0.006]	0.001 [0.007]	0.046** [0.018]
Observations	9,346	9,346	9,346	9,346	9,346	9,346	9,346	9,346
R-squared	0.057	0.040	0.070	0.058	0.147	0.145	0.149	0.142
Individual Controls	YES	YES	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES	YES	YES
Pre-revolution governorate controls			YES	YES			YES	YES
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.000	0.002	0.753	0.175	0.882	0.323	0.994	0.337
Kleibergen-Paap rk Wald F statistic		26.742		57.945		26.742		57.945

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using OLS or IV regressions, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Informal sector employment is defined as having neither a legal work contract nor social security in primary job, reference 3 months, whereas, formal sector employment is defined as having a legal work contract and social security in primary job, reference 3 months. Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment: primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistics corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α₁ and α₂ in each column.

Table A3: Public and private sectors employment

VARIABLES	Private sector employment				Public sector employment			
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV	(7) OLS	(8) IV
Martyrs × female	0.013** [0.006]	0.066*** [0.020]	-0.011 [0.010]	0.056* [0.033]	0.003 [0.004]	0.008 [0.006]	0.004 [0.007]	0.004 [0.017]
Martyrs	-0.002 [0.005]	-0.002 [0.008]	0.013* [0.007]	0.003 [0.017]	-0.005 [0.004]	-0.013** [0.005]	-0.006 [0.006]	-0.017 [0.014]
Observations	12,399	12,399	12,399	12,399	12,399	12,399	12,399	12,399
R-squared	0.069	0.048	0.079	0.073	0.091	0.089	0.093	0.092
Individual Controls	YES	YES	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES	YES	YES
Pre-revolution governorate controls			YES	YES			YES	YES
H ₀ : α ₁ + α ₂ = 0 (P- value)	0.009	0.000	0.843	0.035	0.393	0.124	0.606	0.234
Kleibergen-Paap rk Wald F statistic		26.352		50.600		26.352		50.600

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using OLS or IV regressions, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Private and public sectors employment are defined according to the economic sector of primary job, reference 1 week. Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment: primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α₁ and α₂ in each column.

Table A4: Labor Force Participation, unemployment and employment by religious groups

VARIABLES	Labor Force Participation		Unemployment		Employment	
	(1)	(2)	(3)	(4)	(5)	(6)
	IV					
	Muslims	IV Christians	IV Muslims	IV Christians	IV Muslims	IV Christians
Martyrs × female	0.186*** [0.062]	-0.336 [0.298]	0.067** [0.028]	0.019 [0.130]	0.119** [0.056]	-0.355 [0.308]
Martyrs	0.004 [0.021]	0.216 [0.211]	0.017 [0.013]	0.106 [0.102]	-0.013 [0.022]	0.110 [0.183]
Observations	5,977	429	5,977	429	5,977	429
R-squared	0.050	0.076	0.027	0.028	0.125	0.123
Individual Controls	YES	YES	YES	YES	YES	YES
Household Controls	YES	YES	YES	YES	YES	YES
Pre-revolution Governorate Controls	YES	YES	YES	YES	YES	YES
H ₀ : α ₁ + α ₂ = 0 (P-value)	0.002	0.528	0.003	0.282	0.037	0.209
Kleibergen-Paap rk Wald F statistic	31.709	2.345	31.709	2.345	31.709	2.345

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using IV regression, where the distance to the capital Cairo and the distance to the capital Cairo interacted with a female dummy are used to instrument the number of martyrs by governorate and the interaction term between the number of martyrs by governorate and the female dummy. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. A female dummy is included which results from first-differencing our equation in level (from the interaction term between female and 2012 in equation 1). The dependent variable and all controls variables are first-differenced. Labor force participation, unemployment and employment are defined according to the current work status, reference 3 months, excluding subsistence workers (market definition). Individual controls include the following variables in first-difference: a dummy variable for ever-married status, three dummies for educational attainment primary and preparatory education, secondary education either general or vocational and above secondary education, either post-secondary institute or university education and above. The reference category is no educational degree either illiterate or literate without any diploma. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables as well as their interaction terms with a female dummy: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 7.03, 4.58, 3.95 and 3.63 at the 10%, 15%, 20% and 25% maximal IV size respectively. The reported P-value corresponds to an F-test of joint significance of the estimated coefficients α₁ and α₂ in each column.

Table A5: Potential mechanisms

VARIABLES	Migration		Remittances		Per capita household income		Per capita household income including remittances		Religious education	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Martyrs	0.000 [0.001]	-0.007* [0.004]	0.055** [0.027]	0.022 [0.090]	-0.030 [0.060]	-0.206 [0.152]	-0.001 [0.062]	-0.217 [0.161]	-0.006 [0.006]	-0.011 [0.019]
Observations	3,296	3,296	3,296	3,296	3,296	3,296	3,296	3,296	1,330	1,330
R-squared	0.013	0.009	0.015	0.015	0.104	0.101	0.081	0.077	0.021	0.021
Household Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pre-revolution governorate controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Kleibergen-Paap rk Wald F statistic		122.044		122.044		122.044		122.044		122.311

Robust standard errors in brackets

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

Notes. Each cell represents coefficient estimate using OLS or IV regressions, where the distance to the capital Cairo is used to instrument the number of martyrs by governorate. The number of martyrs represents the number of fatalities from the 25th of January 2011 to the end of June 2012, by governorate and is expressed in hundreds. Standard errors in parentheses are clustered at the community level. The dependent variable and all controls variables are first-differenced. The dependent variable in column (1) and (2) corresponds to migration at the household level, households report having a household member living or working abroad. The dependent variable in column (3) and (4) corresponds to the log of the total value of remittances received by households in cash and/or in kind from all listed migrants, during the last 12 months preceding the survey. The dependent variable in column (5) and (6) corresponds to the log of per capita household income. The dependent variable in column (7) and (8) corresponds to the log of per capita household income including remittances. Remittances, per capita household income and per capita household income including remittances are expressed in Egyptian Pounds (EGP), in constant terms (2006 EGP). The dependent variable in column (9) and (10) corresponds to religious education (Azhari education). The ratio is calculated on a subsample of individuals who are currently studying at the time of the surveys in 2006 and 2012. It is equal to the number of individuals studying at Azhari at the time of the survey over the total number of individuals currently studying at the household level. Household controls include the following variables in first difference: a rural dummy, an indicator for male headed household, the natural log of per capita household income, household size, the number of adults aged 15 to 64 years old, a dummy variable for land ownership, an indicator for the head's marital status is single, three dummies for the head of the household's educational attainment and four dummies for the head of the household's occupation according to the ISCO-88 occupation classification: low skilled blue-collar (elementary occupations, plant and machine operators and assemblers), high skilled blue collar (Skilled agricultural and fishery workers, craft and related trades workers), low skilled white collar (clerks, services workers and shop and market sales workers) and high skilled white collar (legislators, senior officials and managers, professionals, technicians and associate professionals). The reference category is not working category. Pre-revolution governorate controls include the following variables: the share of public sector employment by governorate in 2006, the number of police stations by governorate per 10,000 inhabitants, the average number of years of schooling for individuals aged 15-30 by governorate in 2006, the population density by governorate in 2006, the natural log of GDP per capita by governorate in 2005/2006 and a dummy variable for fully urban governorates (Cairo, Alexandria, Suez and Port Said). The reported Kleibergen-Paap rk Wald F-statistic corresponds to the first stage IV regression F-statistic. The Stock-Yogo weak identification test critical values are the following 16.38, 8.96, 6.66 and 5.53 at the 10%, 15%, 20% and 25% maximal IV size respectively.

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