Entry into Marriage, Motherhood and the Arab Spring: Evidence from Egypt

Samia Ferhat
THEMA-CY Cergy Paris Université,

Rozenn Hotte
Université de Tours – IRJI

Philip Verwimp
ECARES, SBS-EM, Université libre de Bruxelles

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ECARES
ULB - CP 114/04
50, F.D. Roosevelt Ave., B-1050 Brussels BELGIUM
www.ecares.org

Entry into Marriage, Motherhood and the Arab Spring: Evidence from Egypt

Samia Ferhat, Rozenn Hotte and Philip Verwimp *

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Abstract

The Egyptian Revolution has been shown to have triggered important economic and social changes, including the reduction of gender inequalities. However, few has been said on the impact of the Arab Spring on the age of entry into marriage and motherhood, which are key issues for women's welfare. To shed light on this question, we combine a dataset of the Egyptian Revolution, with the 2018 wave of the Egyptian Labor Market Panel Survey. We rely on quasi-experimental geographical and historical variations in the level of violence, to build a difference-in-differences analysis. Our main findings are that women residing in rural areas who were aged between 16 and 20 at the time of the Egyptian Revolution, marry earlier than the previous cohorts, and have children earlier as well. These results tend to moderate previous evidence on the increase in women's empowerment following the Arab Spring.

***JEL* Classification: J12, J16, 055**
Keywords: Arab Spring, Marriage, Fertility, Egypt.

*Contact information: Samia Ferhat: THEMA-CY Cergy Paris Université, samia.ferhat@cyu.fr; Rozenn Hotte: Université de Tours - IRJI, rozenn.hotte@univ-tours.fr; Philip Verwimp: ECARES - Université Libre de Bruxelles.

1 Introduction

The Egyptian revolution, during which almost 1000 civilians were killed and more than 6000 injured, has been shown to have triggered important economic and social changes.

El-Mallakh et al. (2018) have shown that the Arab Spring has decreased intra-household differences in labor force participation, and Bargain et al. (2019) have highlighted that these events have improved women's empowerment by increasing their final say within the household regarding decisions on health and expenditures. However, the revolution's positive impact on women's situation in the labor market is not that obvious. Conversely, Hendy (2015) argues that the January 25th revolution has had a negative effect on women's status in the labor market. Labor force participation has decreased, and unemployment has increased. These contrasting findings invite us to investigate the determinants of women's participation in the labor market, mainly marriage and fertility. This investigation is all the more important in a context where very few married women work: in 2018, according to the World Bank, only 20% of women participate in the labor force.

Few has been said on the impact of the Arab Spring on the age of entry into marriage and motherhood, which are not only key determinants for women's participation in labor market but also essential for women's welfare. Beyond the health problems and lower educational attainment induced when women marry and give birth at young age, women's age at marriage impact their bargaining power within the household. Moeeni (2021) for instance shows that women that are less educated have lower bargaining power. Now that the revolution took place almost 10 years ago, we are able to look at its impact on these outcomes.

To shed light on the question, we combine a dataset of the Egyptian revolution, which provides information on the number of people killed, injured and arrested during the entire period of the Egyptian Arab Spring, with the 2018 wave of the Egyptian Labor Market Panel Survey. We rely on quasi-experimental geographical and historical variations in the level of violence, to build a difference-in-differences analysis. We use variation over space and over time, in particular women's place of residence at the time of revolution and their birth cohort.

We use binary outcomes, defined for the whole sample (such as being married or not before a certain age), and continuous variables such as age at marriage and age at first child. Since the last variables are right censored, we use duration models to take this into account.

Our main findings are that women residing in rural areas who were aged between 16 and 20 at the time of the Egyptian revolution, marry earlier than the previous cohorts, and have children earlier as well. These results tend potentially to moderate previous evidence on the increase in women's empowerment following the Arab Spring. The discrepancies with previous research may be explained by the fact that we are looking at longer term outcomes. The impact we also find concerns a specific type of women, the ones residing in rural areas. This paper's findings raise important questions in terms of the repercussions that the decrease in the age of marriage could have on women's economic activity and bargaining power within the household.

2 Literature review

Conflicts and entry of women into marriage and fertility The Egyptian revolution counted 1000 civilian casualties and is responsible for the injury of at least 6000. As our research exploits the occurrence of violence in Egypt, we contribute to the literature on the consequences of conflict for women's welfare in general and their marital and fertility decisions in particular. There is no clear-cut conclusion in the literature in terms of the direction and magnitude of the impact of conflict on marriage and motherhood. Shemyakina et al. (2009) provide evidence of the armed conflict in Tajikistan between 1992-1998 and show that an economic crisis when associated with armed conflict delays age at first marriage for women. Jayaraman et al. (2009) also support the hypothesis that conflict delay age at marriage, by considering the 1994 genocide in Rwanda. They find that the conflict delays marriage in regions where people experience more siblings' deaths, but accelerates the entry into fertility in places with higher levels of under-five mortality. They conclude that the conflict affected age at marriage through disruption in the age structure and the sex ratio in the aftermath of

the genocide, and the decomposition of kinship in the case of women who lost their siblings. On the contrary, in the context of Cambodia, Saing and Kazianga (2019) find that bombing reduced age at marriage, potentially due to reduced education attainment or old-age security motives. Taking evidence from Nepal decade-long conflict, Williams et al. (2012) find that conflicts increase the likelihood of marriages, most probably since single people were more at risk of imposed conscription and forced labor. In addition, conflicts have also been shown to increase fertility, with negative consequences for women and their children (Nepal et al. (2018) in the context of Nepal). Therefore, the impact of conflicts on age at marriage and age at first child seem to depend on the context.

Egyptian Context In the particular context of the Egyptian revolution conflict, the consequences on women's welfare are not that obvious. On the one hand, El-Mallakh et al. (2018) show that the revolution has decreased intra-household differences through increasing labor force participation of women compared to men in both private and public sectors. In another paper, Bargain et al. (2019) show that 2011 Arab Spring protests in Egypt improved women empowerment by increasing their final say within the household regarding decisions on health expenditures. Women also showed reduced tolerance towards domestic violence in places mostly affected by the protests. However, these studies focus on the short term (one year after the revolution) and do not look at the impact on age at marriage. The positive impact on women's welfare could for instance be compatible with a delay in age at marriage and entry into motherhood, if the Egyptian revolution introduced a change in norms pertaining to women's position and status in the society. On the other hand, Hendy (2015) shows that the 2011 Egyptian revolution had a negative impact on women's status in the labor market. This mixed evidence in the literature on the impact of Arab Spring on women's welfare calls for further investigation. In this paper, we attempt to provide a part of the answer to support one of the two strands of literature.

Marriage and fertility in Egypt Egypt witnessed a reversal of the trend in the total fertility rate (TFR) before the 2011 revolution. It first decreased in 2000 and continued to decrease till

2007, after which it increased again. Goujon and Al Zalak (2018), show that according to the Egypt Demographic and Health Survey (EDHS) the TFR increased from 3 to 3.5 children per woman between 2008 - 2014. And the most rapid increase was observed in rural areas. Goujon and Al Zalak (2018) argue that this rise in fertility is more likely to be the consequence of an increase in women unemployment. Krafft (2020) observes a decrease in the public sector jobs that coincides with the increase in fertility. The public sector in Egypt is much more attractive to women compared to the private sector since it is easier to balance with marital life in terms of lower working hours and higher job security. Nevertheless, she suggests that the decrease in public sector employment is unlikely to be the main reason for the rise in fertility observed in Egypt starting 2008. She explains that the reasons behind the rise in fertility in Egypt is a complex question including different factors and is subject of debate and discussion. This paper attempts to contribute to this debate by investigating to which extent the Arab Spring has affected the fertility trend. We focus on age at marriage and age of entry into fertility, as these are less studied aspects in the literature reflecting women's well-being.

3 Conflict setting

The Egyptian revolution refers to a long series of protests and upheavals, marked by its starting date of January 25, 2011 that coincides with "Police day" yearly celebrations. Thousands of protesters inspired by the Tunisian revolution gathered in "Tahreer square" in the capital city Cairo and several Egyptian cities at the same time. The protesters demonstrated peacefully, demanding the government to leave by chanting slogans as "The people want to bring down the regime". A curfew was imposed in Egypt three days after the beginning of protests, however, this did not stop protesters so that many of them got arrested, injured or killed in an attempt from the police and army to contain the situation and put an end to demonstrations. 18 days later, on February 11, 2011 President Hosni Mubarak resigned, thereby ending the first phase of violence. The Supreme Council of the Armed Forces ruled Egypt until elections were held and Mohamed Morsi, candidate of the Muslim brotherhood was elected in June 2012.

During the rule of the Supreme Council, violence did not stop as clashes between Egyptian soldiers and civilians continued in a series of events leading to more victims. The victory of removing the head of the ancient regime was only the beginning for Egyptian protesters. They demanded the resignation of remaining regime figures and to stand trials for all the corrupt former officials and those responsible for the mass killings during the 18 days leading to Mubarak's resignation. Protesters eventually demanded the dissolution of the Supreme Council as they were frustrated about the slow pace of economic reform and the slow process of investigations to prosecute former regime figures.

President Morsi has faced fierce opposition, after releasing a declaration that immunizes his decrees from challenge in an attempt to pass an Islamic oriented constitution. The declaration was criticized by the constitution party leader and led secular and liberal groups to leave the constituent party. Violent protests took place across Egypt demanding the dissolution of the constituent party and the reversal of Morsi's declaration. By the first anniversary of Morsi's election on 30th of June 2013, millions of Egyptians protested asking that he steps down from office. 3 days later he was overthrown and a civilian senior jurist Adly Mansour was appointed interim president. Morsi and his supporters, mainly from Islamic parties refused his removal. Sit-ins were organised but quickly met security forces interventions leaving hundreds of killed civilians. On March 26, 2014, Abdel Fattah el-Sissi the head of the Egyptian Armed Forces, resigned from the military, and announced himself candidate for presidential election. He took office as president on 8th of June 2014.

As the geography of the protests will play an important role in our identification strategy, we want to highlight it here: the protests took place mainly in big cities. Nevertheless, protests cover almost all the Egyptian territory and rural areas were also impacted. We investigate the potential correlation of the protest with the pre-existing economic situation in Table 1. The number of people killed by governorate is not correlated with the share of unemployment before the revolution (in 2006). In the next section, we show the evolution of our major outcomes, according to the intensity of the revolution, thereby highlighting that there were no differences in pre-Arab Spring trends between high and low treated areas.

Table 1: Geography of the revolution

Descriptive statistics	(1) Mean	(2) Mean	(3) Diff.
	Treated	**Not treated**	
Unemployment level	0.11	0.09	-0.02
% Rural	0.15	0.74	0.58***
Secondary education or higher	0.81	0.76	-0.05
Number of governorates	6	15	21

Note: Column (1) reports the mean of each variable listed for the 6 more impacted governorates. Column (2) reports the mean of each variable listed for the other governorates. Column (3) reports the difference between these two groups and the significance level from a t-test.
Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01.

4 Data

4.1 The ELMPS

The Egyptian Labor Market Panel Survey is a nationally representative panel survey who was first conducted in 1998. Three waves followed in 2006, 2012 and then in 2018, directed by the Economic Research Forum (ERF) in cooperation with Egypt's Central Agency for Public Mobilization and Statistics (CAPMAS). A total of 30.698 women have been interviewed.

In this paper, we use the 2018 wave, conducted 7 years after the the revolution, which gives us a long enough period to study the consequences of the Arab Spring on marriage and fertility. The 2018 wave of the ELMPS provides the complete record of marital and fertility life for interviewed women. We are also able to locate women at the time of revolution as the data provides the place of residence at birth, current place of residence and all the changes in residence in between. Our two main outcomes of interest are the age at marriage and the age at first child.

4.2 The Egyptian revolution database

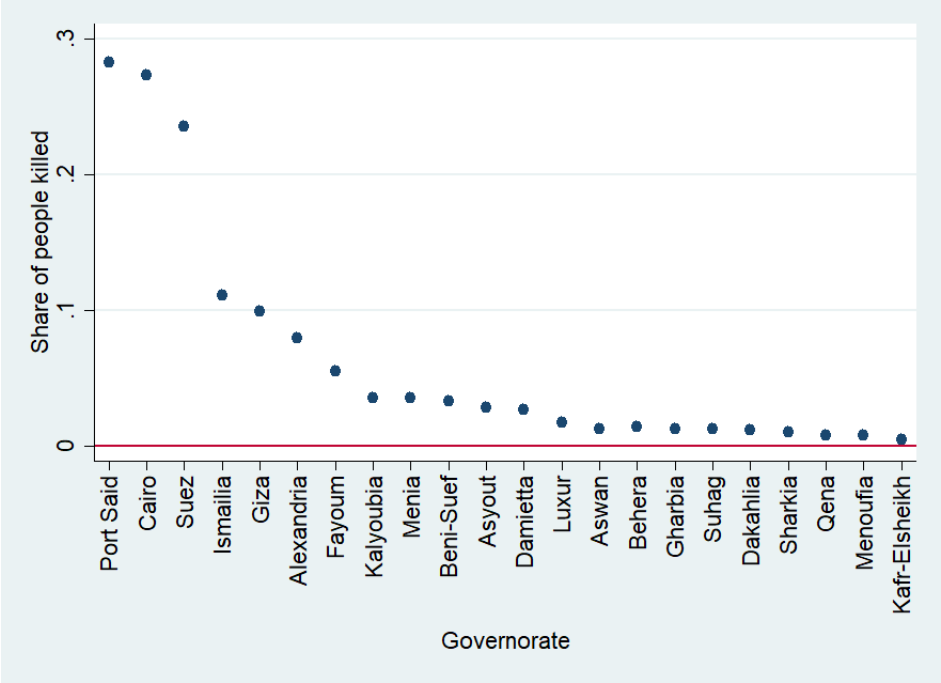
Our second source is "Wikithawra", a database on the Egyptian revolution that reports the list of individuals who were arrested, injured or killed during the entire duration of the Egyp-

tian revolution, i.e., January 25, 2011 till January 31, 2014. Detailed information on the exact location of each person arrested, killed or injured, is given along with the date of the event, which allows to properly locate killed individuals into governorates and districts. We use information on killed individuals only as this is the most accurate one, parts of the reported data on arrested and injured persons is missing. Also, it is less likely to mistakenly report a killed individual in comparison to an injured one. In addition, previous papers such as El-Mallakh et al. (2018) and Bargain et al. (2019) also use only the data on fatalities, allowing for a better comparison .

4.3 Definition of the Treatment

We use two definitions of the treatment. The first one, that we call Treatment 1, is a commonly used measure of the intensity of violence: the number of people killed during the whole period of the revolution (January 25, 2011 - January 31, 2014), relative to the number of people living in the governorate.[1] The second one, Treatment 2, is a dummy taking the value 1 for the 6 governorates with the highest share of killed people, and zero otherwise. We use this second definition to capture a potential non-linearity in the effect of violence, it could for example be that only the most violent areas drive the effect. The map in Figure 1 and the graph presented in Figure 2 give a visual representation of the data. The map shows the geographical distribution of the event. The red parts are the governorates with the highest share of killed individuals. In Figure 2 we choose these 6 governorates as their share of killed people is significantly higher compared to the other governorates (above the median, as can be seen in Figure 1).[2] We present alternative measures of the treatment in the robustness checks. We compute treatment measures at the district level.

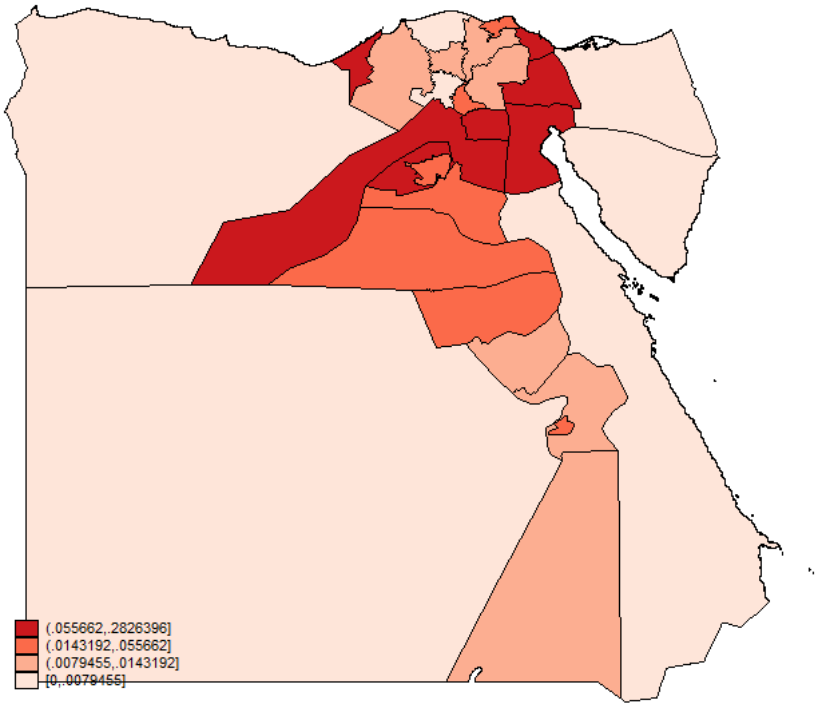
[1] We use population census that reports the number of individuals by governorate.
[2] These are also the more affected governorates according to Bargain et al. (2019).



Note: The figure presents the number of people killed for 1000 individuals by governorate.

Source: Egyptian revolution database

Figure 1: Number of people killed during the protests for 1000 inhabitants by governorates



Note: The map presents the number of people killed for 1000 individuals by governorate.

Source: Egyptian revolution database

Figure 2: Geographic distribution of people killed during the protests for 1000 inhabitants by governorates

4.4 Descriptive Statistics

Table 2 presents some descriptive statistics for women interviewed in our sample by type of residence in January 2011 at the time of revolution (rural /urban). Table 2 shows that the average age at marriage and age at first birth is slightly lower for rural women compared to urban women. The education level is also lower for rural women, and the violence intensity measure by the share of people killed during the revolution is lower in rural areas.

Table 2: Descriptive statistics

	All women	Rural women	Urban women
Age at first marriage	20.945	20.505	22.639
	(4.496)	(4.343)	(4.687)
Age at first child	22.390	21.979	23.949
	(4.258)	(4.144)	(4.353)
No schooling	0.248	0.279	0.137
	(0.432)	(0.448)	(0.344)
Secondary education and above	0.323	0.346	0.529
	(0.468)	(0.476)	(0.499)
Mother secondary education and above	0.282	0.187	0.324
	(0.450)	(0.390)	(0.468)
Father secondary education and above	0.345	0.254	0.392
	(0.475)	(0.436)	(0.488)
Currently working	0.670	0.655	0.710
	(0.470)	(0.475)	(0.454)
Share of killed people	0.046	.0265	0.113
	(0.066)	(.026)	(0.108)
Cohort 16-20	2562	1983	509
Cohort 26-30	2257	1667	524

Note: First column reports the mean for some of the variables characterising women in the whole sample. Second column is for women in rural areas and third column is for women in urban areas. Standard errors are in parenthesis. .

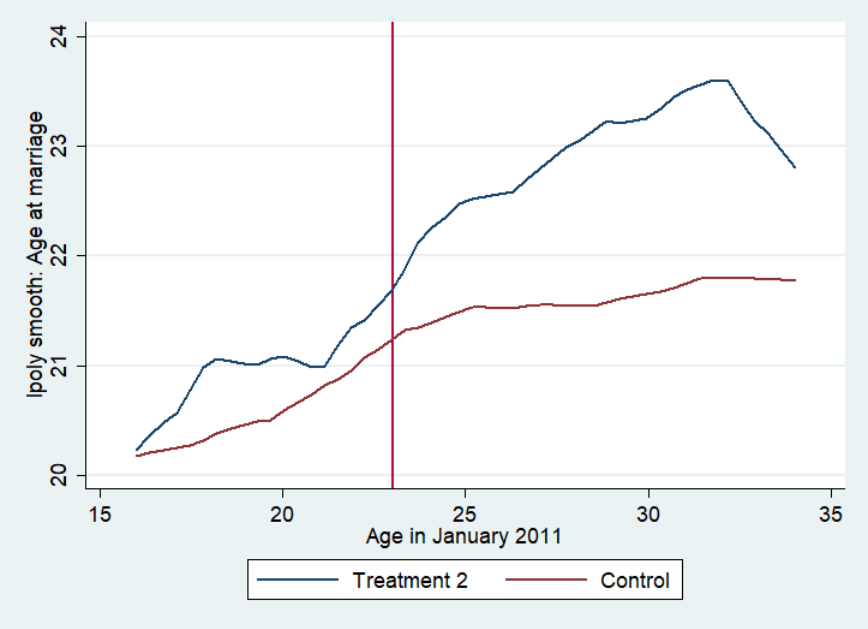
Source: ELMPS Egypt 2018.

5 Estimation approach

5.1 Graphical Evidence

Figure 3 plots the average age at marriage, according to the age of the respondent in January 2011 (beginning of the Egyptian Revolution), and compares women who lived in the 6 more affected governorates (in terms of the number of people killed) with women in the less affected governorates. The figure shows that women who were 27 years or older in January 2011 (meaning born before 1994) married at 23 years on average in the more affected areas, whereas this was on average 21 years old in less affected areas. The gap between the two areas is stable, when comparing with the older cohort of women being 35 years old in 2011. On the contrary, for younger cohorts, the age at marriage seems to decrease everywhere, but more strongly in highly affected areas. As a result, the gap between highly and the less affected areas seems to drastically reduce.

This figure however only tells part of the story. Indeed, age at marriage is a right-censored variable, since it is only known for individuals who were already married at the time of the survey. Younger cohorts have a higher probability not to be married at this time, and it is even more the case in highly treated areas, which were more urban areas. The computation of age at marriage averages for these younger cohorts will mechanically downward bias the results, even more strongly for urban areas where the age at marriage is higher relative to rural areas (see Table 2). There are two ways to correct for this type of error: either use duration model (which we will do in Subsection 5.3), or look at variables that are not right-censored, such as to be married before a certain threshold, as presented in the next subsection.



Note: The figure presents the average age at marriage according to the age in January 2011.
Source: ELMPS 2018

Figure 3: Average age at marriage

5.2 Difference-in-Differences

We use a standard difference-in-differences method. We compare individuals according to their governorate of residence and their birth cohort: women being between 16-20 years old at the time of the Revolution are considered as treated, while the control group is composed of women between 26 and 30 years old. We choose this age group since women start to marry at 18 years old (in 2018, 6% of women of 17 years old are married, versus 15% of women of 18 years old). At the age of 26, 70% of a cohort is married. Therefore, women who are older than 26 at the time of the Egyptian Revolution are far less susceptible to be affected in terms of entry into marriage.

We estimate the following model:

$$y_{igc} = a_0 + \beta * Post_i + \theta * Treat_g + \delta * Treat_g * Post_i + \alpha_g + \eta X_i + \varepsilon_{igc} \quad (1)$$

where y_{imc} is the outcome of interest for individual i residing in governorate g and born in

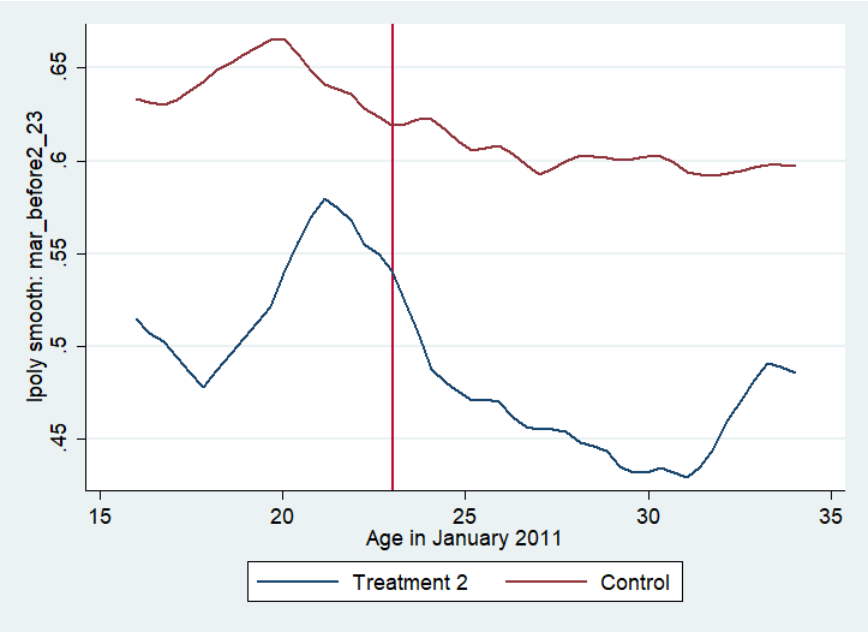
year c; a_0 is a constant; α_g is a governorate of residence fixed effect. $Post_i$ is a dummy variable equal to 1 if the individual was between 16 and 20 years old in January 2011. It is equal to 0 if she was between 26 and 30 (women who are in general already married at that time). $Treat_g$ is a measure of the treatment: we use alternatively treatment different definitions, as presented in Section 4. We also add a set of individual controls X_i, which includes whether the individual has some education and, and whether she was living in rural or urban areas in 2011. To build the type of residence variable (rural or urban) in 2011, we use retrospective information on the kism (district) of residence collected in the survey, that we match with information coming from the census data. More precisely, we compute the average level of rurality by district using the 2006 census data, that are more representative and of higher size than the ELMPS data. We match this variable with the kism (district) of residence of the individual in 2011, that we built thanks to information on migration present in the ELMPS data: changes of kism are reported [3].

For each set of results, we provide placebo estimations, comparing women who were between 26 and 30 at the time of the Revolution, to women who were between 36 and 40. The age at marriage of these women is not supposed to be affected by the revolution, since they were already married. This is a way to test the parallel trend assumption.

We look at different outcomes: age at marriage and age at first birth. Though, classical ordinary least squares with these variables are biased since women in the treatment group are not all married, as explained in the previous section. We therefore consider an alternative variable, the probability to be married before 23 years old. This variable is known at the time of the survey for every woman being 16 years old or older at the time of the Revolution (in 2011): there is no right-censorship of the variable.

[3] There is one exception in the report of changes of kism. Enumerators were advised that "Moving within the same governorate from urban to urban or rural to rural does not count as a move." We need therefore to do an approximation (not changing the kism of residence when the type of area is the same), but since the type of residence did not change, we think that the issue is limited. We present also results using the current place and type of residence at the time of the survey (2018) in Appendix: results are in line with our main results. In this alternative strategy, we do not have to do the earlier mentioned approximation but we think that these results are less reliable since changes of residence following the Arab spring can introduce a bias (we discuss concerns relative to migration in Section 8).

Figure 4 plots the probability to be married before the age of 23 years old, according to the age at the beginning of the Egyptian Revolution. Women have a higher probability to be married before 23 years old in less treated areas; but the gap with highly treated areas drastically reduces for women who were younger than 23 years old at the time of the Revolution. This time, the results are not biased by the censorship of the variable, and thus offer evidence of the represent a first hint of a potential impact of the Egyptian Revolution on the age of entry into marriage for women.[4].



Note: The figure presents the probability of marriage before 23 according to the age in January 2011.
Source: ELMPS 2018

Figure 4: Probability of marriage before 23

5.3 Duration model

Since two of our main outcome variables are right-censored (age at marriage and age at first birth), we use a duration model to correct for this bias.

We use more precisely a discrete-time duration model to test whether being exposed to the revolution accelerates the entry into marital and fertile life. The Cox proportional haz-

[4]In Figure 5 in Appendix, we present the same analysis for women in rural areas, since it is in this type of areas that results are significant

ard model (Cox (1972); Lancaster (1990)) is more commonly used in the literature. Here, we choose the discrete time duration model for two main reasons.

First, in models such as the Cox model, time is continuous and there should not be any simultaneous events. A duration, t_i, that leads to the studied event should be associated with one observation, i, if the clock for measuring the duration is sufficiently precise. Yet the Labor Market Panel Survey (as well as many other household surveys), collects time-discretized data. Therefore, many events can happen at the same time (women born the same year and the same month having their child at the same age, for instance). Second, and more importantly, the Cox model relies on the parallel hazard assumption. In the context of this paper, it would mean that the ratio of the risk of experiencing a marriage is constant between treated and untreated women at every moment within the studied duration. But here, we can not assert that the risk of experiencing the first marriage in the studied duration is the same, whatever the geolocation (and therefore the intensity of the treatment) and the age of the women. The discrete-time model allows us to introduce time as a covariate, and therefore reduces this issue. We use the most commonly used function in this setting, the logistic regression:

$$\begin{aligned} log(\frac{p_{tigc}}{1-p_{tigc}}) = a_0 + a_k * t + a_p k * t^2 + \alpha_g + \beta * Post_i \\ + \theta * Treat_g + \delta * TREAT_g * Post_i + \gamma X_i \end{aligned} \tag{2}$$

where p_{tigc} is the probability of experimenting the event (marriage or first birth) and t is the number of years passed since the respondent's birth. For this analysis, the data is reshaped: there is one observation per year and per woman until she gets married or, if she does not, until she is surveyed. We keep only observations for which the age of the woman is at least 11 years old, since there is almost no marriage before this age. As in the previous model, X_i includes whether the individual has an education or not; $TREAT$ is the binary exposure to treatment according to the birth cohort; and α_g is the governorate of residence (in 2011) fixed effect. We present the odd-ratios (and not the coefficients) in the tables displaying the results.

As a robustness check, we present in appendix the results using the more traditional Cox Proportional Hazard model, according to which the hazard function satisfies:

$$h_{imct} = h_0(t) * \exp(\beta * Post_i + \theta * Treat_g + \delta * Treat_g * Post_i + \alpha_g + \eta X_i) \quad (3)$$

where h_{imct} represents the hazard function, determined by the same covariates we use in the OLS model and $h_0(t)$ is the baseline hazard. Variables with positive coefficients (the β values) are associated with increased hazard and decreased survival times, i.e. as the predictor increases the hazard of the event and the predicted survival duration decreases. The results (in hazard-ratios) using a Cox Model are very similar to the ones found with the discrete time duration model.

6 Regression results

6.1 Linear Probability Models

Age at marriage being right-censored, using this variable with an OLS model would bias the results. Age at marriage is only known for women who are already married, this constitute a bias in the difference-in-differences setup. In the control group women are aged between (33-37 at the year of the survey) so almost all of them are married, however in the treatment group, women are younger (aged between 23-27 at the year of the survey) and not all of them are married yet. As women who are already married in the treatment group are those who got married at a young age, this would artificially lower the age of marriage and lead to over estimate the effect of revolution on age at marriage. [5] We consider an alternative variable, the probability to be married before 23 years old. We choose this age threshold, because it is

[5] Table 11 in the Appendix displays the estimates of the OLS estimation of the age at marriage. Columns (1), (3) and (5) present the results using the first definition of the treatment, meaning the share of people killed. The coefficient of interest is not significant no matter the sample considered (all women, women in rural areas or in urban areas). If we use the second definition of the treatment (dummy variable for the six governorates with the highest share of killed people), the coefficient is negative and significant, regardless of the sample definition. The results of the placebo are overall never significant. Note that these results are potentially biased.

the threshold for which, at the time of the survey, in 2018, this variable is known for every respondent considered in the age interval of the specification (ages between 16-30 in January 2011). We could not look at the probability to be married before 25 years old because women who are 16 or 17 in 2011, at the time of the revolution, are only 23 or 24 at the time of the survey, and we do not know yet whether they will be married before 25. Table 3 displays the results.[6] Results with the first treatment definition ,i.e., the share of persons killed at the level of the governorate are depicted in columns (1), (3) and (5). Results with the second definition of treatment ,i.e., a dummy variable that takes the value 1 for the six governorates with the highest share of persons killed and 0 for remaining governorates, are depicted in columns (2), (4) and (6). The coefficient of interest for the first treatment definition is not statistically significant when considering the whole sample or for urban areas. It is positive and significant at the 5% level for rural areas, meaning that the Arab Spring has accelerated the marriage for this specific sample. We find the same results when using the second definition of treatment : not statistically significant when using the entire sample and for urban areas, but positive and significant at the 5% level for rural areas sample (column(4)). The latter result suggests that the probability of being married before 23 increased by 12.8 percentage points in rural areas highly affected by the violence of the Arab Spring. The placebo is not significant, suggesting the presence of parallel trends.

When considering the probability to have a child before 23 years old, Table 4 does not show a statistically significant effect at the usual thresholds, it is marginally significant at the 15% threshold. Moreover, the placebo is significant. As these results only consider this specific threshold, we turn to a duration model for a more complete picture, in the next section.

[6]We show results using logit model in tables 18 and 19 of the Appendix. We find that Logit results are consistent with LPM.

Table 3: LPM Model: Marriage before 23 years old

	All		Rural		Urban	
	(1)	(2)	(3)	(4)	(5)	(6)
	Comparing people between 16-20 in January 2011 versus 26-30					
Treatment 1: Share of killed people	0.319** (0.140)		18.12*** (0.393)		-0.521*** (0.0310)	
People aged between 16 and 20 in January 2011 (vs 26-30)	0.0157 (0.0168)	0.00232 (0.0140)	-0.00833 (0.0252)	0.0196 (0.0171)	-0.0529+ (0.0345)	-0.110*** (0.0303)
Aged 16-20*Share of killed people	-0.198 (0.177)		1.447** (0.718)		-0.0271 (0.126)	
Treatment 2: 6 more impacted governorates		0.0557* (0.0322)		0.0860** (0.0315)		-0.154*** (0.0129)
Aged 16-20*6 more impacted governorates		0.00555 (0.0630)		0.128** (0.0621)		0.0747+ (0.0478)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	4640	4640	3647	3647	993	993
r2	0.07	0.07	0.03	0.03	0.04	0.04
	Comparing people between 26-30 in January 2011 versus 36-40					
Treatment 1: Share of killed people	0.310** (0.124)		8.458*** (0.874)		0.413*** (0.0926)	
People aged between 26 and 30 in January 2011 (vs 36-40)	0.0599** (0.0249)	0.0524** (0.0255)	0.0503 (0.0377)	0.0403 (0.0300)	0.0861** (0.0410)	0.0963** (0.0461)
Aged 26-30*Share of killed people	-0.214* (0.115)		-0.245 (0.851)		-0.315* (0.158)	
Treatment 2: 6 more impacted governorates		0.0584* (0.0317)		0.0233 (0.0246)		0.102*** (0.0301)
Aged 26-30*6 more impacted governorates		-0.0202 (0.0307)		0.0471 (0.0372)		-0.0759 (0.0528)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3334	3334	2555	2555	779	779
r2	0.06	0.06	0.02	0.02	0.04	0.04

Note: The dependent variable is a dummy taking the value 1 if the marriage happens before 23 years old. We control also for primary education. Panel A and panel B present the results of the double difference model. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Women.

Source: ELMPS Egypt 2018.

Table 4: LPM Model: Child before 23 years old

	All		Rural		Urban	
	(1)	(2)	(3)	(4)	(5)	(6)
	Comparing people between 16-20 in January 2011 versus 26-30					
Treatment 1: Share of killed people	0.732*** (0.158)		20.78*** (0.459)		-0.409*** (0.0562)	
People aged between 16 and 20 in January 2011 (vs 26-30)	-0.000190 (0.0182)	-0.0143 (0.0160)	-0.0143 (0.0273)	0.00437 (0.0193)	-0.0689+ (0.0440)	-0.137*** (0.0467)
Aged 16-20*Share of killed people	-0.171 (0.191)		1.044 (0.786)		0.0259 (0.194)	
Treatment 2: 6 more impacted governorates		0.161*** (0.0365)		0.188*** (0.0328)		-0.127*** (0.0164)
Aged 16-20*6 more impacted governorates		0.0143 (0.0613)		0.110+ (0.0636)		0.100+ (0.0611)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	4640	4640	3647	3647	993	993
r2	0.07	0.07	0.03	0.03	0.04	0.04
	Comparing people between 26-30 in January 2011 versus 36-40					
Treatment 1: Share of killed people	0.594*** (0.152)		13.45*** (0.725)		0.186* (0.103)	
People aged between 26 and 30 in January 2011 (vs 36-40)	0.0804*** (0.0251)	0.0807*** (0.0242)	0.0773** (0.0331)	0.0774** (0.0271)	0.0312 (0.0480)	0.0774+ (0.0478)
Aged 26-30*Share of killed people	-0.267* (0.135)		0.143 (0.602)		-0.0765 (0.184)	
Treatment 2: 6 more impacted governorates		0.147*** (0.0345)		0.103*** (0.0218)		0.0823** (0.0357)
Aged 26-30*6 more impacted governorates		-0.0605** (0.0253)		0.0484* (0.0271)		-0.0811 (0.0582)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3334	3334	2555	2555	779	779
r2	0.05	0.05	0.03	0.03	0.04	0.04

Note: The dependent variable is a dummy taking the value 1 if the woman had a child before 23 years old. We control also for primary education. Panel A and panel B present the results of the double difference model. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Women.

Source: ELMPS Egypt 2018.

6.2 Duration Model

Table 5 displays the estimates of the duration model for rural women (we present results for all women in Appendix Table 13 and for urban women in Table 14 of the Appendix), whereby we estimate the determinants of the probability to be married at a given age. Considering the first definition of the treatment, the Arab Spring seems to have increased the likelihood of experiencing marriages in rural areas. The placebo estimations are not significant, which gives confidence in the validity of the results. When considering the second definition of the treatment, results are in line with the results obtained with the first treatment definition. Furthermore, with this second treatment, the placebo is also not significant. We can thus state that in treated rural areas, the Arab Spring has increased the probability to experience a marriage for women. Results for the probability to obtain a first child (columns (3) and (4)) are coherent with the probability of entering into marriage (columns (1) and (2)). For instance, to live in one of the 6 more impacted governorates, in rural areas, for the treated cohort, multiplies the odd of experiencing the event by 1.6055 relatively to the older cohort, meaning it increases the probability to experience the event. The Arab Spring has accelerated the occurrence of giving birth, for women in rural areas. Results with the Cox model are displayed in Appendix in Table 15, they are very in line with the discrete time duration model.

Table 5: Marital outcome at the governorate level, for rural women - DISCRETE TIME DURATION MODEL

	Age at marriage		Age at first child	
	(1)	(2)	(3)	(4)
	Comparing people between 16-20 in January 2011 versus 26-30			
Treatment 1: Share of killed people	1.86137e+12*** (3.17128e+12)		3.64043e+20*** (8.17905e+20)	
Aged 16-20*Share of killed people	211.9** (591.0)		33.08** (53.74)	
Treatment 2: more impacted governorates		1.460*** (0.178)		1.724*** (0.105)
Aged 16-20*6 more impacted governorates		1.605** (0.396)		1.352*** (0.153)
governorate fixed effects	Yes	Yes	Yes	Yes
N	38146	38146	43914	43914
r2_p	0.14	0.14	0.15	0.15
	Comparing people between 26-30 in January 2011 versus 36-40			
Treatment 1: Share of killed people	1292309.5*** (2752429.3)		1.05354e+17*** (2.93027e+17)	
Aged 26-30*Share of killed people	0.0588+ (0.109)		0.282 (0.489)	
Treatment 2: more impacted governorates		1.273*** (0.0825)		1.581*** (0.107)
Aged 26-30*6 more impacted governorates		0.930 (0.0893)		1.022 (0.0805)
governorate fixed effects	Yes	Yes	Yes	Yes
N	28725	28725	34546	34546
r2_p	0.07	0.07	0.13	0.13

Note: The dependent variable is age at marriage for columns (1) and (2), and age at first child for columns (3) and (4). We control also for primary education. Odd-ratios are displayed. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Rural Women.

Source: ELMPS Egypt 2018.

7 Robustness checks and Discussion

In this section, we conduct several robustness tests by varying the definition of the treatment and the scale of the analysis.

7.1 Alternative definition of the treatment

We use two alternative measures of the treatment. The first one, *Treatment 3*, is a binary variable taking the value 1 if the share of people killed is larger than the median, and the second one, *Treatment 4*, is the same measure, except that people injured and arrested are also considered. These measures have the advantage of being less correlated with the urbanization, as opposed to Treatment 2, which was especially concentrating big cities. Results for rural women regarding the probability to marry before 23 years old hold when using these two alternative treatment measures, as shown in Table 6. For the *Treatment 3*, results are also significant when considering the age at marriage (but results are no more significant with *Treatment 4*).

When considering the entry into fertility, the signs of coefficients are consistent but results are no longer significant with *Treatment 3*. Considering *Treatment 4*, results are nevertheless marginally significant at 15% level for the probability to have a child before 23 years old.

7.2 At the district level

In order to strengthen our results, we perform the analysis at a finer geographic level, the district (there are 351 different districts in Egypt). We geo-coded every event of the "Wikithawra" database, and construct two treatment variables at this level: the share of killed people in the district, and a dummy variable. This dummy variable takes the value 1 for districts, in which the share of people killed is over the median, and 0 otherwise. Results are very consistent with the results at the governorate level (Table 7). Rural women residing in "high" treated districts marry earlier, and have children earlier as well. We still prefer to use the governorate

analysis as the main one, in order to limit the issues linked to migration (since the governorate analysis mitigates some concerns due to governorate-internal migration.) [7])

[7]Within governorate migration from rural to rural or urban to urban between districts is not considered as migration in the database.

Table 6: Marital outcome at the governorate level, rural women - Alternative definitions of the treatment (Treatment 3 and Treatment 4) with discrete time duration model

	Marriage before 23		Child before 23		Age at marriage		Age at first child	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Comparing people between 16-20 in January 2011 versus 26-30								
Treatment 3: Share killed p. above the median	-0.0811*** (0.0165)		-0.0161 (0.0218)		0.714*** (0.0493)		0.792*** (0.0407)	
Aged 16-20*Share killed p. above the median	0.0656* (0.0343)		0.0191 (0.0447)		1.240* (0.159)		1.126 (0.138)	
Treatment 4: Share killed/arrested p. above the median		0.150*** (0.0171)		0.175*** (0.0211)		1.224** (0.103)		1.531*** (0.104)
Aged 16-20*Share killed/arrested p. above the median		0.0749* (0.0378)		0.0730+ (0.0451)		1.228 (0.209)		1.139 (0.170)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3647	3647	3647	3647	38146	38146	43914	43914
r2_p					0.14	0.14	0.15	0.15
Comparing people between 26-30 in January 2011 versus 36-40								
Treatment 3: Share killed p. above the median	-0.0174 (0.0297)		-0.0251 (0.0298)		0.826** (0.0627)		0.852* (0.0772)	
Aged 26-30*Share killed p. above the median	-0.0560 (0.0559)		0.00323 (0.0496)		0.829+ (0.0984)		0.911 (0.130)	
Treatment 4: Share killed/arrested p. above the median		0.133*** (0.0398)		0.169*** (0.0315)		1.298*** (0.0998)		1.613*** (0.152)
Aged 26-30*Share killed/arrested p. above the median		-0.0842 (0.0625)		-0.0605 (0.0480)		0.777* (0.106)		0.845 (0.123)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2555	2555	2555	2555	28725	28725	34546	34546
r2_p					0.07	0.07	0.13	0.13

Note: The dependent variable is age at marriage for columns (1) and (2), marriage before 23 years old for columns (3) and (4), age at first child (5) and (6) and child before 23 years old for columns (7) and (8). We control also for primary education. Panel A and panel B present the results of the double difference model. For the duration model, odd-ratios are displayed. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Rural Women.

Source: ELMPS Egypt 2018.

Table 7: Marital outcome at the district level - discrete time duration model, for rural women

	Age at marriage		Marriage before 23		Age at first child		Child before 23	
	(1)	(2)	(3)	(4)	(5)	(6))	(7)	(8)
Comparing people between 16-20 in January 2011 versus 26-30								
Treatment 1: Share of killed people	0.473 (0.629)		-0.385 (0.516)		0.637 (0.879)		0.317 (0.711)	
Aged 16-20*Share of killed people	51.25** (87.34)		1.322*** (0.421)		62.51** (120.9)		0.780 (0.907)	
Treatment 3: Share killed above the median		0.975 (0.0773)		0.0108 (0.0352)		0.994 (0.0787)		0.0337 (0.0422)
Aged 16-20*Share killed p. above the median		1.381*** (0.134)		0.0755** (0.0359)		1.452*** (0.144)		0.0754* (0.0407)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	38146	38146	3647	3647	43914	43914	3647	3647
r2_p	0.14	0.14			0.15	0.16		
Comparing people between 26-30 in January 2011 versus 36-40								
Treatment 1: Share of killed people	0.741 (1.282)		-0.265 (0.805)		1.160 (1.802)		0.314 (0.700)	
Aged 26-30*Share of killed people	0.640 (0.881)		0.140 (0.325)		0.580 (0.487)		0.291 (0.587)	
Treatment 3: Share killed above the median		1.247* (0.152)		0.000866 (0.0368)		1.053 (0.121)		0.00559 (0.0302)
Aged 26-30*Share killed p. above the median		0.766** (0.0815)		0.0118 (0.0359)		0.934 (0.104)		0.0309 (0.0446)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	28725	28725	2555	2555	34546	34546	2555	2555
r2_p	0.07	0.07			0.13	0.13		

Note: The dependent variable is age at marriage for columns (1) and (2), marriage before 23 years old for columns (3) and (4), age at first child (5) and (6) and child before 23 years old for columns (7) and (8). We control also for primary education. For the duration model, odd-ratios are displayed. Panel A and panel B present the results of the double difference model. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Rural Women.

Source: ELMPS Egypt 2018.

7.3 Alternative specification : discretized duration model

We also tested an alternative specification of the discretized duration model. This is a LPM model, but with the following data structure: there is one observation by woman and by year starting from age 11 (since there is almost no marriage and birth before this age). The outcome (marriage or birth) takes the value 0 if the woman is not married (or has not given birth) at the age considered. It takes the value 1 at the age where the woman married (or gave birth). The subsequent year, the woman leaves the sample. For women who are still not married, the outcome takes the value 0 for each age. Results are presented in Table 8. They are in line with our main results.

7.4 Threats to the Identification Strategy

The use of the difference-in-differences in this setting raises several issues.

Urbanization The protests mostly occurred in cities. One threat to our identification strategy would be that we are capturing the effect of urbanization, instead of the one of protests intensity. Indeed, the 6 most impacted governorates are big urban cities. This threat is nevertheless mitigated by the fact that our results concern above all rural areas (where violence intensity is low). Our results hold also when we use a more continuous variable of the treatment, and when we are at the district level. Moreover, we are using governorates fixed effects that control for the level of urbanization.

Impact of other changes The protests follow and create economic difficulties. Another potential threat to our identification strategy could be that the results are not driven by the protests, but by pre-existing socio-economic difficulties. We do not think that this is a major issue since the protests are not correlated with economic difficulties, as shown in Table 1. This table allows to assess the correlation of the protests with the pre-existing economic situation according to highly treated and less treated areas. The difference in unemployment rate between treated and less treated before the revolution (2006) is not significantly different from zero which gives confidence in the fact that our results are not entirely drawn by pre-existing socio-economic trends.

Table 8: Alternative specification

	Age at marriage		Age at first birth	
	(1)	(2)	(3)	(4)
	Comparing people between 16-20 in January 2011 versus 26-30			
Treatment 1: Share of killed people	1.105*** (0.128)		1.658*** (0.0975)	
Aged 16-20*Share of killed people	0.238+ (0.146)		0.137* (0.0712)	
Treatment 2: 6 more impacted governorates		0.0176** (0.00646)		0.0222*** (0.00261)
Aged 16-20*6 more impacted governorates		0.0204+ (0.0136)		0.0111** (0.00484)
governorate fixed effects	Yes	Yes	Yes	Yes
N	38135	38135	43881	43881
r2_p				

Note: The dependent variable is age at marriage and age at first birth. We control also for primary education. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Rural Women.

Source: ELMPS Egypt 2018.

Migration Thanks to the retrospective information on migration, the individual's place of residence at the time of the Egyptian revolution is known and used to determine the intensity of the treatment. Meaning that even when a woman migrated after the revolution, we assign the level of violence in her place of residence at the time of the revolution, because she was clearly affected or exposed to it. Migration implied by the revolution should therefore not be a threat to our strategy. Nevertheless, to build the information on the type of the place of residence in 2011 (rural or urban district, called "kism"), we have to do a small approximation, since enumerators were advised that "Moving within the same governorate from urban to urban or rural to rural does not count as a move". Thus, we have to consider that there was no move when individuals moved within the same governorate, from rural to rural, or urban to urban. When our analysis is at the governorate level, it affects only one variable: the type of residence in 2011 (rural or urban). Indeed, the type of the place of residence in 2011 (rural or urban) is defined at the district level (because we do not have the individual (very local) information for 2011). The approximation we are forced to do could bias this measure, for instance in the case where the individual has effectively changed the district, staying in a rural area at the individual level (very locally), but moving from a district considered globally as rural to a district globally considered as urban. This should be nevertheless very rare. This approximation is also the reason why we present our results at the governorate level as our main or 'preferred' specification and not the results at the district level: even when the last one is at a more disaggregated level, it is more prone to migration bias. The use of governorate level as the location of the violence should be immune to within-governorate migration movements.

To convince that this approximation is not a strong issue, we redo the analysis, using the place of residence and the type of place of residence (rural or urban) at the time of survey (2018) as our indicator of residence. As can be seen in Table 16 of the Appendix, results are in line with the main ones, suggesting that our approximation does not affect the results, as well as migration: indeed if migration was affecting the results, we would expect different results when using the place of residence of 2018 instead of 2011.

We prefer using the place of residence in 2011, at the cost of the approximation already mentioned for the following reason. When using as intensity of the treatment, the place of residence in 2018, not taking into account the migration could introduce a measurement error because people may not be in the same place as in 2011. Not taking into account the migration could even bias the results if migration is not orthogonal to the treatment. Migration however is in fact very limited. Only 6.44% of women who were between 16 and 20 years old at the time of the revolution have moved from the districts where they were born. There is no significant difference according to whether they lived in highly treated governorates or less treated. Also, we observe that 95.43% of women in our sample live in 2018 in the same district in which they lived in 2011. The latter share is even higher (96.23%) when we consider women in the age category of interest (16-30) and in rural areas.

Even if migration is not a threat to our identification strategy, it could be a channel explaining the results on marriages: it would be the case if for instance the revolution fostered women to migrate in places where they marry sooner. We restrict the sample to only women who did not move between 2011 and 2018, results are presented in Table 17 in Appendix. The table show consistent results to those in (Table 5), where the place of residence in 2011 is used. Overall, migration does not seem to impact our results.

What if marriage and fertility at younger age had nothing to do with the revolution? Even though the total fertility rate in Egypt was increasing before the revolution, we argue that the Egyptian revolution played a role in increasing this trend further, by impacting the age at entry into marriage, a pre-requisite to have a child.

Krafft (2020) observes a decrease in the public sector jobs that coincides with the increase in fertility. However, the decrease of opportunities of employment in the public sector impacts more the third and fourth births, and not the first births, which is our outcome of interest in this paper. This suggests that this mechanism can not explain the decrease in the age at marriage and age at first birth, that we document in this paper.

Ambrosetti et al. (2019) suggest that the trend reversal is due to a change in ideals related to family size preferences. When comparing cohorts of women in 2008 and 2015 between the age of 15 and 24, Ambrosetti et al. (2019) shows that there is an increase in the preference for more children and this preference is observed no matter women's level of education or place of residence. The Arab Spring could have affected preferences, but we see clearly a difference of impact between rural and urban areas, suggesting that the channel of preferences change cannot explain our results.

Overall, even if fertility had already been increasing before the revolution, this does not run counter to our results. The revolution seems to have reinforced the trend shift.We argue that revolution played a role in reducing childbearing age in Egypt.

8 Channels and Interpretation

8.1 By which period of the Revolution are the results driven?

As explained in Section 3, the Egyptian Revolution can be roughly decomposed in 4 time periods: the first 18 days leading to Mubarak resignation, the Supreme Council of Armed Force rule until June 2012, then the governance of President Morsi and finally the period of protests against him and oppression of his supporters until Sissi's arrival on January 2014.

We put together the two first periods and the two last periods of the revolution, since the election of President Morsi from Muslim brotherhood party is a turning point in the Revolution. We look at the impact of the number of people killed, for each aggregated period separately. Results on age at marriage and age at first birth are presented in (Table 9)[8]. We find that results are statistically significant for both periods, and hence we can not conclude on whether the results are driven by the first period of revolution against "Hosni Mubarak regime" or the second period characterized by the arrival of muslim brotherhood adept "president Mohamed Morsi".

[8]In this table, coefficients and not odd-ratios are presented, because the magnitude of the odd-ratio for the variable "share of killed people" would be too large. For this reason, only the sign of the coefficients may be commented.

8.2 Economic shock versus social norms and religiosity

When we show that the Arab Spring has reduced the age at marriage in rural areas, we wonder whether the effect could channel through an economic variable, meaning economic difficulties proper to this uncertain period, or to another channel, pertaining to social norms and religiosity highlighted in the first or second period of the Egyptian Revolution. Two arguments speak against the economic channel: (i) according to World Bank data, the decrease in the GDP occurs in 2017 and not earlier (ii) results are not driven by the areas that have been the most impacted economically. Results however seem to be driven by areas where people have a more conservative vote.

To further investigate to what extent results are driven by the level of conservatism, we use data from the Arab Barometer 2010-2011. We compute indicators of conservatism by governorate, such as the share of people who think women are worse in government positions than men and the share of people who think Islamic laws should be applied in marriage and divorce. Results in (Table 10)[9] suggest that the decrease in the age of marriage in rural areas are driven by the most conservative areas (among the rural areas). It could have been driven in the first period, by a reaction to the ideas carried by the Egyptian Revolution, and driven in the second period by the presence of Morsi as President and by the revolt against his destitution.

[9]In this table, coefficients and not odd-ratios are presented, because the magnitude of the odd-ratio for the variable "share of killed people" would be too large. For this reason, only the sign of the coefficients may be commented.

Table 9: DURATION MODEL: Occurrence of the event. Age at marriage and first birth according to Revolution period in rural areas - discrete time duration model

	Age at marriage		Age at first child	
	(1)	(2)	(5)	(6)
	Comparing people between 16-20 in January 2011 versus 26-30			
Share of killed people **until** June 2012	1901.4*** (87.32)		3021.5*** (124.6)	
People aged between 16 and 20 in January 2011 (vs 26-30)	-0.0156 (0.0699)	0.0246 (0.0641)	-0.106+ (0.0664)	-0.0425 (0.0700)
Aged 16-20*Share of killed people **until** June 2012	19.15** (9.975)		16.24*** (6.114)	
Share of killed people **after** June 2012		28.35*** (1.920)		48.08*** (2.447)
Aged 16-20*Share of killed people **after** June 2012		6.274* (3.437)		3.710* (2.186)
governorate fixed effects	Yes	Yes	Yes	Yes
N	38146	38146	43914	43914
r2_p	0.14	0.14	0.15	0.15

Note: The dependent variable is age at marriage for columns (1) and (2). The dependent variable is age at first child for columns (3) and (4). The model is estimated with a discrete-time duration model (coefficients are displayed). We control also for primary education. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Rural Women.

Source: ELMPS Egypt 2018.

Table 10: Impact of the revolution on the probability of marriage according to the degree of conservatism in rural areas (discrete time duration model)

	Women worse in politics belief		Not the case		Islamic rules should apply in marriage		Not the case
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Comparing people between 16-20 in January 2011 versus 26-30						
Treatment 1: Share of killed people	42.75*** (2.334)		7627.8*** (237.2)		40.63*** (0.968)		
Aged 16-20*Share of killed people	2.183 (1.782)		-0.488 (1.913)		4.304** (1.987)		
Treatment 2: 6 more impacted governorates		0.323*** (0.0486)		3.834*** (0.175)		0.277*** (0.0429)	2.896*** (0.188)
Aged 16-20*6 more impacted governorates		0.302*** (0.0820)		-0.204** (0.0881)		0.326*** (0.0854)	-0.205** (0.100)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	20078	20078	17116	17116	18170	18170	19024
r2_p	0.14	0.14	0.13	0.13	0.14	0.14	0.13

Note: The dependent variable is age at marriage, and the model estimated is a discrete time duration model (coefficients are displayed). Results of the estimation of the model with treatment 1 for the sample of people who think not that islamic rules should apply in marriage are not displayed because the model does not converge. We control also for primary education. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Rural Women.

Source: ELMPS Egypt 2018.

9 Conclusion

This paper studies the impact of the Arab spring on women's age of entry into marriage and fertility in the case of Egypt. We find that women residing in rural areas, who were aged between 16 and 20 at the time of the Egyptian revolution, marry earlier than the previous cohorts, and have children earlier as well. These results moderate previous evidence on the increase in women's empowerment following the Arab Spring.

Our results contribute to the ambiguous context of existing literature on the impact of the Egyptian revolution on women's status and participation in the labor market. The fact that women marry earlier in rural areas corresponds with the negative impact of 2011 revolution on labor market status shown by Hendy (2015), since women marrying earlier are less likely to participate in the labor market. Our results also highlight the heterogeneity of the impact of the revolution on entry into marriage and motherhood between urban and rural areas.

References

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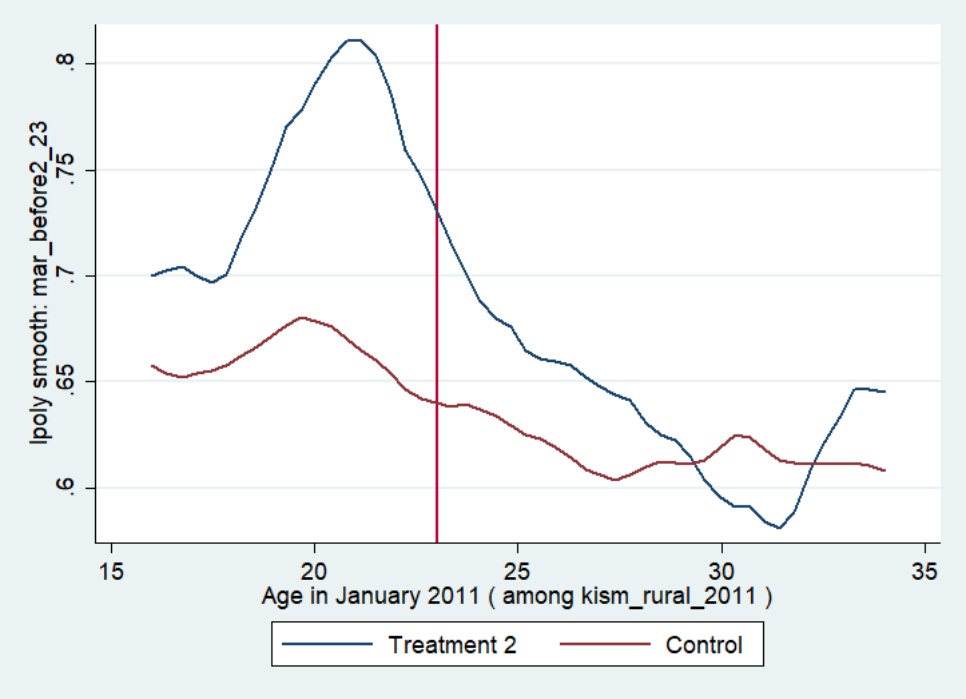
A Appendix



Note: The figure presents the probability of marriage before 23 according to the age in January 2011 in rural areas.
Source: ELMPS 2018

Figure 5: Probability of marriage before 23 for rural women

Table 11: LPM Model: Age at marriage

	All		Rural		Urban	
	(1)	(2)	(3)	(4)	(5)	(6)
Comparing people between 16-20 in January 2011 versus 26-30						
Treatment 1: Share of killed people	1.065 (1.413)		-143.2*** (3.866)		7.945*** (0.293)	
People aged between 16 and 20 in January 2011 (vs 26-30)	-1.054*** (0.144)	-0.950*** (0.116)	-0.931*** (0.219)	-1.053*** (0.133)	-1.118** (0.397)	-0.390+ (0.242)
Aged 16-20*Share of killed people	-2.658 (1.896)		-8.254 (6.643)		-1.833 (1.673)	
Treatment 2: 6 more impacted governorates		0.383 (0.348)		-0.183 (0.199)		2.089*** (0.0613)
Aged 16-20*6 more impacted governorates		-0.992*** (0.347)		-1.151*** (0.380)		-1.377*** (0.374)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	4102	4102	3293	3293	809	809
r2	0.11	0.11	0.07	0.07	0.06	0.07
Comparing people between 26-30 in January 2011 versus 36-40						
Treatment 1: Share of killed people	-4.314** (1.676)		-173.8*** (9.357)		-4.211*** (1.284)	
People aged between 26 and 30 in January 2011 (vs 36-40)	-0.720** (0.304)	-0.699** (0.292)	-0.815* (0.436)	-0.637* (0.318)	-0.435 (0.444)	-0.645 (0.588)
Aged 26-30*Share of killed people	2.856+ (1.754)		7.013 (7.361)		1.483 (2.012)	
Treatment 2: 6 more impacted governorates		-0.999** (0.374)		-0.122 (0.287)		-1.187*** (0.360)
Aged 26-30*6 more impacted governorates		0.555* (0.305)		0.0970 (0.392)		0.582 (0.601)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3131	3131	2418	2418	713	713
r2	0.07	0.07	0.05	0.05	0.04	0.04

Note: The dependent variable is age at marriage. We control also for primary education. Panel A and panel B present the results of the double difference model. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Women.

Source: ELMPS Egypt 2018.

Table 12: LPM Model: Age at first child

	All		Rural		Urban	
	(1)	(2)	(3)	(4)	(5)	(6)
Comparing people between 16-20 in January 2011 versus 26-30						
Treatment 1: Share of killed people	-3.732*** (1.265)		-241.7*** (2.216)		6.957*** (0.308)	
People aged between 16 and 20 in January 2011 (vs 26-30)	-1.356*** (0.143)	-1.318*** (0.116)	-1.195*** (0.206)	-1.382*** (0.138)	-1.637*** (0.315)	-1.007*** (0.236)
Aged 16-20*Share of killed people	-4.901** (2.107)		-10.40** (5.085)		-3.065* (1.552)	
Treatment 2: 6 more impacted governorates		-0.971*** (0.302)		-0.855*** (0.172)		1.777*** (0.0392)
Aged 16-20*6 more impacted governorates		-1.222*** (0.248)		-1.055*** (0.355)		-1.466*** (0.302)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3705	3705	2978	2978	727	727
r2	0.13	0.14	0.09	0.09	0.10	0.11
Comparing people between 26-30 in January 2011 versus 36-40						
Treatment 1: Share of killed people	-5.890** (2.168)		-160.2*** (7.872)		0.480 (1.549)	
People aged between 26 and 30 in January 2011 (vs 36-40)	-0.931*** (0.319)	-0.911*** (0.306)	-0.992** (0.413)	-0.870** (0.304)	-0.353 (0.547)	-0.315 (0.705)
Aged 26-30*Share of killed people	2.308 (1.761)		4.869 (7.182)		-0.363 (2.391)	
Treatment 2: 6 more impacted governorates		-1.408*** (0.480)		-1.285*** (0.243)		0.139 (0.453)
Aged 26-30*6 more impacted governorates		0.430 (0.354)		0.0806 (0.339)		-0.122 (0.731)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	2955	2955	2282	2282	673	673
r2	0.08	0.08	0.05	0.05	0.07	0.07

Note: The dependent variable is age at first child. We control also for primary education. Panel A and panel B present the results of the double difference model. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Women.

Source: ELMPS Egypt 2018.

Table 13: Marital outcome at the governorate level, for ALL women - Discrete time Duration model

	Age at marriage		Age at first child	
	(1)	(2)	(3)	(4)
	Comparing people between 16-20 in January 2011 versus 26-30			
Treatment 1: Share of killed people	1.587 (0.634)		6.195*** (3.026)	
Aged 16-20*Share of killed people	0.528* (0.202)		0.529+ (0.217)	
Treatment 2: more impacted governorates		1.079 (0.0882)		1.546*** (0.173)
Aged 16-20*6 more impacted governorates		0.936 (0.156)		0.920 (0.126)
governorate fixed effects	Yes	Yes	Yes	Yes
N	50543	50543	57641	57641
r2_p	0.14	0.14	0.15	0.15
	Comparing people between 26-30 in January 2011 versus 36-40			
Treatment 1: Share of killed people	1.527 (0.461)		5.283*** (1.950)	
Aged 26-30*Share of killed people	0.216*** (0.0761)		0.475** (0.157)	
Treatment 2: more impacted governorates		1.039 (0.0591)		1.480*** (0.119)
Aged 26-30*6 more impacted governorates		0.760*** (0.0608)		0.874+ (0.0835)
governorate fixed effects	Yes	Yes	Yes	Yes
N	39206	39206	46617	46617
r2_p	0.04	0.04	0.13	0.13

Note: The dependent variable is age at marriage for columns (1) and (2), and age at first child for columns (3) and (4). We control also for primary education. Odd-ratios are displayed. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: All Women.

Source: ELMPS Egypt 2018.

Table 14: Marital outcome at the governorate level, for URBAN women - Discrete time Duration Model

	Age at marriage		Age at first child	
	(1)	(2)	(3)	(4)
	Comparing people between 16-20 in January 2011 versus 26-30			
Treatment 1: Share of killed people	0.0746*** (0.00683)		0.597*** (0.0494)	
Aged 16-20*Share of killed people	1.776** (0.531)		1.529 (0.650)	
Treatment 2: more impacted governorates		0.515*** (0.0203)		0.881*** (0.0195)
Aged 16-20*6 more impacted governorates		1.190+ (0.128)		1.123 (0.151)
governorate fixed effects	Yes	Yes	Yes	Yes
N	12397	12397	13727	13727
r2_p	0.15	0.15	0.16	0.16
	Comparing people between 26-30 in January 2011 versus 36-40			
Treatment 1: Share of killed people	1.184 (0.237)		2.157*** (0.470)	
Aged 26-30*Share of killed people	0.164*** (0.0748)		0.456* (0.208)	
Treatment 2: more impacted governorates		1.032 (0.0600)		1.279*** (0.0906)
Aged 26-30*6 more impacted governorates		0.610*** (0.0872)		0.730** (0.0963)
governorate fixed effects	Yes	Yes	Yes	Yes
N	10481	10481	12071	12071
r2_p	0.12	0.12	0.14	0.14

Note: The dependent variable is age at marriage for columns (1) and (2), and age at first child for columns (3) and (4). We control also for primary education. Odd-ratios are displayed. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Urban Women.

Source: ELMPS Egypt 2018.

Table 15: Marital outcome at the governorate level, for rural women - COX DURATION MODEL

	Age at marriage		Age at first child	
	(1)	(2)	(3)	(4)
	Comparing people between 16-20 in January 2011 versus 26-30			
Treatment 1: Share of killed people	7.03247e+10*** (9.66827e+10)		7.60806e+17*** (1.40982e+18)	
Aged 16-20*Share of killed people	85.05** (188.0)		22.34** (29.83)	
Treatment 2: more impacted governorates		1.334*** (0.134)		1.562*** (0.0788)
Aged 16-20*6 more impacted governorates		1.474** (0.284)		1.305*** (0.120)
governorate fixed effects	Yes	Yes	Yes	Yes
N	3647	3647	3647	3647
r2_p	0.00	0.00	0.00	0.00
	Comparing people between 26-30 in January 2011 versus 36-40			
Treatment 1: Share of killed people	288840110.0*** (580121168.6)		4.70361e+14*** (1.09894e+15)	
Aged 26-30*Share of killed people	0.0919+ (0.149)		0.271 (0.397)	
Treatment 2: more impacted governorates		1.164*** (0.0627)		1.455*** (0.0887)
Aged 26-30*6 more impacted governorates		0.955 (0.0675)		1.002 (0.0731)
governorate fixed effects	Yes	Yes	Yes	Yes
N	2555	2555	2555	2555
r2_p	0.00	0.00	0.00	0.00

Note: The dependent variable is age at marriage for columns (1) and (2), and age at first child for columns (3) and (4). We control also for primary education. Hazard-ratios are displayed. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Rural Women.

Source: ELMPS Egypt 2018.

Table 16: Marital outcome at the governorate level, for rural women - CURRENT PLACE OF RESIDENCE, discrete time duration model

	Age at marriage		Age at first child	
	(1)	(2)	(3)	(4)
	Comparing people between 16-20 in January 2011 versus 26-30			
Treatment 1: Share of killed people	4.31980e+09*** (2.11501e+10)		4.60588e+17*** (3.49209e+18)	
Aged 16-20*Share of killed people	1429.8*** (3654.6)		43.25** (74.52)	
Treatment 2: more impacted governorates		1.415*** (0.149)		1.737*** (0.101)
Aged 16-20*6 more impacted governorates		1.942*** (0.390)		1.435*** (0.141)
governorate fixed effects	Yes	Yes	Yes	Yes
N	30137	30137	35075	35075
r2_p	0.14	0.14	0.16	0.16
	Comparing people between 26-30 in January 2011 versus 36-40			
Treatment 1: Share of killed people	44827.0 (521425.2)		2.87335e+13** (4.27557e+14)	
Aged 26-30*Share of killed people	0.0242** (0.0466)		0.278 (0.487)	
Treatment 2: more impacted governorates		1.467*** (0.173)		1.698*** (0.168)
Aged 26-30*6 more impacted governorates		0.813 (0.131)		0.954 (0.106)
governorate fixed effects	Yes	Yes	Yes	Yes
N	23064	23064	27994	27994
r2_p	0.10	0.10	0.13	0.13

Note: The dependent variable is age at marriage for columns (1) and (2), and age at first child for columns (3) and (4). We control also for primary education .Odd-ratios are displayed. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Rural Women.

Source: ELMPS Egypt 2018.

Table 17: Outcomes at the governorate level for non migrant rural women between 2011-2018, discrete time duration model

	Age at marriage		Age at first child	
	(1)	(2)	(3)	(4)
	Comparing people between 16-20 in January 2011 versus 26-30			
Treatment 2: more impacted governorates	1.431*** (0.181)		1.707*** (0.121)	
Aged 16-20*6 more impacted governorates	1.644** (0.418)		1.359** (0.183)	
Treatment 1: Share of killed people		1.47356e+12*** (2.62156e+12)		1.87266e+20*** (4.27594e+20)
Aged 16-20*Share of killed people		258.9** (755.2)		37.04** (68.57)
governorate fixed effects	Yes	Yes	Yes	Yes
N	36506	36506	42074	42074
r2_p	0.13	0.13	0.15	0.15
	Comparing people between 26-30 in January 2011 versus 36-40			
Treatment 2: more impacted governorates			1.651*** (0.133)	
Aged 26-30*6 more impacted governorates			0.980 (0.0959)	
Treatment 1: Share of killed people				5.14912e+16*** (1.44884e+17)
Aged 26-30*Share of killed people				0.399 (0.698)
governorate fixed effects			Yes	Yes
N			33268	33268
r2_p			0.13	0.13

Note: The dependent variable is age at marriage for columns (1) and (2), and age at first child for columns (3) and (4). We control also for primary education. Results for treatment 2 and the placebo are not displayed because the model does not converge. Odd-ratios are displayed. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Rural Women.

Source: ELMPS Egypt 2018.

Table 18: Logit Model: Marriage before 23 years old

	All		Rural		Urban	
	(1)	(2)	(3)	(4)	(5)	(6)
	Comparing people between 16-20 in January 2011 versus 26-30					
Treatment 1: Share of killed people	1.445** (0.623)		73.80*** (2.492)		-2.105*** (0.127)	
People aged between 16 and 20 in January 2011 (vs 26-30)	0.0687 (0.0758)	0.00921 (0.0632)	-0.0624 (0.134)	0.0906 (0.0788)	-0.223+ (0.145)	-0.459*** (0.126)
Aged 16-20*Share of killed people	-0.851 (0.742)		8.211+ (5.041)		-0.116 (0.519)	
Treatment 2: more impacted governorates		0.259* (0.142)		0.448** (0.192)		-0.624*** (0.0525)
Aged 16-20*6 more impacted governorates		0.0244 (0.272)		0.784+ (0.493)		0.309+ (0.198)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	4640	4640	3647	3647	993	993
r2						
	Comparing people between 26-30 in January 2011 versus 36-40					
Treatment 1: Share of killed people	1.364*** (0.527)		35.05*** (3.966)		1.752*** (0.394)	
People aged between 26 and 30 in January 2011 (vs 36-40)	0.264** (0.108)	0.232** (0.111)	0.223 (0.166)	0.182 (0.133)	0.364** (0.174)	0.400** (0.190)
Aged 26-30*Share of killed people	-0.936** (0.493)		-0.994 (3.786)		-1.323** (0.655)	
Treatment 2: more impacted governorates		0.261** (0.134)		0.0956 (0.111)		0.431*** (0.129)
Aged 26-30*6 more impacted governorates		-0.0949 (0.133)		0.212 (0.169)		-0.313+ (0.218)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3334	3334	2555	2555	777	777
r2						

Note: The dependent variable is a dummy taking the value 1 if the marriage happens before 23 years old. We control also for primary education. Panel A and panel B present the results of the double difference model. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Women.

Source: ELMPS Egypt 2018.

Table 19: Logit Model: Child before 23 years old

	All		Rural		Urban	
	(1)	(2)	(3)	(4)	(5)	(6)
	Comparing people between 16-20 in January 2011 versus 26-30					
Treatment 1: Share of killed people	3.290*** (0.780)		93.93*** (2.230)		-1.835*** (0.248)	
People aged between 16 and 20 in January 2011 (vs 26-30)	0.00481 (0.0765)	-0.0580 (0.0661)	-0.0643 (0.116)	0.0186 (0.0793)	-0.331+ (0.210)	-0.631*** (0.226)
Aged 16-20*Share of killed people	-0.892 (0.969)		4.710 (3.761)		0.0159 (0.921)	
Treatment 2: more impacted governorates		0.711*** (0.182)		0.785*** (0.151)		-0.570*** (0.0771)
Aged 16-20*6 more impacted governorates		0.0569 (0.289)		0.517+ (0.323)		0.437+ (0.302)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	4640	4640	3647	3647	984	984
r2						
	Comparing people between 26-30 in January 2011 versus 36-40					
Treatment 1: Share of killed people	2.606*** (0.713)		58.18*** (3.172)		0.919** (0.480)	
People aged between 26 and 30 in January 2011 (vs 36-40)	0.338*** (0.104)	0.336*** (0.0999)	0.315** (0.135)	0.318*** (0.111)	0.148 (0.222)	0.345* (0.210)
Aged 26-30*Share of killed people	-1.082* (0.581)		0.672 (2.439)		-0.350 (0.837)	
Treatment 2: more impacted governorates		0.645*** (0.164)		0.416*** (0.0888)		0.395** (0.170)
Aged 26-30*6 more impacted governorates		-0.241** (0.108)		0.203* (0.111)		-0.362 (0.265)
governorate fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3334	3334	2555	2555	762	762
r2						

Note: The dependent variable is a dummy taking the value 1 if the woman had a child before 23 years old. We control also for primary education. Panel A and panel B present the results of the double difference model. Significance levels are denoted as follows: + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Sample: Women.

Source: ELMPS Egypt 2018.