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ABSTRACT

Fertility and the Puzzle of Female Employment in the Middle East

Female labor force participation rates across the Middle East and North Africa (MENA) region have remained low for over four decades, despite the fact that in the same period, women's education rapidly increased and fertility rates substantially decreased. This surprising phenomenon has remained a puzzle. This study tries to provide a better understanding of this puzzle by testing whether there is a causal impact of the number of children on mother's labor supply. It uses twins at first birth as an instrumental variable to estimate the causal impact of fertility on participation of mothers in the labor market, free of bias. It finds that having more children does not reduce women's employment. The paper discusses the implications of this interesting result in understanding the puzzle of female participation in MENA and in designing policies to increase women's work.

JEL Classification: J13, J22, O53

Keywords: female labor force participation, fertility, instrumental variable, Middle East and North Africa, twins

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1. INTRODUCTION

Middle East and North Africa (MENA) has witnessed a puzzling phenomenon in the last four decades: Average years of education for women aged 15 to 65 in the region has increased from less than two years in 1970 to over seven years in 2010 (Figure 1(a)). In effect, young women in some MENA countries are now more educated than young men. In addition, fertility rates have declined continuously between 1970 and 2000, from 6.5 to less than 3 children per woman (Figure 1(b)). Five of the ten biggest declines in fertility rates after 1945 have occurred in MENA. Fertility in Bahrain, Iran, Lebanon, Qatar, and Tunisia is already below the replacement rate of 2.1.[1] Nevertheless, female labor force participation (FLFP) rates have remained around 20% in the last two decades, significantly below the world average and the lowest among all regions (Figure 1(c)).

It is not surprising that this phenomenon, which has remained a puzzle (FLFP puzzle), has prompted a large body of research.[2] Understanding this puzzle has important policy and scholarly implications. To see this, one only needs to imagine the extent to which output, efficiency, and economic growth in MENA increase if the share of employed women doubles. For example, Cavalcanti and Tavares (2008) suggest that if women's participation in Saudi Arabia increases to levels seen in the West, its GDP per capita nearly reaches to the level of the US (i.e. more than doubles.)[3]

One hypothesis to explain this puzzle is that in MENA, economic forces such as lower fertility (or more education) have little impact, if any, on female labor supply. But this claim has not been seen in the rest of the world and is not consistent with the predictions of economic theory, in general.

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[1] Data Source: World Bank Development Indicators, http://data.worldbank.org/indicator/SP.DYN.TFRT.IN; accessed February 9, 2017.

[2] For a discussion of this puzzle, please see World Bank (2004).

[3] For a discussion of women's work in MENA, see Karshenas et al. (2016) and Moghadam (2013).

Therefore, understanding the causal impact of these factors (fertility and education) on labor force participation is substantially more insightful in the context of the Middle East than other regions of the world. It is not surprising that having more children has reduced female labor supply in the United States or other countries (see Jacobsen et al 1999, Bronars and Grogger 1994, and Rosenzweig and Wolpin 1980a, for instance). It is more impelling to examine whether similar causal impacts, predicted by the economic theory, can be found in the MENA region which has the FLFP puzzle. This is the goal of this study. Moreover, in finding this causal effect, this study aims to improve our understanding of the FLFP puzzle.

Studies on this subject in the MENA region focus on the correlation (rather than the causal effect) between the number of children and female labor force participation and most show that this correlation is negative. For example, Spierings and Smits (2007) find a negative correlation between the number of children and FLFP in Egypt, Jordan, Morocco, Syria and Tunisia. Assaad and El-Hamidi (2002), however, find no correlation in Egypt. For Turkey, Dayıoğlu and Kirdar (2010) depict a negative correlation between having children and FLFP. Salehi-Isfahani (2005) finds a negative correlation in Iran, only between the number of children aged 0-3 and their mother's participation in the labor force (no statistically significant correlation for older children). Using a larger data set, however, Esfahani and Shajari (2012) find a negative correlation between the number of children ever born and FLFP in Iran. To avoid endogeneity and to come closer to the causal link, Majbouri (2010) only considers children aged 15 to 18 in the household in Iran and finds a positive correlation between the number of female children in that age group and FLFP in the household and no correlation for the male children of the same age (potentially because female children help mothers in household chores).

Fertility and labor supply, however, are choice variables and endogenous to many omitted variables. Therefore, it is not possible to infer any causation from these correlations in the data. This study, however, uses multiple births (twins, triplets, etc.) at first birth as an instrumental variable for the number of children a mother has to estimate the effect of children on mother's employment status in several countries in MENA. Using Demographic and Health Surveys (DHS) of Egypt, Jordan, Morocco, and Tunisia, it first documents that having multiple births at first birth raises the number of children. It then finds that this exogenous shock to the number of children does not have any impact on mother's employment[4] in any of these countries.

Combining the sample for these four countries produces the same result as each of those countries separately (i.e. no causal effect). Because data are not available for the other Arab countries[5], it is not possible to estimate the effect for them. But the sample covers a broad spectrum of Arab countries. These countries vary greatly in terms of institutions and norms (from Tunisia and Morocco with more egalitarian family laws and norms to Egypt and Jordan with less egalitarian laws and norms), geography, and economy. Therefore, the consistency of results across these countries and similarity of labor market conditions and outcomes for women across MENA suggest that similar results can potentially be found in other MENA countries as well.

These results imply that female employment in (at least) these MENA countries is not responsive to an exogenous shock to the number of children. In other words, women who work will do so regardless of this exogenous increase in their number of children. Working is not sensitive to these factors and is too rigid to be affected by them. This implies that there are other more important

[4] As discussed later, data only contain whether a mother is employed or not. Unemployment is not measured in the DHS data sets. Therefore, the outcome variable is employment/working not participation in the labor force.

[5] DHS data are available for Turkey. But, this study does not use them because as will be discussed later, fertility treatment were prevalent there which could potentially invalidate the exclusion restriction for the IV design in this study, and create bias in the results. DHS data for Iran are not available publically.

factors (such as cultural norms) that directly affect female employment and potentially overrule the effect of any other factor.

Giving multiple births has also been used as an instrumental variable in the empirical literature on the quality-quantity trade off to study the impact of family size on children's outcomes (Rosenzweig and Wolpin 1980b; Black et al. 2005; Dayıoğlu et al. 2009). Another instrumental variable that is used to estimate the impact of family size on FLFP as well as children's outcomes is sibling sex mix. Angrist and Evans (1998) used this IV to estimate the effect of family size on mother's labor supply. Parents in the U.S. prefer to have children of both sexes. So the likelihood of the third child increases when they have two children of the same sex. In the MENA region, however, parents prefer to have sons. Therefore, parents whose first two children are female are more likely to have a third child in the hope of it being a son. Hence, the gender of the first children is an instrument for family size (Azimi 2015). But using this instrument to find the effect of family size on FLFP can be problematic because it is correlated with both family size and FLFP: households who have a preference for sons may not have a favorable view towards women's work as well. Therefore, this study refrains from using sibling sex mix as an instrument.[6]

The remainder of this paper is organized as follows: the following section discusses the methodology and data. Section 3 demonstrates the impact of twins at first birth on the number of children, separated by the age of the first child, and reports the causal link (or lack of it) between the number of children and FLFP. The last section concludes with the research and policy implications of the results.

[6] Sibling sex mix is also used to study the effect of family size on children's educational outcome. Booth and Kee (2005), Baez (2006), and Conley and Glauber (2005) find a negative causal effect in the UK, Colombia, and the US. But, de Haan (2006) finds no effect for US, and the Netherlands.

2. METHODOLOGY AND DATA

Having more children is endogenous to the decision to work. In other words, factors that affect the number of children also affect the decision to work. But if an exogenous factor can be identified that affects the number of children yet does not have any impact on the female labor supply except through the number of children, it can be used to estimate the true effect of fertility on female labor supply.

Having multiple births (*twins* from now on) is a good example of this exogenous factor. But there are issues involved: first, mothers who have twins have already decided to have more kids. So they cannot be compared to mothers who do not have any children. Therefore, one should not include women without children in the sample. This means that the results cannot be generalized to all women. Particularly in the case of MENA, this is not an issue because almost all women are mothers and have at least one child. An interesting corollary to this is that in order to find a result general enough that would be applicable to almost all women, one would like to have all mothers, i.e. all who have at least one child in the sample. Therefore, the right choice of an exogenous variable is having *twins* at first birth, not second (or higher) birth. Mothers who had twins at first birth chose to have at least one child, therefore, they are comparable to the pool of all mothers (all mothers have at least one child). But, a mother who gave birth to twins in her second birth has already decided to have at least two children and should be only compared to mothers who have at least two children. Therefore, for such a mother the sample of the comparison group (which is mothers with at least two children) is smaller.

Second, having *twins* at first birth is positively and strongly correlated with the mother's age at first birth (Mittler 1971). Meanwhile, mother's age at first birth (which is highly correlated with the mother's current age) affects mother's decision to work in other ways. This violates the exclusion restriction of instrumental variable. But, based on the medical literature, Rosenzweig and Wolpin

(1980a), and the economics literature that followed their seminal work, argue that after controlling for mother's age at first birth, having *twins* becomes random. Therefore, one needs to control for the age of mother at first birth.

Third, infertility treatments, such as In Vitro Fertilization (IVF), increase the chance of giving multiple births at first parturition (e.g., Callahan et al., 1994; Gleicher et al., 2000; Fauser et al., 2005). But, the use of IVF and other treatments in the Arab countries of the MENA region is rare because of cultural and religious factors.[7] In fact, Karbownik and Myck (2016) who use twins as an instrument for the number of children argue that even in the case of Poland "IVF and other assisted reproductive technologies are rare" and having twins is a random phenomenon. Further, Braakmann and Wildman (2014) show that the bias caused by not controlling for these treatments is small, even when infertility treatments are common.

Giving multiple births at first parturition has also been used as an instrumental variable in the empirical literature on the quality-quantity trade off to study the impact of family size on children's outcomes. The seminal work on this subject is by Rosenzweig and Wolpin (1980b) who find a negative impact of sibling size on educational attainment in India. Black et al. (2005), however, find no effect for Norway (a developed country with strong social safety nets). Interestingly, Dayıoğlu et al. (2009) find a negative impact on female siblings and poorer households in Turkey.

Another instrumental variable that is used to estimate the impact of family size on FLFP as well as children's outcomes is sibling sex mix. As explained in the Introduction, in the MENA region, son preference is common. Parents whose first two children are female are more likely to have a third

[7] Only in Iran and in complete contrast with the rest of MENA, the use of these treatments is approved by the government and religious authorities. There is anecdotal evidence that even doctors from the rest of the MENA region are shocked to hear that these methods are acceptable in Iran. (https://www.pri.org/stories/2014-01-22/how-iran-became-leader-fertility-treatment-courtesy-ayatollahs; accessed on Feb. 11, 2017)

child in the hope of it being a son. Hence, first children's sex is an instrument for family size (Azimi 2015). But this instrument may not satisfy the exclusion restriction, particularly when one studies the effect of family size on FLFP; households who have a preference for sons may not have a favorable view towards women's work. Hence, the instrument (son preference) is correlated with both family size and FLFP. Therefore, this study refrains from using sibling sex mix as an instrument.

The following regression estimates the impact of having twins on the number of children a mother has:

$$N_{irt} = f(AFB_{irt}) + \delta X_{irt} + \gamma T_{irt} + \mu_{rt} + e_{irt} \tag{1}$$

In this equation, N_{irt} is the number of children mother i in region r and year t has[8], AFB_{irt} is the mother's age at first birth, and $f(AFB_{irt})$ is the third degree polynomial function of AFB_{irt}. X_{irt} is the mother's years of schooling (age is not included because it is highly correlated with age at first birth[9]). T_{irt} is a dummy that is equal to one if the mother gave multiple births in her first birth and zero otherwise. μ_{rt} are region-year fixed effects that capture heterogeneity across both region and time. They control for any factor that affects fertility and is common across observations in a region at a particular time. These include healthcare infrastructure, labor market conditions, institutional factors, etc. Regions are territories within a country. For example, Egypt has six regions in the data. e_{irt} is the error term. This regression becomes the first stage for the following second stage regression:

$$L_{irt} = g(AFB_{irt}) + \delta_L X_{irt} + \beta N_{irt} + \theta_{rt} + u_{irt} \tag{2}$$

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[8] As discussed later, there are multiple surveys for each country across time. Although these surveys do not form a panel and each mother is observed in one survey, we can control for the year the survey was collected to consider any idiosyncratic factor in that year that affects mothers' employment.

[9] Including age does not change the results.

in which L_{irt} is the employment status of mother i in region r and year t, $g(AFB_{irt})$ is the third degree polynomial function of AFB_{irt}, with different coefficients than $f(AFB_{irt})$ in Equation (1). Note that the variables in $g(AFB_{irt})$ are the same as those in $f(AFB_{irt})$, only the coefficients are different. The function is denoted with g rather than f to acknowledge the difference in coefficients. N_{irt} is predicted from the first stage and its coefficient, β, is the parameter of interest. θ_{rt} capture any factor specific to region r in year t that could affect mother's labor supply. They control for any factor that affects mother's employment status and is common across observations in a region at a particular time. These include labor market conditions, labor demand factors, other economic conditions, institutional factors, etc. Theoretically, it is not necessary to include these fixed effects as having twins is not correlated with these region-year specific factors. u_{irt} is the random error term.

This study uses the Demographic and Health Surveys (DHS) of MENA countries that are available on the *DHS program* website[10]. These include Egypt (1988, 1992, 1995, 2000, 2003, 2008, 2014), Jordan (1990, 1997, 2002, 2007, 2012), Morocco (1987, 1992, 2003-04), and Tunisia (1988). Turkey has three DHS data sets available on the DHS program website (for the years 1993, 1998, and 2003). This study, however, does not use the data for Turkey as fertility treatments were prevalent there which could potentially invalidate the exclusion restriction for the IV design in this study.[11] Table 1 reports some stylized facts about the share of all mothers employed. These facts are relatively consistent across the MENA region. The share of employed mothers is low and fluctuates around

[10] http://www.dhsprogram.com/

[11] DHS data for Iran is not publicly available.

10 to 20 percent in various surveys. Share of mothers employed in all countries is relatively higher in urban areas[12] and increases as mother's level of education increases.

The sample used for the rest of this study, however, only includes mothers in households that have two features: 1) have only one mother, and 2) the number of children present in the household is equal to the number of children ever born by the mother. The second condition serves to make sure that all children are present in the household so that the number of children a mother has truly affects the mother's decision to work. For example, a mother who has four children all of which left the household may behave more like a mother with no children. She has fewer obligations and more free to work than a mother with four children all of whom are present in the household.

The benefit of the DHS data is that it records the full birth history and identifies all multiple births, all of which are easily accessible to the researcher as separate variables. In DHS datasets, whether or not a mother is currently working is observed. However, whether she is looking for a job (i.e. being unemployed) is not recorded. Therefore, our outcome variable does not measure the extent of female participation in the labor market. The summary statistics of the variables for the sample of mothers are reported in Table 2.

3. RESULTS

First, we would like to see the impact of giving multiple births at first parturition on the total number of children a mother has. This is Equation (1) and the first stage of the two-stage least squares estimation of Equation (2). Table 3 has the result of this regression (i.e. γ in Equation (1)) for the four countries in this study. Because Tunisia has only one wave of DHS survey (only 1988) and accordingly few observations, it is combined with Morocco. All regressions include region-year

[12] In Iran and Turkey, more women are employed in rural areas than urban areas (Salehi-Isfahani 2005; Majbouri 2010).

fixed effects that control for many unobservable factors that are common for mothers in a specific region at a specific time. These factors can be time varying and differ across regions. Since regions are defined within a country, these fixed effects also control for any country level time varying or time-constant variable.

The results in Table 3 show that having twins increases the number of children a mother has in all countries.[13] The size of the effect in Egypt, and Jordan ranges from 0.3 to 0.4 more children. In Morocco and Tunisia, multiple births raises the number of children by 0.823. These are highly statistically significant results. The size of the effect may become smaller as time passes since the first birth. Figure 2 depicts the impact of twins on fertility with respect to the number of years passed since the twins were born. In the year the twins were born, the effect is close to 1. This is intuitive as mothers who gave birth to twins have one child more than mothers who delivered a single birth.[14] Over time, this gap is reduced since some mothers with single first birth want to have more children and give birth to more kids.

Table 4 reports the OLS estimates of Equation (2) using the same DHS data sets and shows that having one more child is associated with about a 2 percentage point decline in the likelihood of a mother working in all countries.[15] This is a large coefficient considering the share of employed mothers reported at the bottom of Table 4. Table 5, however, which shows the causal effects, depicts a different story from Table 4. The table presents the causal effect of the number of children on female labor supply (i.e. β in Equation (2), the second stage of the two stage least squares.)[16] The

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[13] Table A1 in the appendix reports the results for urban and rural areas separately as well.

[14] A few mothers give birth to triplets or more. Therefore, the average number of extra children that mothers with multiple births have in the first year after giving birth is slightly more than one.

[15] Majbouri (2016) reports these results. It is publicly available in the online journal of ***Topics in Middle Eastern and North African Economies*** at http://www.luc.edu/orgs/meea/volume18/pdfs/9%20-%20Children%20and%20Mother's%20participation.pdf, where you can find the OLS estimates on page 179 in Table 2.

[16] The first stage is reported in Table A1 of the appendix.

top panel reports the results for the whole country, and the middle and bottom panels depict results for the rural and urban areas respectively. In Egypt, Jordan, Morocco, Tunisia, and all these countries combined (the last column in Table 5), having more children does not decrease nor increase mother's propensity to work. This is true in both urban and rural areas. These results are in contrast to the correlational evidence for these countries (Table 4). This demonstrates that the omitted variable bias is substantial and the OLS estimates are misleading.

Table 5 also reports the Kleibergen-Paap Wald F statistics of the first stage of these 2SLS estimations. These F-statistics are large for all estimations except for Jordan[17], showing that giving multiple births is a strong predictor of number of children. Hence, it is a strong instrument for the number of children and the reported results (coefficients of the second stage) are reliable.

One can argue that the effect of having twins is only pronounced when the twins are young. In other words, as they get older the effect dissipates. To test this claim, we can divide the sample based on the age of the first child and estimate the results for each sample. For each country, the whole as well as urban and rural samples were divided as follows: the first child's age is 0-3, 4-7, 8-12, and 12-17. Interestingly, almost none of the estimates (even for all countries combined) are statistically significant. These results are reported in Table A2 in the appendix.[18] Some may argue that based on the results in Figure 2, the effect of twins on number of children is only pronounced statistically when the first child is less than 9 years old. Hence, we may find a different result if we

[17] The Kleibergen-Paap Wald F statistic should be roughly larger than 16 to reject the null hypothesis of weak instruments.

[18] The result for Morocco and Tunisia when the age of the first child is between 0 and 3 is statistically significant at 10% level. But the coefficient is positive, stating that more children increase participation of women in the labor market. Similar to non-results in other cases, this result is against the expectation that having more children should reduce participation of mothers.

only consider mothers whose first child is younger than 9. Considering such sample, however, produces the same results as Table 5.[19]

One may argue that these interestingly insignificant results are due to the presence of the extended family in the household; members of the extended family, like grandparents or siblings of parents, help mothers take care of children and hence increase the opportunity for mothers to work. To test this claim we can confine our samples to those households without extended family members.[20] Estimating the same 2SLS regressions reported in Table 5 for these confined samples, we find no statistically significant coefficient for the number of children in any of these countries.[21] Therefore, the evidence does not support the claim that presence of extended families is the reason for why having more children does not affect mother's participation.

One may also argue that we observe whether a household had extended family members or not at the time the survey was collected, not when the child was born. It is possible that a household had no extended family members at the time of the survey, yet it had had extended family members living within the household and helping the mother with child rearing when the child was young. To test this claim, we can estimate the regressions only for mothers of young children (children up to age 3) who live in households without extended family members. We still find no effect for these

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[19] Table A3 in the appendix reports the results.

[20] Extended family members were identified using the variables indicating relationship to the head. If there were at least one member in the household who was the parent of the head, the sibling of the head, co-spouse of the head, grandchild of the head, or other relatives of the head. Presence of extended family members were not possible to identify in some of the DHS surveys used in this study; specifically 1990 Jordan DHS, 1988 Tunisia DHS (only DHS for the country), 1987 and 1995 Morocco DHS. This was because the variable indicating relationship to the head or any other variable that could be used to identify extended families is not collected in these surveys. So these surveys were dropped from the sample.

[21] Results are reported in Table A4 of the appendix.

mothers.[22] This provides further support against the claim that the result depends on the presence of extended family members.

One way to explain these non-results is through the social norms and labor market structure for women in these countries. Labor force participation rates in the MENA region are the lowest in the world (about 10-20 percent). There are many discriminatory social norms and laws that women should overcome in order to be able to work. Furthermore, mothers who do overcome these hurdles and work are a small minority and different from those who do not. These women have such a strong willingness to work or unique conducive conditions (such as being in a household with less patriarchal norms) that they will work irrespective of challenges. An unexpected rise in the number of their children hardly dissuades them from participation in the labor market. These are usually educated women and level of education could be one potential way to identify them. For example, 31% of Egyptian mothers in the sample with more than eight years of education work, while only 10% of Egyptian mothers with less than eight years of education do (these numbers are 20% and 5% for Jordan, 45% and 12% for Morocco, and 47% and 7% for Tunisia.) Based on this, one wonders if the result differs on the bases of mother's level of education, i.e. having more children affects only low educated mothers' work decision. To test this, we find the results for mothers with more than and less than high school education separately (i.e. more than and less than eight years of education). Results show that number of children has no impact on mothers with eight or fewer than eight years of education. There is also no evidence for mothers with more than eight years of education. The results are reported in Tables A6 and A7 in the appendix.

[22] Results are reported in Table A5 of the appendix. Only for Morocco the coefficient is statistically significant (at 5%), but there are only 4 mothers who gave multiple births in the data and the result could be an artefact of measurement error.

4. CONCLUSION

The puzzle of female labor force participation in MENA is one of the most important economic phenomena in the region. Household income in the region can increase by more than fifty percent if all mothers participate in the labor market. This substantially increases resources available to the household, reduces budgetary constraints on investments on human capital, and improves many outcomes, particularly for children. Despite this gravity, we do not clearly know what factors affect the low participation of women in MENA and, more importantly, to what extent. Policy makers, hence, are relatively blind and unknowing of which policies are effective.

This paper is an attempt to dissect this research problem and understand whether one factor, i.e. the number of children a mother has, affects female participation in the labor markets. It finds that in countries as diverse as Egypt, Jordan, Morocco, and Tunisia, a mother's number of children has no impact on her working status. The results for these MENA countries are different from the usual predictions of the economic theory and those of other countries outside the MENA region that used the same instrumental variable; for instance, the United States (Jacobsen et al. 1999, Bronars and Grogger 1994, and Rosenzweig and Wolpin 1980a).

The results are also in contrast to the correlational evidence. Thus, they serve, firstly, to remind policy makers of the importance of identifying the causal evidence before designing policies based on correlations. Second, they imply that governments should investigate other more important causes of low FLFP and address them using rigorous scientific studies such as RCTs. Third, the results explain why female participation remained constant despite the substantial decline in fertility rate in the MENA region. Finally, they shed light on this aspect of the puzzle of FLFP in MENA and pave the way for continued investigation as further research is required to explain this puzzle.

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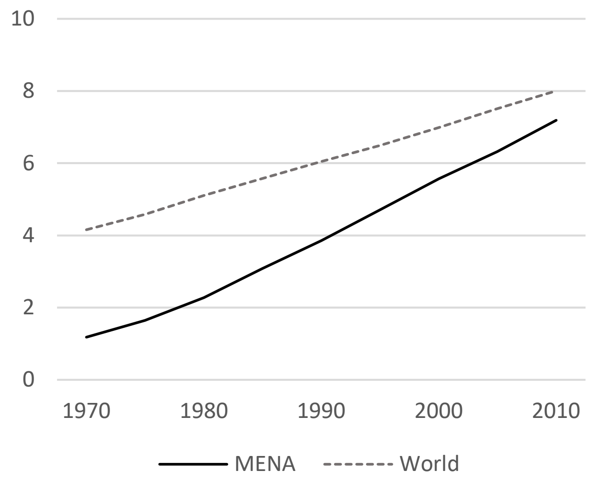
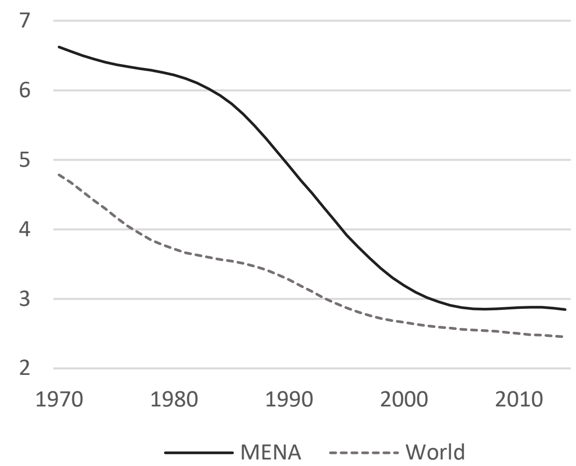
Figures

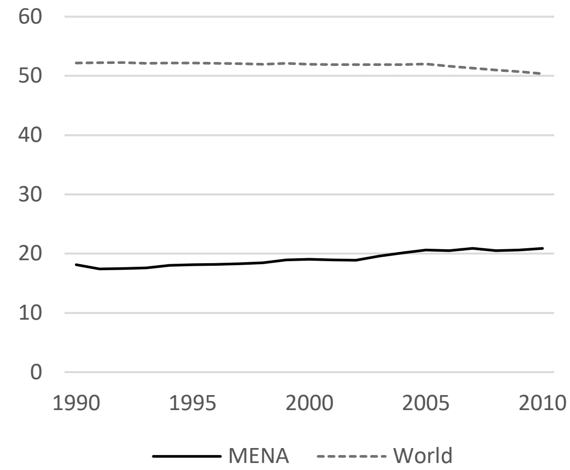
Figure 1 – Education, Fertility, and Labor Force Participation of Women in MENA



(a) Average years of education for women aged 15-65



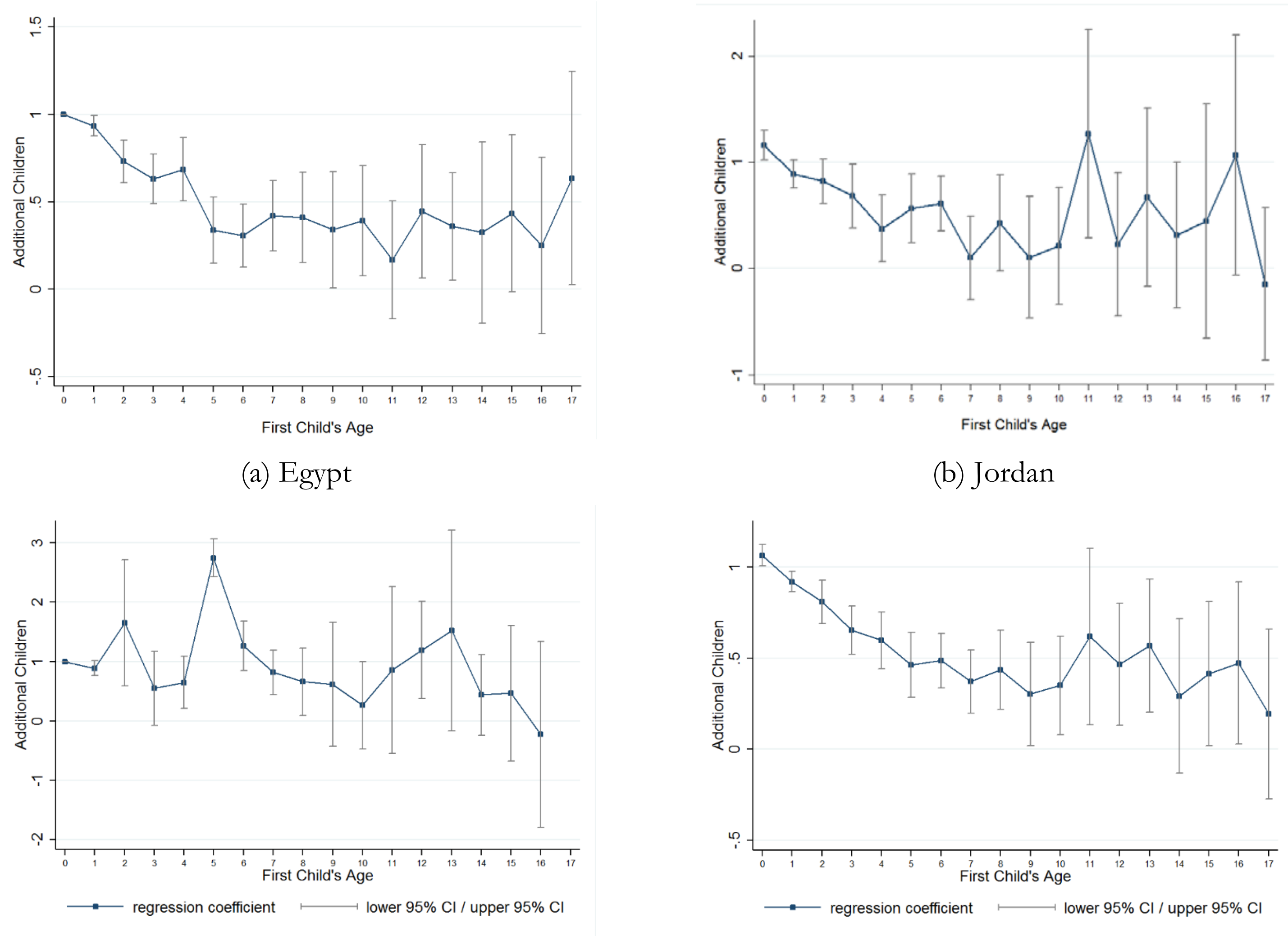
(b) Fertility rate (children per woman)



(c) Female labor force participation (% of female pop.)

Note: Figure 1(a) depicts author's calculations using Barro and Lee (2013) dataset. It is generated by calculating the population-weighted average of years of education for women across various age groups and countries. Data source for Figures 1(b), and (c) is World Bank Development Indicators (http://data.worldbank.org/indicator/SP.DYN.TFRT.IN and http://data.worldbank.org/indicator/SL.TLF.CACT.FE.ZS; accessed on Feb. 9, 2017)

Figure 2 – Effect of Having Twins on Number of Children Across the First Child's Age



(a) Egypt

(b) Jordan

(c) Morocco and Tunisia

(d) All Countries

Note: The dependent variable is the number of children ever born. The figure shows coefficient of twins in the first birth when a polynomial of mother's age at first birth and mother's years of education as well as year fixed effects are controlled for. See Table 2 notes for more information.

Tables

Table 1 – Share of Mothers* Employed

Survey	Egypt (N=104,880)	Jordan (N=45,728)	Morocco (N=18,962)	Tunisia (N=3,856)
1987			0.07	
1988	0.12			0.11
1990		0.10		
1992	0.22		0.21	
1993				
1995	0.19			
1997		0.13		
1998				
2000	0.17			
2002		0.10		
2003	0.23		0.18	
2005	0.22			
2007		0.12		
2008	0.17			
2009		0.15		
2012		0.16		
2014	0.16			
Rural	0.16	0.13	0.13	0.06
Urban	0.22	0.13	0.18	0.14
Education Level				
None	0.13	0.08	0.12	0.06
Primary	0.10	0.06	0.14	0.07
Secondary	0.21	0.05	0.30	0.35
Higher	0.50	0.34	0.66	0.80

* Sample includes all mothers (women with at least one child) aged 15 to 49. Note that this sample is intentionally different from the sample used in the rest of this study. The sample used in other tables and figures only includes mothers whose number of children ever born was the same as number of children living with the household at the time of the interview.

Table 2 – Summary Statistics of the Sample of Mothers

Variable	Egypt (N = 60,925)				Jordan (N = 33,112)			
	Mean	St. dev.	Min	Max	Mean	St. dev.	Min	Max
Working	0.21	0.41	0	1	0.16	0.37	0	1
Mother's age at first birth	21.7	4.09	10	45	22.30	4.07	9	44
Twins at first birth	0.01	0.11	0	1	0.01	0.11	0	1
Mother's years of education	7.78	5.79	0	24	10.58	4.08	0	22
Urban	0.52	0.50	0	1	0.71	0.45	0	1
Children ever born	2.80	1.42	1	12	3.80	2.11	1	17
	Morocco & Tunisia (N = 11,124)				All Countries (N = 105,161)			
	Mean	St. dev.	Min	Max	Mean	St. dev.	Min	Max
Working	0.16	0.36	0	1	0.19	0.39	0	1
Mother's age at first birth	22.08	4.44	11	43	22.02	4.13	9	45
Twins at first birth	0.01	0.08	0	1	0.01	0.11	0	1
Mother's years of education	2.86	4.34	0	27	8.16	5.62	0	27
Urban	0.60	0.49	0	1	0.59	0.49	0	1
Children ever born	3.06	1.80	1	13	3.14	1.77	1	17

Note: Data are from Demographic and Health Surveys (DHS) of Egypt (1988, 1992, 1995, 2000, 2003, 2008, 2014), Jordan (1990, 1997, 2002, 2007, 2012), Morocco (1987, 1992, 2003-04), Tunisia (1988), and Turkey (1993, 1998, 2003). They are provided by http://www.dhsprogram.com. The individuals in the sample are mothers in households that 1) have only one mother, 2) the number of children present in the household is equal to the number of children ever born by the mother. The last condition is there to make sure that all children are present in the household, so that their presence affects mother's decision to work. Working is a dummy equal to one if the mother was working at the time of the survey and zero otherwise. Urban is a dummy equal to one if the household resides in urban area and zero otherwise.

Table 3 – The Effect of Multiple First Births on the Number of Children

	Egypt	Jordan	Morocco & Tunisia	All
Multiple first birth	0.407***	0.309***	0.817***	0.401***
	(0.041)	(0.082)	(0.161)	(0.038)
Adjusted R-squared	0.129	0.145	0.133	0.180
Observations	60,925	33,112	11,124	105,161

Note: This table reports the estimates for γ in Equation (1). The dependent variable is the number of children a mother has. The sample and summary statistics are described in Table 2. All regressions include a polynomial of age at first birth, years of education, and region and year fixed effects. Regions are areas within a country. This is also the first stage for estimating the effect of number of children on mother's employment. Multiple first birth is the instrument for the number of children. The regressions for urban and rural areas separately are reported in Table A2 in the appendix. Robust-heteroskedastic standard errors are in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

Table 4 – Mother's Employment and the Number of Children

	Egypt	Jordan	Morocco & Tunisia	All
Number of children	-0.021***	-0.023***	-0.022***	-0.025***
	(0.001)	(0.001)	(0.002)	(0.001)
Years of education	0.022***	0.031***	0.027***	0.024***
	(0.000)	(0.001)	(0.001)	(0.000)
Age	0.027***	0.047***	0.017***	0.034***
	(0.002)	(0.002)	(0.004)	(0.001)
$\text{Age}^2 \times 10^{-2}$	-0.019***	-0.053***	-0.011**	-0.031***
	(0.003)	(0.003)	(0.006)	(0.002)
Urban	0.035**	-0.030***	-0.044***	-0.026***
	(0.014)	(0.004)	(0.007)	(0.003)
Share of women employed	21.3	16.2	15.8	19.1
Adjusted R-squared	0.161	0.162	0.163	0.160
Observations	60,925	33,112	11,124	105,161

Note: This table reports the estimates for Equation (2). The dependent variable is a dummy equal to one if the mother is working or not. All regressions include region-year fixed effects. Regions are areas within a country. Robust-heteroskedastic standard errors are reported in the parentheses.
*** p < 0.01, ** p < 0.05, * p < 0.10

Table 5 – Two-Stage Least Squares Estimates of the Effect of Number of Children on Mother's Employment
(First-birth twin is the instrument)

	Egypt	Jordan	Morocco & Tunisia	All
All				
Number of children	-0.026	-0.051	0.001	-0.029
	(0.036)	(0.064)	(0.044)	(0.028)
First-Stage F-statistic	98.19	14.23	25.78	109
Average LFP Rate (in %)	21.3	16.2	15.8	19.1
Average Number of Children	2.8	3.8	3.1	3.1
Observations	60,925	33,112	11,124	105,161
Rural				
Number of children	-0.071	0.064	-0.054	-0.038
	(0.056)	(0.107)	(0.049)	(0.042)
First-Stage F-statistic	33.19	4.510	11.32	41.83
Average LFP Rate (in %)	16.8	16.0	10.8	16.0
Average Number of Children	2.9	4.0	3.3	3.2
Observations	29,224	9,578	4,490	43,292
Urban				
Number of children	0.009	-0.108	0.037	-0.020
	(0.048)	(0.087)	(0.076)	(0.038)
First-Stage F-statistic	67.79	9.342	11.44	64.62
Average LFP Rate (in %)	25.3	16.3	19.1	21.2
Average Number of Children	2.7	3.7	2.9	3.1
Observations	31,701	23,534	6,634	61,839

Note: This table reports the estimates for β in Equation (2). The dependent variable is mother's employment status and number of children a mother has is instrumented using multiple first birth. The sample and summary statistics are described in Table 2. All regressions include a polynomial of age at first birth, years of education, and region-year fixed effects. Regions are areas within a country. Robust-heteroskedastic standard errors are in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

Appendix

Table A1 – First Stage of the Two-Stage Least Squares Estimates of the Effect of Number of Children on Mother's Employment – Dependent variable is the number of children.

	All			
	Egypt	Jordan	Morocco & Tunisia	All
Multiple first birth	0.407***	0.309***	0.817***	0.401***
	(0.041)	(0.082)	(0.161)	(0.038)
Adjusted R-squared	0.129	0.145	0.133	0.180
Observations	60,925	33,112	11,124	105,161
	Rural			
Multiple first birth	0.382***	0.366**	0.842***	0.412***
	(0.066)	(0.172)	(0.250)	(0.064)
Adjusted R-squared	0.125	0.182	0.098	0.176
Observations	29,224	9,578	4,490	43,292
	Urban			
Multiple first birth	0.426***	0.283***	0.707***	0.387***
	(0.052)	(0.092)	(0.209)	(0.048)
Adjusted R-squared	0.118	0.124	0.155	0.185
Observations	31,701	23,534	6,634	61,869

Note: This table reports the estimates for γ in Equation (1). The dependent variable is the number of children a mother has. The sample and summary statistics are described in Table 1. This is also the first stage for estimating the effect of number of children on mother's employment. Multiple first birth is the instrument for the number of children. All regressions include a polynomial of age at first birth, years of education, and region and year fixed effects. Regions are areas within a country. Robust-heteroskedastic standard errors are in parentheses.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table A2 – Two-Stage Least Squares Estimates of the Effect of Number of Children on Mother's Employment by the First Child's Age

	Egypt				Jordan			
	0-3	4-7	8-12	13-17	0-3	4-7	8-12	13-17
Number of children	-0.011	0.016	-0.050	0.043	-0.019	0.005	0.004	0.059
	(0.030)	(0.059)	(0.085)	(0.100)	(0.041)	(0.070)	(0.079)	(0.243)
First-Stage F-statistic	1250	107.9	24.78	12.25	278.9	41.38	8.233	1.161
Observations	11,938	13,140	13,838	11,894	6,404	7,025	7,450	6,479
	Morocco & Tunisia				**All Countries**			
	0-3	4-7	8-12	13-17	0-3	4-7	8-12	13-17
Number of children	0.200*	-0.051	-0.051	-0.089	-0.002	0.013	-0.047	0.021
	(0.116)	(0.053)	(0.075)	(0.133)	(0.024)	(0.041)	(0.052)	(0.082)
First-Stage F-statistic	25.53	32.22	5.246	6.268	1188	165.7	34.84	13.91
Observations	2,097	2,554	2,878	2,008	20,439	22,719	24,166	20,381

Note: This table reports the estimates for β in Equation (2). The dependent variable is mother's employment status and number of children a mother has is instrumented using multiple first birth. The sample and summary statistics are described in Table 1. All regressions include a polynomial of age at first birth, years of education, and region and year fixed effects. Regions are areas within a country.
* p<0.10, ** p<0.05, *** p<0.01

Table A3 – Two-Stage Least Squares Estimates of the Effect of Number of Children on Mother's Employment, Only For Mothers Whose First child is younger than 9
(First-birth twin is the instrument)

	Egypt	Jordan	Morocco & Tunisia	All
	All			
Number of children	-0.002	0.001	0.061	0.006
	(0.029)	(0.041)	(0.063)	(0.022)
First-Stage F-statistic	398.1	103	40.53	495.1
Observations	27,990	14,978	5,244	48,212
	Rural			
Number of children	-0.022	0.056	-0.024	-0.004
	(0.040)	(0.075)	(0.042)	(0.032)
First-Stage F-statistic	162.3	24.31	25.37	188.7
Observations	14,319	4,409	2,350	21,078
	Urban			
Number of children	0.015	-0.020	0.296	0.014
	(0.042)	(0.049)	(0.212)	(0.032)
First-Stage F-statistic	236.8	77.95	24.58	298.4
Observations	13,671	10,569	2,894	27,134

Note: This table reports the estimates for β in Equation (2). The dependent variable is mother's employment status and number of children a mother has is instrumented using multiple first birth. The sample and summary statistics are described in Table 1. All regressions include a polynomial of age at first birth, years of education, and region and year fixed effects. Regions are areas within a country.

Table A4 – Two-Stage Least Squares Estimates of the Effect of Number of Children on Mother's Employment, Only For Mothers Living in Households Without Extended Family Members
(First-birth twin is the instrument)

	All*			
	Egypt	Jordan	Morocco**	All
Number of children	-0.013	-0.069	0.048	-0.028
	(0.046)	(0.063)	(0.113)	(0.036)
First-Stage F-statistic	70.98	15.38	7.957	76.42
Observations	49,432	25,750	4,047	79,229
	Rural			
Number of children	-0.069	0.041	0.060	-0.041
	(0.071)	(0.159)	(0.224)	(0.063)
First-Stage F-statistic	27.15	1.904	0.945	22.19
Observations	22,419	7,587	1,497	31,503
	Urban			
Number of children	0.030	-0.101	0.014	-0.019
	(0.060)	(0.071)	(0.120)	(0.043)
First-Stage F-statistic	43.78	14.60	11.27	53.39
Observations	27,013	18,163	2,550	47,726

Note: This table reports the estimates for β in Equation (2). The dependent variable is mother's employment status and number of children a mother has is instrumented using multiple first birth. The sample and summary statistics are described in Table 1. All regressions include a polynomial of age at first birth, years of education, and region and year fixed effects. Regions are areas within a country.
* The samples only include households without extended family members. Extended family members were identified using the variables indicating relationship to the head. If there were at least one member in the household who was the parent of the head, the sibling of the head, co-spouse of the head, grandchild of the head, or other relatives of the head. Presence of extended family members were not possible to identify in some of the DHS surveys used in this study; specifically 1990 Jordan's DHS, 1988 Tunisia's DHS, and 1987 and 1995 Morocco's DHS. This was because the variable indicating relationship to the head or any other variable that could be used to identify extended families is not collected in these surveys. So these surveys were dropped from the sample.
** As explained in the previous note, it is not possible to identify extended family members in Tunisia's DHS. Therefore, this country is not part of these regressions.

Table A5 – Two-Stage Least Squares Estimates of the Effect of Number of Children on Mother's Employment, Only For Mothers Living in Households Without Extended Family Members and Age of the First Child is Between 0 and 3
(First-birth twin is the instrument)

	All			
	Egypt	Jordan	Morocco*	All
Number of children	0.007	-0.043	0.409**	-0.001
	(0.036)	(0.051)	(0.170)	(0.029)
First-Stage F-statistic	910.3	174.1	166.2	896.5
Observations	8,806	4,562	520	13,888
	Rural			
Number of children	-0.003	-0.045	0.259	-0.015
	(0.048)	(0.098)	(0.275)	(0.042)
First-Stage F-statistic	464.9	75.12	23.75	530.6
Observations	4,401	1,433	186	6,020
	Urban			
Number of children	0.011	-0.038	0.852***	0.001
	(0.052)	(0.060)	(0.090)	(0.040)
First-Stage F-statistic	465.3	114.8	456.8	460.2
Observations	4,405	3,129	334	7,868

Note: See the notes for Table A5.

* The results for Morocco are statistically significant at 5%. But note that there are only 4 observations with multiple births in the sample. The results for Morocco could be an artefact of few observations with multiple first birth. As explained in notes for Table A4, it is not possible to identify extended family members in Tunisia's DHS. Therefore, this country is not part of these regressions.

Table A6 – Two-Stage Least Squares Estimates of the Effect of Number of Children on Mother's Employment, Only For Mothers with More than Eight Years of Education (First-birth twin is the instrument)

	Egypt	Jordan	Morocco & Tunisia	All
	All*			
Number of children	-0.025	-0.089	0.325	-0.043
	(0.048)	(0.071)	(0.268)	(0.039)
First-Stage F-statistic	79.81	13.20	10.98	72.92
Observations	32,242	25,185	1,608	59,035
	Rural			
Number of children	-0.050	0.025	2.270	-0.017
	(0.071)	(0.075)	(2.786)	(0.053)
First-Stage F-statistic	32.83	9.024	0.293	35.16
Observations	11,705	6,556	86	18,334
	Urban			
Number of children	-0.008	-0.198	0.195	-0.063
	(0.064)	(0.138)	(0.230)	(0.056)
First-Stage F-statistic	48.04	5.447	11.21	38.96
Observations	20,537	18,629	1,522	40,688

Note: The results for Morocco are statistically significant at 5%. But note that the F-statistic is very weak and the estimates can be highly biased.

Table A7 – Two-Stage Least Squares Estimates of the Effect of Number of Children on Mother's Employment, Only For Mothers with Eight or Fewer Years of Education
(First-birth twin is the instrument)

	All*			
	Egypt	Jordan	Morocco & Tunisia	All
Number of children	-0.085	0.237	-0.030	-0.028
	(0.052)	(0.211)	(0.040)	(0.035)
First-Stage F-statistic	16.43	1.501	22.62	27.81
Observations	28,683	7,927	9,516	46,126
	Rural			
Number of children	-0.170	-0.213	-0.086*	-0.128
	(0.117)	(0.283)	(0.049)	(0.089)
First-Stage F-statistic	5.229	1.621	10.37	6.728
Observations	17,519	3,022	4,404	24,945
	Urban			
Number of children	-0.018	0.101	0.009	0.020
	(0.055)	(0.086)	(0.079)	(0.041)
First-Stage F-statistic	13.46	3.722	8.857	20.95
Observations	11,164	4,905	5,112	21,181

Note: The result for urban areas of Turkey is statistically significant at 5%. But the F-statistics is too weak and the estimates can be highly biased. Only for the whole sample of Egypt the estimate is barely significant at 10% level (its p-value is equal to 0.10). The first stage F-statistic is also at the Stock-Yogo 10% significance level threshold. This means that we are on the border of having a weak instrument as well. So, as a whole, this result is statistically too weak to make conclusions especially as it vanishes when we combine all countries (even though over 75% of the sample of the combined countries is from Egypt.)
† P-value is equal to 10%.