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DETERMINANTS OF FERTILITY AND POPULATION POLICIES IN MENA COUNTRIES

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Abstract

In this study, we examine the relationship between fertility and population policies and other potential determinants. We use panel data from the United Nations World Population Policies database, Integrated Labor Market Panel Survey (ILMPS) database and the World Development Indicators. In the first part of our analysis, we find significant negative association between the government policy to reduce fertility, and the change in the total fertility rate. On the other hand, there is no significant and robust relationship between the government policy to raise fertility, government's policy to support family planning, and the change in the total fertility rate. In addition we find evidence of spatial autocorrelation in the total fertility rate, and spatial spillovers from government's policy on fertility. In the second part of our analysis, we examine the determinants of fertility using micro data on Egypt, Jordan and Tunisia. We find positive and significant association between fertility and age, household size, marital status and a dummy variable that takes the value 1 if the first child is female and 0 otherwise. At the same time, we find negative and significant association between fertility and urban areas, education level, labor force participation and wealth.

Keywords: fertility rate; population; government policies
JEL Classification: H10, H59, J11, J13, J18

ملخص

في هذه الدراسة ، ندرس علاقة سياسات الخصوبة والسكان، بالمحددات الأخرى المحتملة. نستخدم بيانات الفريق من قاعدة بيانات الأمم المتحدة للسياسات السكانية العالمية ، وقاعدة بيانات مسح سوق العمل المتكاملة ومؤشرات التنمية العالمية. فى الجزء الأول من تحليلنا ، نجد ارتباطًا سلبيًا كبيرًا بين سياسة الحكومة لتقليل الخصوبة ، والتغير في معدل الخصوبة الكلي. من ناحية أخرى ، لا توجد علاقة قوية ومتينة بين سياسة الحكومة لزيادة الخصوبة ، ولدعم تنظيم الأسرة، من ناحبة، والتغير في معدل الخصوبة الكلي، من ناحيةأخرى. بالإضافة إلى ذلك ، نجد دليلاً على ارتباط ذاتي مكاني في معدل الخصوبة الكلي ، والتداعيات المكانية لسياسة الحكومة بشأن الخصوبة. في الجزء الثاني من تحليلنا ، والخاص بدراسة محددات الخصوبة نستخدم البيانات الدقيقة عن مصر والأردن وتونس، ووجدنا ارتباطًا إيجابيًا وهامًا بين الخصوبة والعمر وحجم الأسرة والحالة الزواجية والمتغير الوهمي الذي يأخذ القيمة 1 إذا كان الطفل الأول أنثى وصفر بخلاف ذلك. في نفس الوقت ، نجد ارتباطًا سلبيًا وهامًا بين الخصوبة والمناطق الحضرية ومستوى التعليم والمشاركة في القوى العاملة والثروة.

1. Introduction

Fertility rates have decreased substantially around the world over the last few decades. While decreases are more profound in developed countries, developing countries have also experienced significant changes following, in some cases, specific government policies. While the views and policies of governments towards population control vary quite widely, governments in developing countries have had a relatively negative view towards fertility, which led to the adoption of policies to reduce fertility. It is not clear, however, whether population policies indeed matter or if there are other factors that affect fertility rates.

Other studies have also examined how fertility responds to population policies and other economic, demographic and institutional factors. Pritchett (1994) argues and shows that the significant variation in fertility rates across countries is due to desired fertility of couples, and is not driven by the availability of contraceptives or family planning policy by governments. At the same time, Haub (2010) argues that population control policy in South Korea not only worked but it worked too well. South Korea now has one of the lowest fertility rates in the world. Singapore is another example where the population policy went from anti-natalist in 1960s and 1970s to pro-natalist after the mid-1980s (Yap, 2003). Yap (2003) notes that the total fertility rate in Singapore rose sharply from 1.6 to about 2 children per woman in 1988, soon after the introduction of the new pro-natalist policy in 1987.[2] A recent book by Takayama and Werding (2011) provides an overview of policy responses to low fertility with a particular focus on China, France, Japan, South Korea and Sweden. Studies in the volume also point to difficulties with available data and complexity in studying the fertility behavior. Bradshaw and Attar-Schwartz (2011) examine the relationship between fertility and social policy using the European Social Survey data on sixteen European countries. They point to problems particularly with measurement of social policy variables and do not find strong evidence of a relationship between social policy and fertility.

In this project, we examine the determinants of fertility behavior in selected MENA countries using the ERF's OAMDI and the United Nations World Population Policies Database. We employ various econometric techniques including panel data estimation and spatial econometric methods. Despite significant changes in the fertility rate in MENA countries, these changes weren't examined widely in the existing literature. ERF's Integrated Labor Market Panel Survey (ILMPS) database includes variables regarding family formation and child bearing which enable us to examine fertility behavior in Egypt, Jordan and Tunisia using micro data.

In the first stage of this project, we review the theoretical and empirical literature on the determinants of fertility. This is followed by a macro analysis of the relationship between government policies towards fertility and the change in the total fertility rate using panel data on

[2] Feyrer, Sacerdote and Stern (2008) argue that there may be an increase in the fertility rates in high-income developed countries not due to increased participation of males in the household, which is not necessarily driven by a specific government policy.

133 countries (including MENA countries) over the 1976-2015 period.[3] We use country-level data from the United Nations World Population Policies Database, and the World Bank's World Development Indicators.[4] In our analysis we consider different types of government policy. The first is to reduce fertility through education, health care, family planning, employment programs and availability of low-cost contraception. We can refer to this as anti-fertility policy. The second is to raise fertility through a variety of government subsidies for childcare and housing, tax incentives, maternal and paternal leave and media campaigns. We can refer to this as pro-fertility policy.[5] In addition, within the anti-fertility policy category, we examine family planning policy separately to see if that policy is particularly strongly related to change in fertility. We also control for country fixed effects and spatial autocorrelation in the data.

In the second stage, we examine fertility using data from the Integrated Labor Market Panel Survey data from ERF's Open Access Micro Data Initiative (OAMDI). The dataset includes data from Egypt (1998, 2006 and 2012), Jordan (2010), and Tunisia (2014). It is quite rich in terms of specific variables on fertility, family formation, education, and other demographic and labor market characteristics. It also includes geographic variables such as governorate, region and rural/urban location of individual units.

In the next section, we are examining how the total fertility rate and the government policies towards fertility changed over time. This is followed by a description of our empirical approach, models and variables used in our analysis. We present our results in section 4 and provide summary and concluding remarks in the last section.

2. Fertility Trends and Government View and Policies towards Fertility

There have been significant decreases in fertility rates in recent decades. Figures 1 and 2 show the variation in total fertility rates in1976 and 2013, respectively. Figure 1 shows very high fertility rates (over 5 children per woman) in 90 countries in 1976. Africa and the Middle East had the highest concentration of countries with very high fertility rates. Only 23 countries in Europe and North America had below replacement fertility. Figure 2 shows drastic changes in fertility. In 2013, the number of countries with very high fertility decreased to 15, and the number of countries with below replacement fertility increased to 73. While the highest concentration of countries with very high fertility is still in Africa, none of the MENA countries had very high fertility. Many African countries experienced significant decreases in fertility. Unlike what we observed in the map for 1976, all other European countries (particularly Eastern European countries), and some emerging market economies such as Brazil, China and Turkey also moved to below replacement fertility in 2013. Figure 3 shows that MENA countries

[3] The UN World Population Policies Database provides data for the years 1976, 1986, 1996, 2001, 2003, 2005, 2007, 2009, 2011, 2013 and 2015.

[4] The UN World Population Policies Database provides data for the years 1976, 1986, 1996, 2001, 2003, 2005, 2007, 2009, 2011, and 2013. Data for 2015 became available very recently but was excluded from our analysis due to lack of data for that year for other variables used in our regressions.

[5] The term "pro-natal policy" is also used in many studies.

experienced significant decrease in total fertility rates with a number of countries having below replacement fertility by 2013.

We now turn to government policies towards fertility. United Nations World Population Policy database provides a comprehensive and rich dataset on government attitudes towards fertility and other important demographic variables.[6] United Nations (2013) notes that the database uses four major sources of information. The first is the official response from the country governments to the inquiries directly sent by the United Nations. The second is government documents, publications, laws, regulations and proclamations. The third is the official materials provided by international and intergovernmental organizations, including other United Nations agencies. The final source is the materials provided by non-governmental organizations such as the media outlets, academic and other research institutions.[7]

The key variable of interest in this database is the "policy on fertility level." United Nations (2013) describes this variable as "Government's stated policy to influence the level of fertility in the country." Response categories for the variable are "raise," "maintain," "lower," and "no intervention." The map in Figure 4 shows how government policies towards fertility differ for countries in our dataset. In 1976, only 55 countries had an anti-fertility policy in 1976. We see that a number of governments in Africa did not have an anti-fertility policy. It is also noteworthy that only 18 countries had a pro-fertility policy in 1976.

While we see a similar pattern in 2013 in Figure 5, significantly more governments have anti-fertility policy. At the same time, more governments have adopted pro-fertility policies from 1976 to 2013. This could be seen as an indication of concerns regarding the impact of population aging on economies.[8] Figure 5 shows that the number of governments with an anti-fertility policy rose to 76, which is significantly greater than the number of governments with such policy in 1976. In addition, most African countries now have policies to reduce fertility. The number of governments with pro-fertility policy also increased substantially to 51. In Figure 6, we also summarize the time trend in the percent share of countries with policies to reduce and raise fertility. We see a significant increase in the share of countries with policies to reduce fertility between 1986 and 2001 and then a sharp increase in the share of countries with policies to raise fertility after 2001.

We also show differences between MENA and other countries in a summary statistics table in Table 1. We see in this table that about half (49.5%) of all MENA countries have anti-fertility policy, which is significantly higher than the share for other countries (39%). At the same time, only about 12% of MENA countries have pro-fertility policies, which is smaller than 19% share

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[6] See United Nations (2013) and https://esa.un.org/poppolicy/img/Definitions_Policy_Variables.pdf for a detailed description of the variables in the database.

[7] See United Nations (2013) for more on these data sources. Box I.1 on page 43 in that publication has a chart that shows both the inputs to the database and major outputs or publications from the database.

[8] Note that there are more countries added to the UN World Population Policies Database after 2000.

for other countries in our sample. Finally, about 76% of MENA countries have some form of government support for family planning whereas about 93% of all other countries have such government support.

We also see in figures 4 and 5 that the spatial distribution of the government policies and the total fertility rates are not random. There seems to be a significant degree of spatial clustering among countries. The Local Indicators of Spatial Association (LISA) map in Figure 7 shows that the spatial correlation in total fertility rates in 1976 is particularly strong between countries with high fertility rates, and particularly strong for Africa and the Middle East. The LISA map in Figure 8 shows that this significant spatial association persisted for countries in Africa. These two maps point to presence of spatial autocorrelation in total fertility rates, which we examine further in the next section.

3. Empirical Approach and Methodology

We examine empirically how fertility responds to government policies towards fertility. We use *Change in the total fertility rate* as the dependent variable. Data on total fertility rate comes from the United Nations Population Division. The three key explanatory variables are *Anti-fertility policy, Pro-fertility policy*, and *family planning policy*, which are all constructed from the variables in the United Nations World Population Policies database. *Anti-fertility policy* is a dummy variable that takes the value 1 if the government has an anti-fertility policy, and 0 otherwise. As we explained in section 2, we used the variable "policy on fertility level" from the United Nations database and recoded the response category "lower" as 1 and other responses ("raise," "maintain," and "no intervention") as 0.

Pro-fertility policy is a dummy variable that takes the value 1 if the government has a pro-fertility policy, and 0 otherwise. For this variable, we used "policy on fertility level" from the United Nations database again, and this time recoded "raise," and "maintain" as 1 and other responses ("lower" and "no intervention") as 0.[9]

Family planning policy is also a dummy variable that takes the value 1 if the government has a policy that supports family planning directly or indirectly, and 0 otherwise. While family planning is mentioned as part of the definition of "policy on fertility level" in the United Nations database, the same database has a separate variable called "government support for family planning." For the variable *Family planning policy*, we used "government support for family planning" from the United Nations database, and recoded "direct support" and "indirect support" as 1 and other responses ("no support" and "not permitted") as 0. Our three explanatory variables are related to each other. *Anti-fertility policy* is strongly and negatively correlated with *Pro-fertility policy*. *Family planning policy* is positively correlated with *Anti-fertility policy* but the correlation is not very high (about 0.24). *Family planning policy* is also negatively correlated

[9] We coded "maintain fertility" response as 1 since a policy to maintain fertility or to prevent fertility from declining would still involve some pro-fertility intervention from the government. We have checked the robustness of our results by coding it as zero and found that our results did not change significantly and qualitatively.

with *Pro-fertility policy*. We are using these variables in separate regressions, which gives us a way to compare results across different regressions.

We also use a number of other control variables that include *GDP per capita, Health spending per capita*, *Trade to GDP, Share of urban population*, and country fixed effects. *GDP per capita* is gross domestic product divided by midyear population and measured in constant (2005) US dollars. The relationship between GDP and the fertility rate can be rather complex. While economic development in a country that is measured by GDP per capita can act like a contraceptive, countries at high level of development may engage in promotion of higher fertility.[10] Hence we do not have a specific expectation regarding the relationship between the fertility rate and the GDP per capita. *Health spending per capita,* defined as the ratio of the sum of public and private health expenditures to total population, is an important variable that controls for a potential impact of the level (and quality) of the health care provided to citizens on their fertility behavior. We might expect a negative relationship to total fertility rate since couples may likely decide to have less children if they know that they will receive good healthcare for themselves and their kids. *Trade to GDP*, defined as the ratio of the sum of exports and imports of goods and services to GDP, captures vulnerability of economies to external shocks. Kim and Prskawetz (2006) argue and show evidence that households use children (or fertility) as a consumption smoothing strategy in response to external shocks. Hence we would expect a positive relationship between *Trade to GDP* and the total fertility rate. We use *Share of urban population* as a control for the level of urbanization.

We apply the spatial econometric methods to estimate the relationship between the government policies towards fertility and change in the total fertility rate. Fertility behavior in one country could correlate with the fertility rates in adjacent countries. A lot of countries in our dataset have relatively open borders with good degree of mobility between countries. For example, people in many African countries have ethnic, religious or tribal links with others across the border. That could lead to spatial correlation in the fertility behavior. Similarly, government policies on fertility could also have spillover effects on adjacent countries. Central and regional governments interact with those that are in close proximity, which could lead to spatial dependence in fertility policies. There may also be concern for spatial dependence if the policy of aid organizations in one country is driven by their experience in a neighboring country or region. Other studies have pointed to similar spatial or neighborhood effects in developing countries. For example, Parent and Zouche (2012) show evidence that spatial dependence matters for growth outcomes in Africa and the Middle East. Easterly and Levine (1998) also show evidence of neighborhood effects in growth performance and growth-related policies in African countries.

[10] See also Becker (1960) and Razin and Sadka (1995) for theoretical arguments on the relationship between income and fertility.

Statistically, we refer to the standard Moran's I test statistic to understand the spatial correlation in the data. Figure 8 shows the Moran's I scatter plot of all countries.[11] The Moran's I test statistic is equal to 0.295 and is statistically significant at 0.05 level, which means the spatial autocorrelation is significant and can not be neglected in our data. The x-axis is the value of the total fertility rate of each country, and the y-axis is the corresponding Moran's I values for the country with adjacent countries. The scatter plot shows that generally with the increase of the fertility rate, Moran's I tends to be positive, and vice versa. Most positive Moran's I values are for African countries, while most negative Moran's I values are for countries in Europe.[12]

We examine spatial dependence by running spatial lag and spatial error regressions. Models of spatial dependence account for influences from places that are geographically close to each other. Failing to consider spatial dependence may lead to biased, inefficient, or inconsistent coefficient estimates (Cliff and Ord 1981, Anselin 1988). A spatial error model contains an autoregressive process in the error term, whereas a spatial lag model assumes a spatially lagged dependent variable. The linear spatial lag or spatial autoregressive model (SAR) can be expressed as:

$$\textit{Change in fertility rate}_{it} = \alpha_0 + \boldsymbol{\rho W}\textit{Fertilityrate}_{it} + \beta \boldsymbol{X}_{it} + \gamma_i + \tau_t + \varepsilon_{it}, \qquad (1)$$

where $\boldsymbol{W}$ denotes the spatial weighting matrix that provides the spatial neighborhood information. There are different ways to generate the spatial matrices. Here we use the inverse distance matrix[13] . $\boldsymbol{\rho}$ denotes the spatial parameter. $\boldsymbol{X}$ includes the main explanatory and other control variables that are described at the beginning of this section. Finally, each year in the panel data set is controlled for by time fixed effects (τ), and γ represents the country fixed effects in the model. The spatial error model (SEM) can be expressed as:

$$\textit{Change in fertility rate}_{it} = \alpha_0 + \beta X_{it} + \gamma_i + \tau_t + \varepsilon_{it}, \text{ where } \varepsilon_{it} = \beta W \varepsilon_{it} + v_{it}, \qquad (2)$$

where the error process can be written as a spatially autoregressive process. We will be showing results from both the SAR model and SEM, in addition to the ordinary least squares (OLS) regression that does not include any spatial correction in the next section.[14]

4. Empirical Results

4.1 Population Policies and Change in Fertility

[11] We included a different version of this graph (Appendix Figure 1) with country codes and a list of countries used in the graph in the appendix section.

[12] We also conducted more detailed spatial diagnostic tests where we find that spatial autocorrelation is a concern in our data.

[13] The inverse distance matrix is generated using the latitude and longitude information for countries: https://developers.google.com/public-data/docs/canonical/countries_csv. Note that we also ran regressions with a contiguity matrix. Results are largely similar but inverse distance weighting allows more observations particularly from island nations, which would clearly be dropped from the regression analysis that uses contiguity weighting.

[14] The OLS regression specification is very similar to the one shown in equation 2, with the exception that the error term is not subject to the spatially autoregressive process. That specification can be written as *Change in fertility rate*$_{it} = \alpha_0 + \beta X_{it} + \gamma_i + \tau_t + \varepsilon_{it}$.

In the first set of regressions we are using panel data to examine the relationship between government's policy on fertility and change in the total fertility rate. In Table 2 we are seeing a statistically significant negative association between government's policy to reduce fertility and change in the total fertility rate. The results for *Government's policy (lower fertility)* suggest that a policy to reduce fertility produces both a negative direct effect and a negative indirect (or spatial spillover) effect on the change in total fertility rate, which together lead to a strong negative total effect as indicated in column (3). The coefficient estimate for the SAR direct effect in column (1) shows that when there is a government policy to reduce fertility, change in total fertility rate is lower by about 0.021 points. With an average total fertility growth rate of about -0.058 (or -5.8%) for the 1976-2013 period, this translates into about 35% of the fertility growth rate on average. We see a similar but smaller coefficient estimates in the SEM and OLS regressions in columns (4) and (5). While we get a consistently negative and significant coefficient for *Government's policy (lower fertility)* in all three regression specifications, it is important to note that the magnitude of the association with change in total fertility rate is substantially greater when direct and indirect (spillover) results are combined together in the SAR model results. We also see that both spatial parameters (rho and lambda) are positive and statistically significant.

In tables 3 and 4, we don't see any significant relationship with the change in total fertility rate for government policy to raise fertility or the government policy to support family planning. The latter result (in Table 4) is consistent with the evidence from Pritchett (1994) where evidence suggested desired fertility of families matter more than family planning policies.

Results for the remaining control variables are quite consistent across all three regressions. While the coefficients for GDP per capita, trade-to-GDP ratio and share of urban population are positive and statistically significant, the coefficient for health spending per capita is negative and statistically significant. Note that all regressions also control for time-invariant country fixed effects, which would include institutional differences between countries. It is also noteworthy that, in all three regressions, spatial dependence parameters (rho for the SAR and lambda for the SEM) are positive and significant. We have also examined spatial autocorrelation in total fertility rate and found a positive and significant Moran's I parameter, which we already discussed before in section 2. Hence, we indeed think spatial autocorrelation is a concern, which we control for in SAR and SEM regressions.

While the results in Table 2 may make one think that government policy to reduce fertility has been effective in reducing total fertility rate, these results are not necessarily indicating causal links. It is possible that government policies are also driven by the total fertility rate. As another robustness check, in the next set of regressions, we are moving away from the panel data structure and regressing the change in the fertility rate between 1976 and 2013 on the 1976 value of the policy and other control variables. Results for the policy variables in tables 5-7 are quite similar to the ones in tables 2-4.[15] We are still seeing a negative and statistically significant association between policy to reduce fertility and the change in fertility rate in all three regression specifications, and there is generally no significant association for other policy variables.[16] Among the control variables, the only robust and significant relationship is for GDP per capita where the coefficient is positive. Also, the only robust and significant spatial parameter is for rho in the SAR model, where the parameter is positive.

4.2 Determinants of Fertility in Egypt, Jordan and Tunisia

While the previous results point to a role played by population policies that explain fertility behavior to some extent, we expect that factors other than government policy also play an important role. In the next part of our analysis, we are examining fertility behavior using micro data on Egypt, Jordan and Tunisia. As we noted in the introduction the dataset includes data from Egypt (1998, 2006 and 2012), Jordan (2010), and Tunisia (2014). It is quite rich in terms of specific variables on fertility, family formation, education, and other demographic and labor market characteristics. It also includes geographic variables such as governorate, region and rural/urban location of individual units. The regression specification used in the paper can be written as

$$Fertility_{it}=\alpha_0 + \beta X_{it} + \gamma_i + \tau_t + \varepsilon_{it},, \qquad (3)$$

where the error process represented by ε_{it} is i.i.d. ***X*** includes the main explanatory and other control variables, *Urban, Age, Age squared, Household size, Marital status, Education level, Labor force participation, First child, Wealth index, Monthly wage income*. *Urban* is a dummy variable that takes the value 0 if the respondent is in a rural area and 1 if the respondent is in an urban area. *Age* and *Age squared* are variables that show the age of the respondent. *Household size* indicates the number of members in the respondent's household. *Marital status* is a dummy variable that takes the value 0 if the respondent is not married and 1 if the respondent is married. *Education level* is a categorical variable that ranges from 1 (illiterate) to 7 (post-graduate) with other categories coded as 2 (read and write), 3 (basic education), 4 (secondary education), 5 (post-secondary), and 6 (university). *Labor force participation* is a dummy variable that takes the value 0 if the respondent is not in the labor force and 1 if the respondent is in the labor force. *First child* is a dummy variable that takes the value 0 if the first child of respondent is male and 1 if the first child of respondent is female. *Wealth index* is the continuous household wealth score constructed by the survey. *Monthly wage income* is the real monthly wage of the respondent on PPP basis and calculated using 2012 as the base year. Finally, each year in the panel data set is controlled for by time fixed effects (τ), and γ represents the country fixed effects in the model.

The results from these regressions are shown in Table 8. In the first set of regressions in column 1, we find that total fertility is negatively and significantly associated with *Urban*, which is

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[15] Note that we had to drop health spending per capita due to lack of data for that variable in 1976.
[16] Note that it was not possible to break down the SAR results into direct and indirect components as these regressions are run as spatial cross-sectional regressions.

consistent with findings from other studies. Urbanization is expected to increase the cost of child bearing and decrease the benefits associated with using household members (including children) in family production activities such as farming. We find a positive and significant association with *Age* but a negative and significant association with *Age squared*. This also makes sense since fertility is expected to rise with age but only up to a certain age and we should see a decline in fertility after a certain age threshold. We also find a positive and significant association with both *Household size*, and *Marital status*. Fertility may be higher in larger households where the cost of child care is lower due to presence of multiple individuals in the household who can care for the children. It is also expected that there would be a positive relationship between fertility and being married. Fertility is negatively and significantly associated with *Education level*. This could be due to two possible channels. One is through later marriages as women stay at school longer with higher education level. The other is through making more informed decisions regarding fertility, which could also be driven by the level of education. While we also find a negative association with labor force participation of women, which is expected, this result is not statistically significant. There is a positive and significant association between fertility and the variable *First child*, which indicates whether the first child is a female or not. This result shows that when the first child is female, there has been significantly higher fertility. This could be due to culture in the region towards preference for a son. Finally, we find a negative and significant association between fertility and *Wealth index*. This results is consistent with the quantity-quality trade-off regarding child bearing (Becker, 1960).

In the second set of regressions in column 2, we replaced *Wealth index* with *Monthly wage income*. Our results are largely the same as the ones in column 1 but the coefficient of Monthly wage income is now positive. However, this result is not statistically significant so it is not possible to compare to wealth variable used in the first set. Another difference is that the coefficient for *Labor force participation* is now negative and significant. While it is good to see the robustness of our previous findings, we note that we lose a significant number of observations in the second set of regressions due to lack of data for Monthly wage income.

In the third and final set of regressions, we included both *Wealth index* and *Monthly wage income*. Our results again didn't change in a significant way. It is also good to see that the coefficient for *Wealth index* is still negative and significant. In all regressions reported in Table 7, we included country fixed effects to control for time-invariant country specific effects such as government policies and other institutional factors. We also included year fixed effects to control for time specific effects such as regional or global economic shocks that may have impacted all countries in the region.

5. Summary and Concluding Remarks

In this paper, we find significant negative association between the government policy to reduce fertility, and change in the total fertility rate. On the other hand, there is no significant relationship for the government policy to raise fertility or the government policy to support family planning, which makes it hard to conclude that government policy towards fertility really works. Additionally, as many scholars noted before, fertility behavior is quite complex which makes it hard to establish causal links between government policy and fertility. We also find evidence of spatial autocorrelation in the total fertility rate, and spatial spillovers from government's policy on fertility. It is noteworthy that there is significant spatial autocorrelation with fertility, which may explain the stigma with high fertility in contiguous regions of Africa.

In the second part of our analysis, we examine determinants of fertility using micro data on Egypt, Jordan and Tunisia. We find positive and significant association between fertility and age, household size, marital status and a dummy variable that takes the value 1 if the first child is female and 0 otherwise. At the same time, we find negative and significant association between fertility and urban areas, education level, labor force participation and wealth.

This study can be extended in a number of ways. Particularly, we find both the data from the United Nations World Population Policies database and the Integrated Labor Market Panel Survey (ILMPS) dataset to be quite rich. The UN database would allow one to examine government views and policies on other demographic variables such as population growth, population mobility and population aging, among others. At the same time, we should also caution that the database doesn't provide information specifically on the magnitude of government policies and data are not available annually. Having a policy may not be enough to impact fertility behavior, especially when the policy is seen as a relatively minor intervention by the government. Our analysis using microdata shows that there are indeed a number of other factors that may be explaining fertility behavior in MENA countries.

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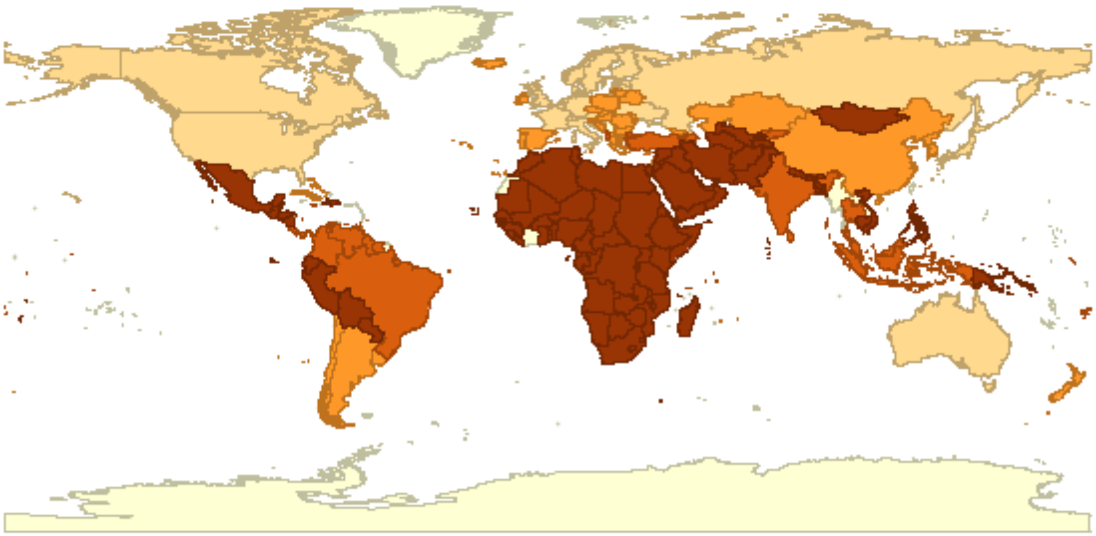
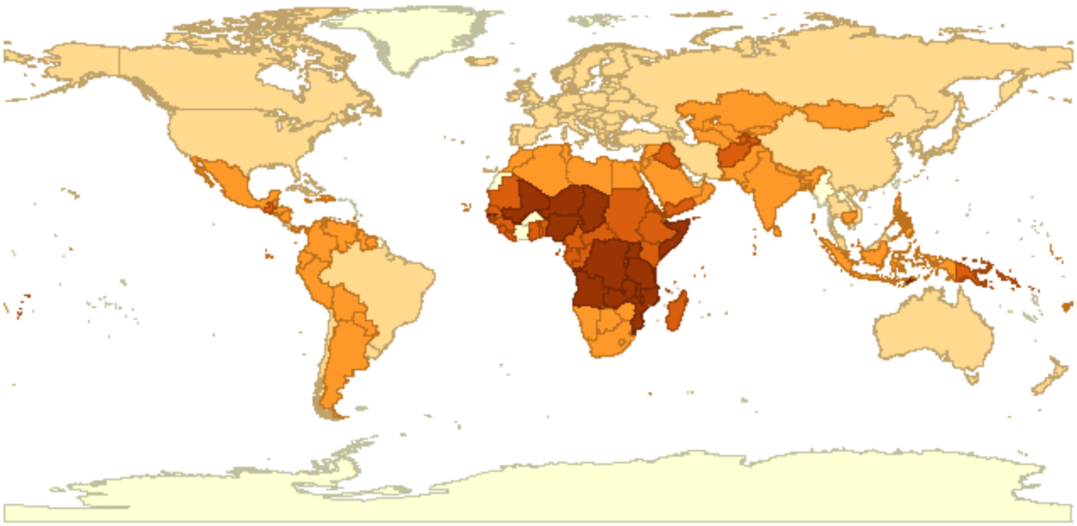
Figure 1: Total Fertility Rate in 1976



Source: United Nations Population Policies Database, 1976.
Total Fertility Rate in 1976

- Missing data (91)
- 0.00-2.09 (23)
- 2.1-3.5 (38)
- 3.51-5.00 (23)
- 5.01+ (90)

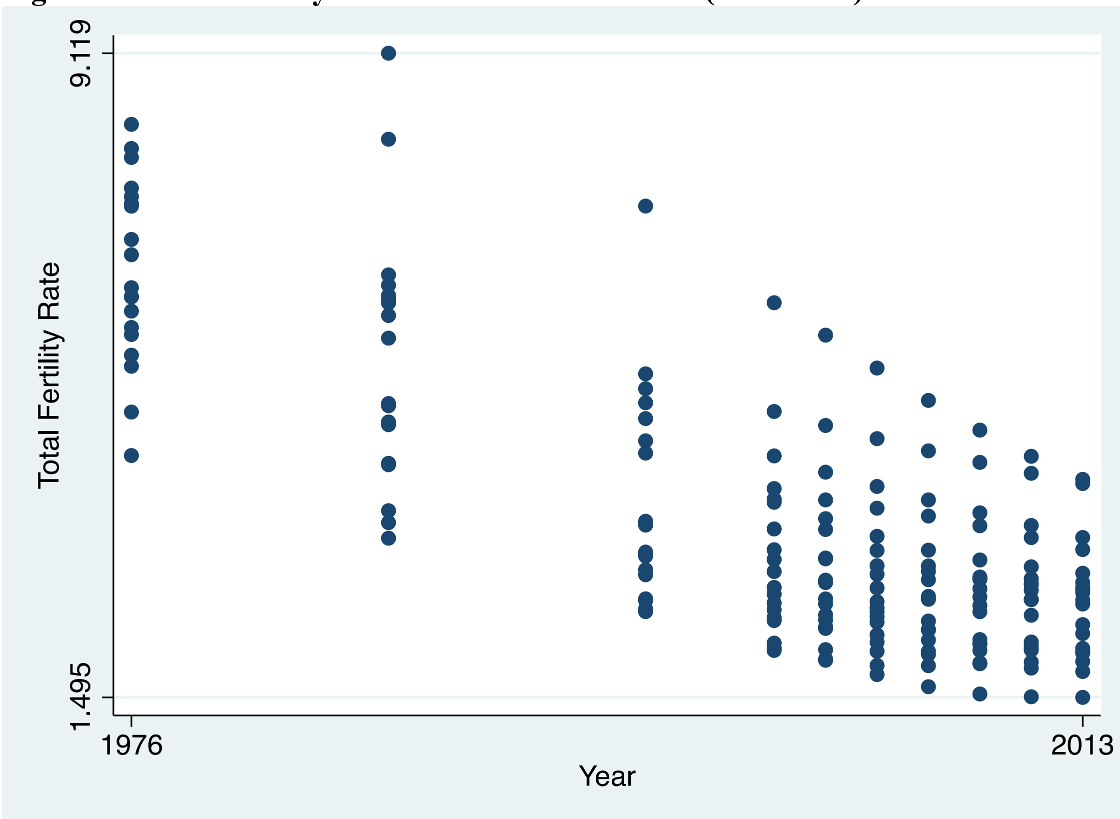
Figure 2: Total Fertility Rate in 2013 (United Nations Population Policies Database)



Total Fertility Rate in 2013

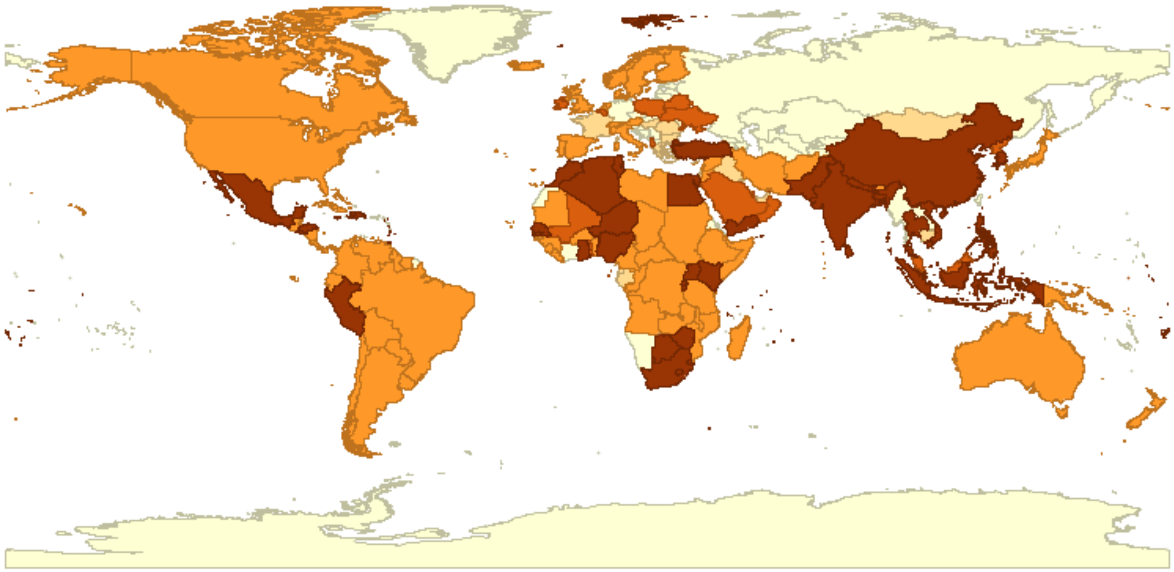
- Missing data (90)
- 0.00-2.09 (73)
- 2.1-3.5 (56)
- 3.51-5.00 (31)
- 5.01+ (15)

Figure 3: Total Fertility Rates in MENA Countries (1976-2013)



Source: United Nations Population Policies Database, 1976-2013.

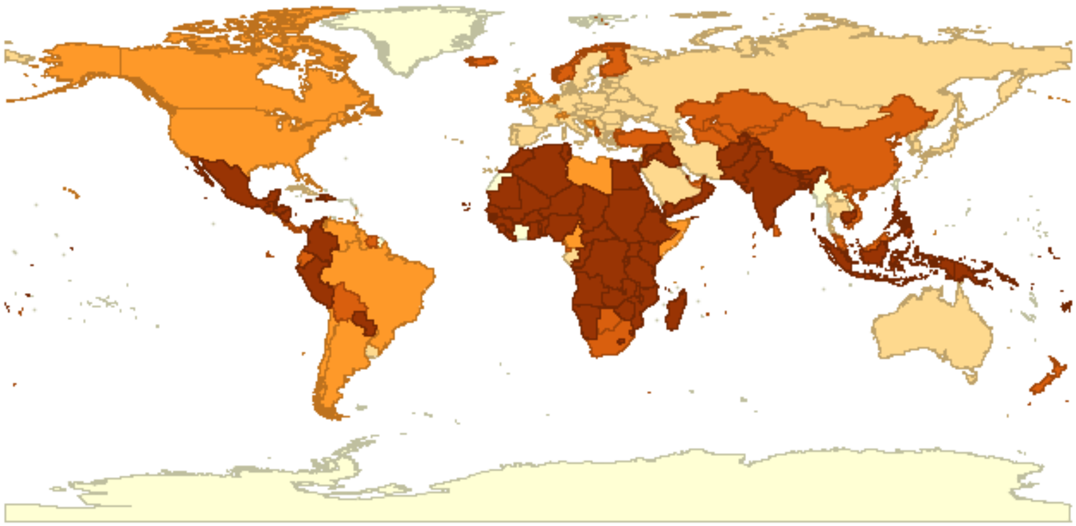
Figure 4: Government Policy on Fertility in 1976



Source: United Nations Population Policies Database, 1976.
Government Policy on Fertility in 1976:

- Missing data (105)
- Raise fertility (18)
- No intervention (72)
- Maintain fertility (15)
- Lower fertility (55)

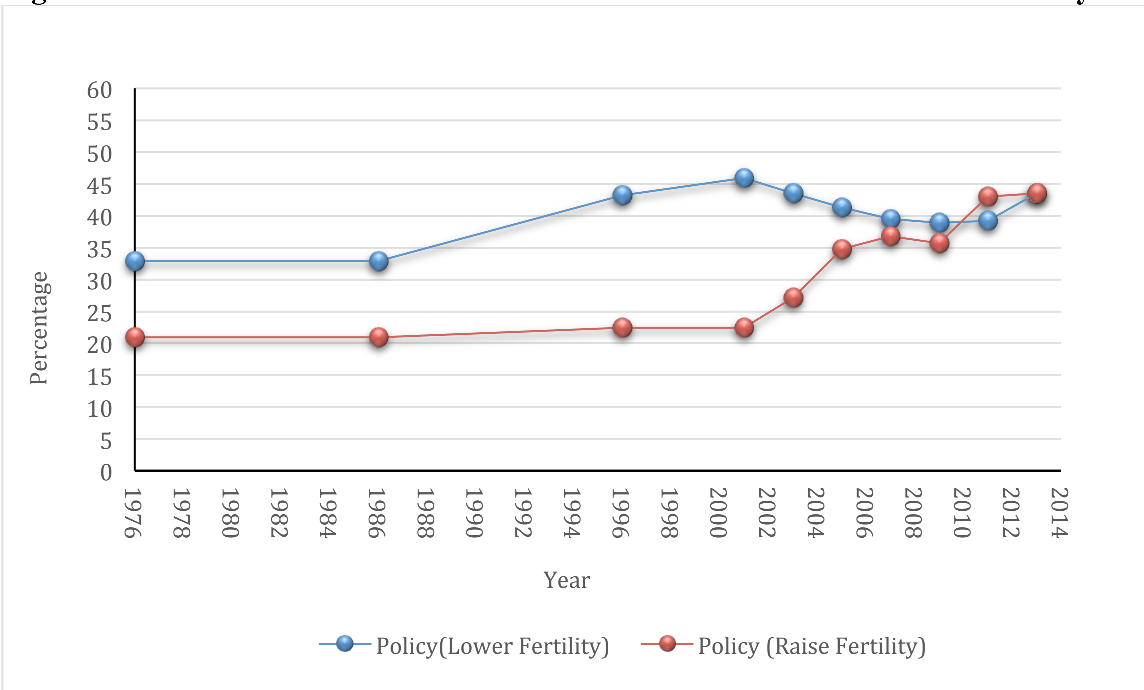
Figure 5: Government Policy on Fertility in 2013



Source: United Nations Population Policies Database, 2013.
Government Policy on Fertility in 2013:

- Missing data (89)
- Raise fertility (51)
- No intervention (22)
- Maintain fertility (27)
- Lower fertility (76)

Figure 6: Percent Share of Countries with Policies to Reduce and Raise Fertility



Source: United Nations Population Policies Database, 1976-2013.

Figure 7: Local Indicators of Spatial Association (LISA Map), Total Fertility Rate in 1976

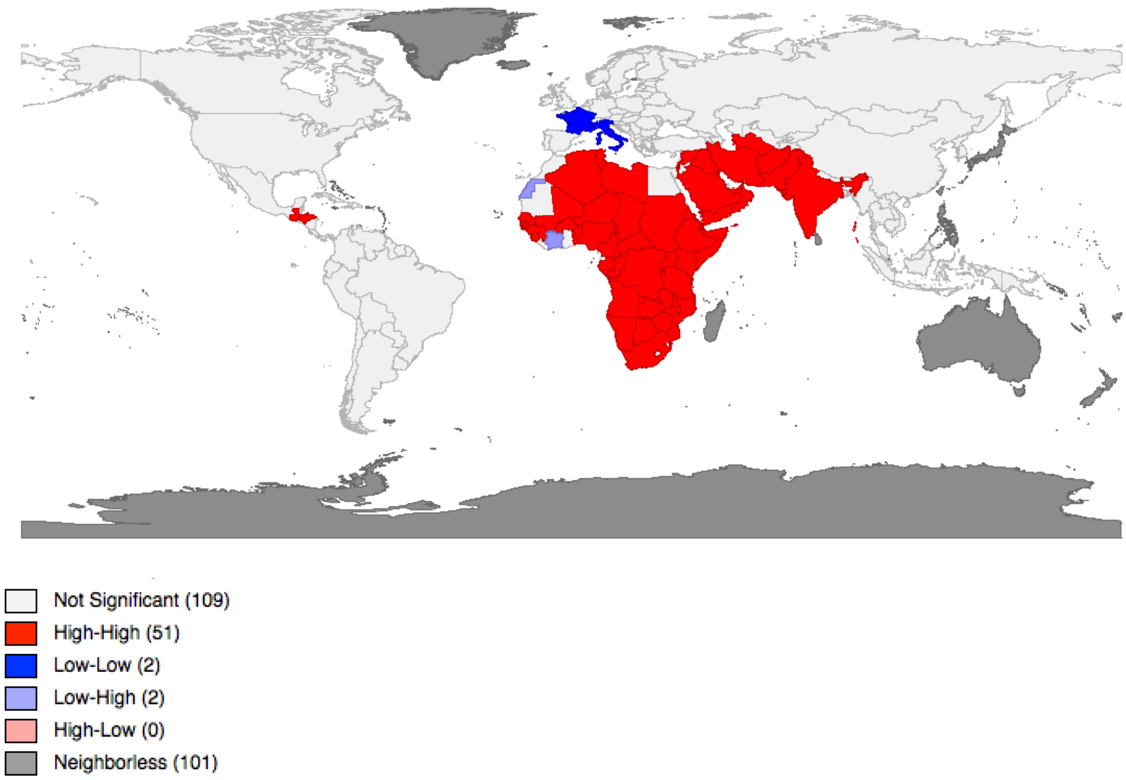


Figure 8: Local Indicators of Spatial Association (LISA Map), Total Fertility Rate in 2013

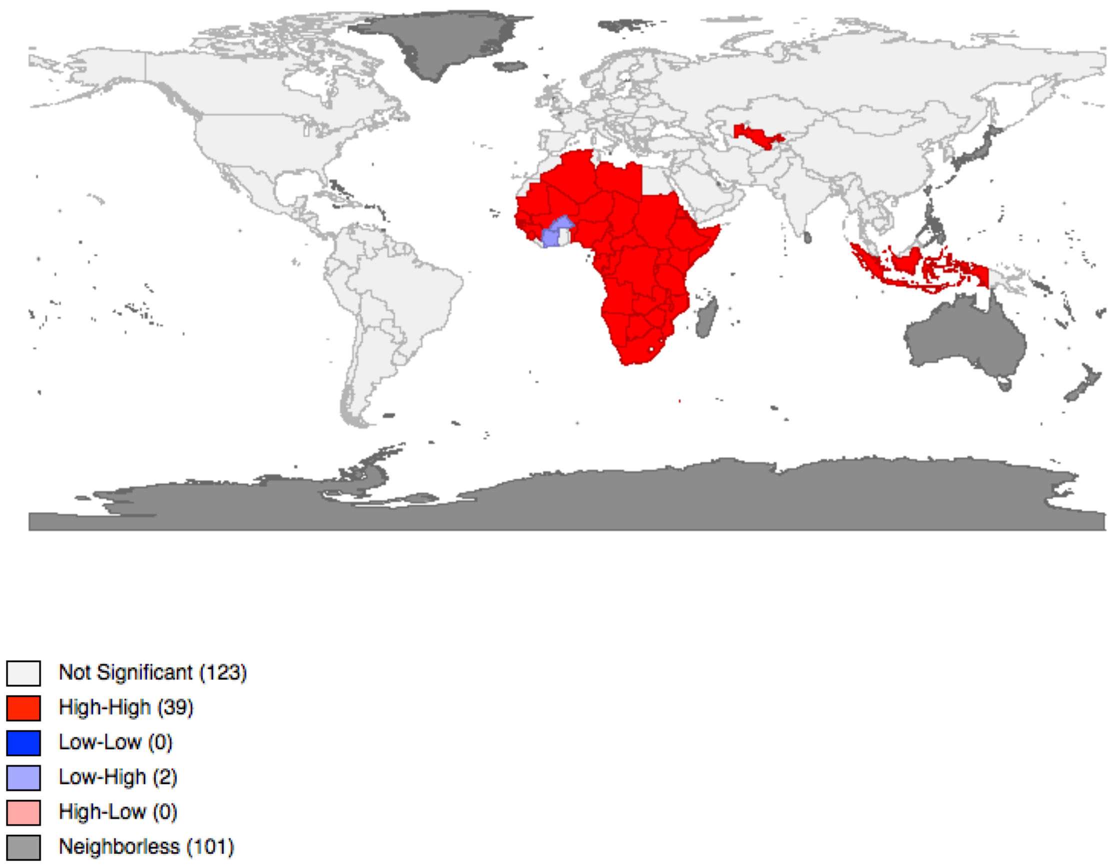


Figure 9: Moran Scatterplot for Total Fertility Rate

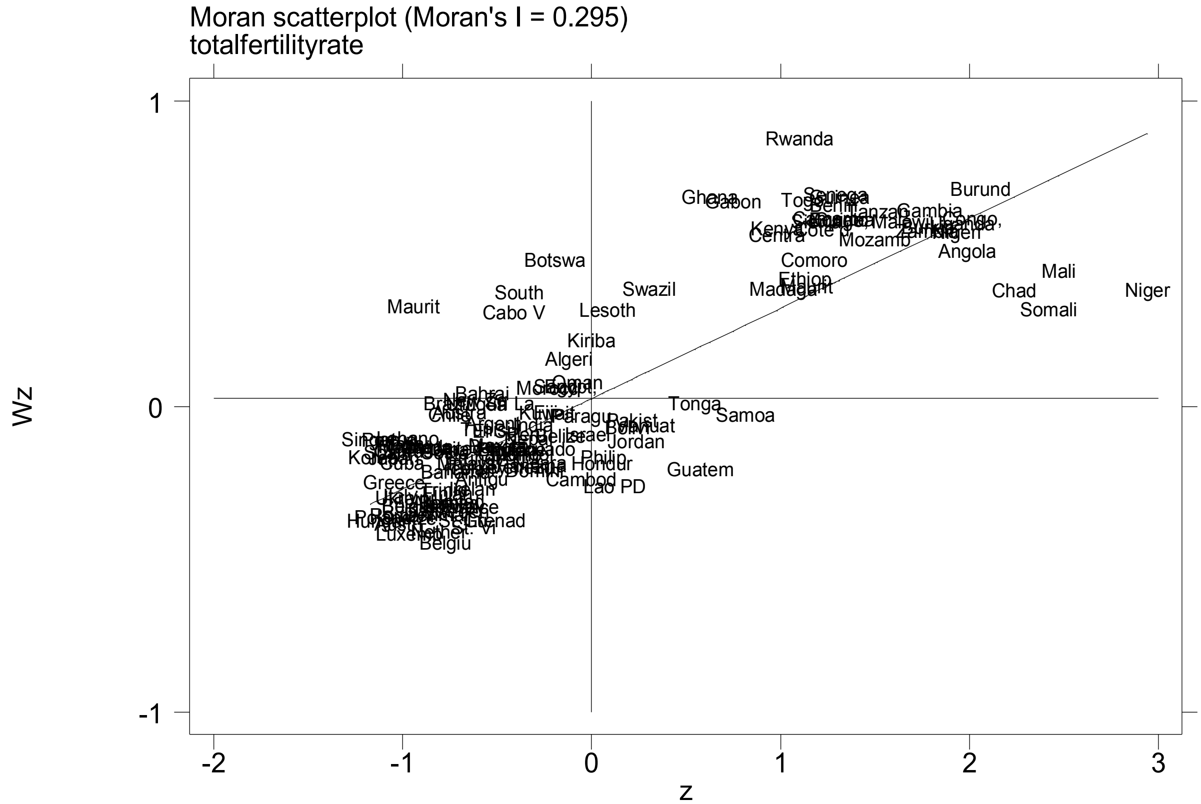


Table 1: Summary Statistics for MENA and Other Countries

	Number of observations	Mean	Standard deviation	Minimum	Maximum
MENA Countries:					
Total fertility rate	190	3.607095	1.627537	1.495	9.119
Anti-fertility policy	190	0.4947368	0.5012932	0	1
Pro-fertility policy	190	0.1210526	0.3270502	0	1
Government support for family planning	190	0.7578947	0.4294894	0	1
Other Countries:					
Total fertility rate	1,643	3.393374	1.839972	1.076	8.399
Anti-fertility policy	1,602	0.39201	0.4883513	0	1
Pro-fertility policy	1,602	0.1928839	0.3946859	0	1
Government support for family planning	1,602	0.928839	0.2571739	0	1

Table 2. Change in Total Fertility Rate and Government's Policy to Reduce Fertility

Dependent Variable:	(1)	(2)	(3)	(4)	(5)
Change in Total Fertility Rate	SAR	SAR	SAR	SEM	OLS
Variables:	Direct	Indirect	Total		
Government's policy	-0.0205***	-0.116*	-0.136*	-0.0183***	-0.0317***
(lower fertility)	(0.0067)	(0.0670)	(0.0709)	(0.0066)	(0.0081)
GDP per capita	3.52e-06***	1.95e-05**	2.30e-05**	3.55e-06**	8.03e-06***
	(0.000001)	(0.000010)	(0.000010)	(0.000002)	(0.000002)
Health spending	-1.28e-05***	-7.33e-05*	-8.61e-05**	-1.20e-05***	-8.17e-06**
per capita	(0.000004)	(0.000040)	(0.000042)	(0.000004)	(0.000004)
Trade to GDP	0.000259**	0.00146	0.00172	0.000265**	0.000255**
	(0.0001)	(0.0010)	(0.0011)	(0.0001)	(0.0001)
Share of urban	0.00323***	0.0176**	0.0209***	0.00324***	0.00725***
population	(0.0009)	(0.0076)	(0.0080)	(0.0010)	(0.0009)
Spatial parameter	25.00***				
(rho)	(1.1740)				
Spatial parameter				25.78***	
(lambda)					
Constant					-0.514***
					(0.0529)
Observations	798	798	798	798	798
Number of countries	133	133	133	133	133
Econometric model	SAR	SAR	SAR	SEM	FE
Country fixed effects	YES	YES	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3. Change in Total Fertility Rate and Government's Policy to Raise Fertility

Dependent Variable:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Change in Total Fertility Rate	**SAR**	**SAR**	**SAR**	**SEM**	**OLS**
Variables:	**Direct**	**Indirect**	**Total**		
Government's policy	-0.00077	-0.00598	-0.00675	-0.00384	0.00917
(raise fertility)	(0.0060)	(0.0383)	(0.0438)	(0.0057)	(0.0072)
GDP per capita	3.83e-06***	2.34e-05**	2.72e-05**	3.66e-06**	8.25e-06***
	(0.000001)	(0.000012)	(0.000013)	(0.000002)	(0.000002)
Health spending	-1.30e-05***	-8.25e-05*	-9.55e-05*	-1.19e-05***	-9.18e-06**
per capita	(0.000004)	(0.000048)	(0.000050)	(0.000004)	(0.000004)
Trade to GDP	0.000249**	0.00154	0.00179	0.000251**	0.000242*
	(0.0001)	(0.0011)	(0.0012)	(0.0001)	(0.0001)
Share of urban	0.00329***	0.0199**	0.0231**	0.00329***	0.00732***
population	(0.0009)	(0.0097)	(0.0101)	(0.0010)	(0.0010)
Spatial parameter	25.30***				
(rho)	(1.1290)				
Spatial parameter				25.92***	
(lambda)				(0.9920)	
Constant					-0.535***
					(0.0532)
Observations	798	798	798	798	798
Number of countries	133	133	133	133	133
Econometric model	SAR	SAR	SAR	SEM	FE
Country fixed effects	YES	YES	YES	YES	YES

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Change in Total Fertility Rate and Government's Policy to Support Family Planning

Dependent Variable: **Change in Total Fertility Rate** **Variables:**	**(1)** **SAR** **Direct**	**(2)** **SAR** **Indirect**	**(3)** **SAR** **Total**	**(4)** **SEM**	**(5)** **OLS**
Government's policy	0.00583	0.0437	0.0496	0.00523	0.00903
(family planning)	(0.0255)	(0.1960)	(0.2180)	(0.0241)	(0.0266)
GDP per capita	3.69e-06*	2.36E-05	2.73E-05	3.59E-06	8.49e-06***
	(0.000002)	(0.000019)	(0.000021)	(0.000003)	(0.000003)
Health spending	-1.27e-05**	-8.22E-05	-9.49E-05	-1.23e-05**	-8.30E-06
per capita	(0.000006)	(0.000063)	(0.000066)	(0.000006)	(0.000005)
Trade to GDP	0.000254*	0.00179	0.00204	0.000258**	0.000246*
	(0.0001)	(0.0021)	(0.0022)	(0.0001)	(0.0001)
Share of urban	0.00321**	0.0215	0.0247	0.00324*	0.00735***
population	(0.0015)	(0.0237)	(0.0245)	(0.0017)	(0.0014)
Spatial parameter	25.28***				
(rho)	(1.3270)				
Spatial parameter				25.88***	
(lambda)				(1.2090)	
Constant					-0.546***
					(0.0808)
Observations	798	798	798	798	798
Number of countries	133	133	133	133	133
Econometric model	SAR	SAR	SAR	SEM	FE
Country fixed effects	YES	YES	YES	YES	YES

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Change in Total Fertility Rate and Government's Policy to Reduce Fertility

VARIABLES	(1) SEM	(2) SAR	(3) OLS
Government's policy	-0.208***	-0.144**	-0.210***
(lower fertility)	(0.0666)	(0.0603)	(0.0609)
GDP per capita	1.80e-05***	1.49e-05***	1.79e-05**
	(4.39E-06)	(4.31E-06)	(6.97E-06)
Trade to GDP	6.79E-05	-0.00049	8.46E-05
	(0.000661)	(0.000612)	(0.000536)
Share of urban	-0.00300*	-0.000645	-0.00303*
population	(0.00163)	(0.0016)	(0.00181)
Constant	-0.406***	-0.625***	-0.394***
	(0.146)	(0.12)	(0.0805)
Spatial parameter	-0.0404		
(lambda)	(0.394)		
Spatial parameter		1.314***	
(rho)		(0.129)	
Observations	102	102	102
Wald chi2(4)	40.0463	31.5678	
Prob > chi2	0	0	
Econometric Model	SEM	SAR	OLS

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Change in Total Fertility Rate and Government's Policy to Raise Fertility

VARIABLES	(1) SEM	(2) SAR	(3) OLS
Government's policy	0.0176	-0.0338	0.0288
(raise fertility)	(0.0877)	(0.0777)	(0.0936)
GDP per capita	2.01e-05***	1.66e-05***	1.93e-05***
	(0.000005)	(0.000004)	(0.000007)
Trade to GDP	0.000128	-0.000449	0.00022
	(0.0007)	(0.0006)	(0.0006)
Share of urban	-0.00135	0.000492	-0.00144
population	(0.0016)	(0.0016)	(0.0019)
Constant	-0.630***	-0.779***	-0.563***
	(0.1350)	(0.1070)	(0.0708)
Spatial parameter	-0.245		
(lambda)	(0.4170)		
Spatial parameter		1.335***	
(rho)		(0.1090)	
Observations	102	102	102
Wald chi2(4)	27.6384	24.6198	
Prob > chi2	0	0.0001	
Econometric Model	SEM	SAR	OLS

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7. Change in Total Fertility Rate and Government's Policy to Support Family Planning

VARIABLES	(1) SEM	(2) SAR	(3) OLS
Government's policy	0.118	0.139*	0.116
(raise fertility)	(0.0927)	(0.0798)	(0.1240)
GDP per capita	2.07e-05***	1.61e-05***	2.00e-05***
	(0.000005)	(0.000005)	(0.000006)
Trade to GDP	0.000247	-8.04E-05	0.000366
	(0.0007)	(0.0006)	(0.0005)
Share of urban	-0.00136	0.000492	-0.00146
population	(0.0016)	(0.0016)	(0.0019)
Constant	-0.754***	-0.696***	-0.676***
	(0.1610)	(0.1120)	(0.1500)
Spatial parameter	-0.277		
(lambda)	(0.4050)		
Spatial parameter		2.453***	
(rho)		(0.3360)	
Observations	102	102	102
Wald chi2(4)	29.6418	19.8782	
Prob > chi2	0	0.0005	
Econometric Model	SEM	SAR	OLS

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8. Fertility Regressions using the Integrated Labor Market Panel Survey (ILMPS) database

VARIABLES	(1) Total fertility	(2) Total fertility	(3) Total fertility
Urban	-0.158***	-0.302***	-0.273***
(0 if rural; 1 if urban)	(0.0273)	(0.0550)	(0.0566)
Age	0.220***	0.142***	0.141***
	(0.0115)	(0.0387)	(0.0386)
Age squared	-0.00112***	-0.000835	-0.000793
	(0.000158)	(0.000509)	(0.000509)
Household size	0.392***	0.736***	0.734***
	(0.0113)	(0.0413)	(0.0413)
Marital status	0.113**	-0.162	-0.156
	(0.0455)	(0.112)	(0.111)
Education level	-0.213***	-0.126***	-0.106***
	(0.00983)	(0.0201)	(0.0218)
Labor force participation	-0.00568	-0.808**	-0.800**
(0 if not working; 1 if working)	(0.0326)	(0.359)	(0.359)
First child	0.182***	0.198***	0.198***
(1 if first child is female; 0 if male)	(0.0247)	(0.0489)	(0.0489)
Wealth index	-0.142***		-0.0693**
	(0.0188)		(0.0349)
Monthly wage income		3.87e-05	5.11e-05
		(4.46e-05)	(4.40e-05)
Constant	-5.384***	-3.469***	-3.566***
	(0.190)	(0.754)	(0.753)
Country dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	20,191	2,492	2,492
R-squared	0.614	0.704	0.705

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1