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Caglar Yurtseven,
Department of Economics,
Bahcesehir University,
Istanbul, Turkey,
E-mail: cayurtseven@yahoo.com

THE SOCIOECONOMIC DETERMINANTS OF FERTILITY RATES IN MUSLIM COUNTRIES: A DYNAMIC PANEL DATA ANALYSIS

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ABSTRACT. The study tries to understand the determinants of fertility in predominately Muslim countries. They have on average higher fertility rates than the western countries. A sample of 33 predominantly Muslim countries is chosen as the target of the study. The dynamic panel data estimation method employed demonstrates that, the socioeconomic conditions are the primary cause of the high fertility rates of the countries used in this study. The study reveals an inverse relationship between economic development and fertility rate. As these countries develop, fertility rates will decline. However, fertility decisions incorporate cultural components that will slow down the transition process.

JEL Classification: I19, I29, C23

Keywords: fertility; dynamic panel data; Muslim countries; socioeconomic determinants.

Introduction

Demographic research around the world focuses on declining rates of fertility, especially in the western world, and offers explanations for the currently trending phenomena. However, fertility rates among primarily Muslim nations, while frequently discussed in the media, are understudied with the tools of Econometrics. Even in European countries suffering from low fertility rates, Muslim minorities residing in European countries are believed to have higher fertility rates. This can affect the demographic structure of the European countries in the future. From scholarly books to social media, people express their fears about the possible demographic changes (Hanks, 2006). In 2013, according to Eurostat, the fertility rate across European Union countries was 1.58 whereas the fertility rate among the Muslim countries in this study was 3.12.

The fertility behavior in Muslim countries deserves to be studied in more detail from both economic and sociological perspectives. Becker (1960) was the first to address birth rates using economic reasoning. However, economic reasoning alone does not suffice for this study because some countries in the study have more favorable economic indicators than others, but their fertility rates are not significantly different from each other. Therefore, this study puts forward an econometric analysis of the fertility decisions in Muslim countries using a comparative approach that considers the economic and social background.

The subject is unique in the sense that in predominately Muslim countries civic life has many different aspects when compared to civic life in western countries. This leads researchers to believe that, in addition to the usual economic determinants, Muslim populations have a higher fertility rate due to cultural and societal differences with western countries.

Due to these differences, the fertility rates in Muslim countries emerges as a topic which deserves detailed examination. In fact, there are many studies which try to explain the striking fertility patterns in Muslim nations, but all of these studies use a similar method: they choose a specific region in a specific country where Muslim and non-Muslim populations live simultaneously and acquire samples from this region. For the first time, in the literature, this study will focus on groups of predominately Muslim countries from different parts of the world, such as Africa, the Middle East, Central, East and South Asia and East Europe, and apply the techniques that are prevalent in the literature to see if the conclusions that are drawn from western countries' data are applicable to Muslim countries as well. In particular, we use determinants that were previously used to understand fertility behavior to see if similar determinants explain fertility decisions in Muslim countries as well or if other variables are necessary to explain these decisions. Hence, this study contributes to the literature by employing comprehensive, dynamic econometric analysis of a panel data set at the country level for Muslim nations. By referring to the results of this study and the results of the previous studies that have targeted non-Muslim countries as the main data, researchers will acquire a comparative view to the fertility decisions of Muslim and non-Muslim nations.

The article will provide a general review of the fertility literature, putting special emphasis on Islamic countries. Economic, social and religious aspects of the topic will be covered in the review. Then it will introduce the variables and estimation technique and will give information about the data set. The dynamic model of this study, main variables of which are income, education, labor force participation, contraceptive prevalence, marriage and inequality will be estimated by the dynamic panel data estimation method. The method was originally created by Holtz-Eakin, Newey, & Rosen (1988) and later developed by Arellano & Bond (1991), Arellano & Bover (1995), and Blun dell & Bond (1998). Finally it will present the results of the estimation. In the results presented in this study, there is nothing that contradicts the results of the studies that examine non-Muslim and mainly western countries. This match is in fact the main conclusion of the study.

1. Literature Survey

The measure of fertility used in this paper is the total fertility rate which is an estimate of the number of children women have, given that they survive to the end of their reproductive years (Palmore and Gardner, 1983). In the literature there are many studies that explain the fertility decisions of humans. First, many studies use economic theories to explain the phenomena. Becker (1981) states that higher education levels and labor force participation rates of women lower fertility. Increases in education levels and labor force participation rates lead to higher foregone earnings, due to the work hours dedicated for childcare (Rindfuss *et al.*, 1996 and Jones *et al.*, 2011). Brewster and Rindfuss (2000) show the negative effect of women's employment on fertility using data from industrialized countries. In addition, in periods of economic uncertainty due to high unemployment or lower earnings fertility tends to decline. Adsera (2004), Orsal and Goldstein (2010), Shreffler and Johnson (2013), consistently show a negative association between unemployment and fertility rates: the higher the unemployment, the lower the quantum of fertility. Adsera (2010 and 2011) shows that as unemployment levels increase people to postpone first and second births. Jeffery and Jeffery (1997) and Weeks (1988) assert that different fertility rates among Hindus and Muslims in

India actually result from the differences in region, residence and schooling. They do not result from the differences in religious matters or autonomy of the women.

Cultural background is another important determinant of fertility (Micheli, 2000; Dalla Zuanna, 2001; Krapf and Wolf, 2015). However, it should be kept in mind that these studies assume that culture shapes institutional settings (Pfau-Effinger, 1999). For example, the patriarchal structure of the Muslim family is used to explain differences in the fertility patterns of Muslims. Even though there has been a decline in the role of men as the head of the family in the last twenty to thirty years due to an increase in the paid employment of women all around the world, the patriarchal family structure still persists in Muslim communities (Siraj, 2010). Siraj shows that in a sample of Muslim families in England, 92% of females recognize the husband as the family head and daughters are not expected to work full time after graduating from university. This obviously affects the fertility decisions in these communities. Siraj also highlights that the breadwinner status of men is considered both internal and intrinsic to the male identity. Espesito and DeLong-Bas (2001) and Ahmed-Ghosh, (2013) also identify the Muslim family structure to be patriarchal. Mir-Hosseini (2006), claims that Muslim women are shaped by patriarchal beliefs and that only the elite and the minority of highly educated women are unaffected by these. The patriarchal family structure can affect the fertility decisions and indeed can increase the birth rate (Morgan *et al.*, 2001). Patriarchal systems restrict women's outside options for social status and economic resources. This, in turn, leads women to look for status and economic resources through family and children. Mason and Taj (1987) state that bearing children strengthens a woman's position in the family and this high fertility brings respect, protection and claim on family resources.

Keeping in mind that cultural background is an important factor determining fertility, Ahmad (1985) studied fertility determinants, especially socioeconomic ones, using data from the World Fertility Survey program for four Muslim nations: Bangladesh, Java (Indonesia), Jordan and Pakistan. While our study seems to have a similar focus, it employs a different econometric technique, includes a wider set of countries, has an updated country level data set and uses the newest approaches to fertility research. In this respect this study is significantly different from Ahmad's research.

Campbell *et al.* (2013) assert that if women's mobility is restricted due to group norms and practices, women's exposure rate to new ideas and innovations, including contraceptives, decreases. In addition to this, opposition from husbands may decrease the use of contraceptives thereby increasing fertility in patriarchal settings. Muslim women's traditional primary role of wife and mother strengthens the position against contraceptive use (Espesito and DeLong-Bas, 2001). Resistance against contraceptive use is more likely to succeed if women cannot directly access the economic resources of the family.

Gender equality is also shown to be another indicator of fertility. For example, Miller, Short and Torr (2004) found a U-shaped relationship between the levels of fertility and gender equity. The probability of having a second child is high in families which have either very low or very high gender equality.

In the past few decades there has been a rising trend in cohabiting couples and this is associated with a later entry into the first marriage (Mills, 2004; Waggoner, 2015). Ogawa (2003) shows, using data of post-war Japan, those delays in the first marriage age cause declines in fertility. In addition, couples who cohabited during their reproductive years are less likely to have children then their married counterparts in general (Baizan *et al.*, 2003, 2004; Speder and Kapitany, 2009; Thoma *et al.*, 2013).

Another theory that is used to explain fertility patterns of Muslim nations involves religious doctrine. Shariah, Islamic law, is based on the Qur'an and the sayings of the prophet of Islam (Muhammed). Mir-Hosseini claims that, since it has divine roots, Shariah is a

powerful law among Islamic states. It gives great importance to marriages in the social life of Muslim people. The basic objectives of marriage in Islam are providing a comfortable life for the wife and the husband and bringing up healthy and faithful children (Behishti and Bahonar, 1982). Although this has never been interpreted as encouraging unrestricted childbearing, Islam praises families which bring up children.

There are many studies which compare fertility rates among Muslim and non-Muslim communities living in the same country or near one another. Dharmalingam and Morgan (2004), using the 1993 Indian family survey, show that Muslims in India are more likely to have the intention of having a second child when compared with the Hindu population coming from a similar socioeconomic background. They also report that of the people who state no intent to have children Muslims are less likely than Hindus to use contraceptives. Goldscheider (1999) reached a similar conclusion for the Muslim and Jewish populations in Israel. However, a study by Jeffery and Jeffery (2002) examines the fertility differences among Hindus and Muslims in India and claims that the difference is not primarily rooted in religion.

Hanks (2006) demonstrates that; in Muslim and non-Muslim communities in West Africa, despite the major differences of these groups, religion is not a major factor influencing fertility decisions. He shows that when Muslims are the minority residents, they tend to have higher fertility rates than non-Muslims, but when they constitute the majority in the area where they live, their fertility rates are actually lower than non-Muslims. McQuillan (2004) argues that religion has a direct effect on fertility only if the particular religion has strong fertility norms. Islam seems to lack those strong norms. There are also researchers, such as Johnson (1979) and Johnson and Nishida (1980), who connect higher fertility among Muslim communities in nations where they are the minority to the insecurities and constraints that the community faces. These may produce pronatalist and antinatalist fertility responses (Morgan *et al.*, 2002). However, this reasoning is outside the scope of this paper.

2. Methodology

To understand the dependent variable of our study, the behavior of the total fertility rate, we use several explanatory variables. Keeping with the literature cited above and noting the difficulty of finding data for the countries we examine in this study, we decided to include income per capita, education, labor force participation, unemployment, pre-primary school enrollment, college enrollment, contraceptive prevalence, gender inequality, first marriage age, and marriage rate as the determinants of fertility rate.[1] A summary of the variables used in the estimation (all in raw form) is presented in *Table 1* below.

Table 1. Variables

F	Total fertility rate (%)
inc	real GDP per person, purchasing power parity
edu*w*	Mean years of schooling among women
edu*m*	Mean years of schooling among men
laborw	Labor force participation rate among women (%)
laborm	Labor force participation rate among men (%)
unempw	Unemployment rate among women (%)
unempm	Unemployment rate among men (%)

[1] Due to the ambiguity in the results and difficulty of finding comparable religiosity data for the large set of countries examined, we do not include an explicit religiosity variable in our estimation.

prep	Pre-primary school enrollment rate (%)
collegew	Post high school (tertiary) education enrollment rate among women (%)
collegem	Post high school (tertiary) education enrollment rate among men (%)
contra	Contraceptive prevalence (0-100)
gii	UNDP gender inequality index (0-1, 1 represents perfect inequality)
firstage	First marriage age of women
marry	Marriage rate (%)

Source: own compilation.

The fertility literature frequently uses the Poisson regression to estimate fertility decisions of households (Wang and Famoye, 1999). However, these studies generally use survey data which have integer responses for the fertility variable. Hence, they assume fertility as a Poisson random variable with a mean μ, where the mean is a function of several explanatory variables.

Instead, this study uses the total fertility rate of 33 countries. Since it is the population's birth rate it can take any value ranging with the integer 0. In addition, all the explanatory variables are at the country level and compiled from country data. For this reason, the first method that can be used to estimate the following model is OLS estimation.

$$F_i = \alpha_{0i} + \alpha_1 inc_i + \alpha_2 edum_i + a_3 eduw_i + a_4 laborw_i + a_5 laborm_i + a_6 unempw_i + a_7 unempm_i + a_8 prep_i + a_9 collegew_i + a_{10} collegem_i + a_{11} contra_i + a_{12} gendere_i + a_{13} firstage_i + a_{14} marry_i + \varepsilon_i$$

However, when a household makes a fertility decision it is generally affected by the population it is located in. Hence we have to consider the previous years' effects on the fertility decisions of the current period. Therefore, a dynamic model is necessary to estimate the above equation.

Panel data has several advantages in estimating dynamic models. First of all, it is not possible to estimate dynamic models from observations at a single point in time and generally cross section surveys do not provide adequate information regarding previous time periods. Therefore, it is better than cross section data for our purpose. For our model, dynamic model panel data is superior to time series data as well because it is possible, for time series data, that microeconomic dynamics may be obscured by aggregation biases. In addition, panel data allows for investigating heterogeneity in adjustment dynamics between individuals which have different types (Bond, 2002). For these reasons and the availability, we employ panel data, and the model becomes:

$$F_{it} = \alpha_{0i} + \alpha_1 F_{i,t-n} + \alpha_2 inc_{i,t} + a_3 eduw_{i,t} + a_4 edum_{i,t} + a_5 laborw_{i,t} + a_6 laborm_{i,t} + a_7 unempw_{i,t} + a_8 unempm_{i,t} + a_9 prep_{i,t} + a_{10} collegew_{i,t} + a_{11} collegem_{i,t} + a_{12} contra_{i,t} + a_{13} gendere_{i,t} + a_{14} firstage_{i,t} + a_{15} marry_{i,t} + \varepsilon_{i,t}$$

Considering the fact that fertility decisions are made at least nine months prior to birth, lagged (one period) variables of all the explanatory variables are used in the estimation. To a certain extent this helps to cope with the possible endogeneity problem in the estimation that may arise from the dependency of current women's labor force participation and unemployment on current fertility as well. Even though lagged unemployment and labor force participation variables are used, since fertility decisions are heavily affected by cultural norms formed in the long term, the endogeneity problem may still affect the estimation. A possible

solution is the instrumental variables method, however we lack proper instruments. Considering this, to estimate this dynamic model, the dynamic panel data estimation method was chosen. It was created by Holtz-Eakin, Newey, & Rosen (1988) and later developed by Arellano & Bond (1991), Arellano & Bover (1995), and Blundell & Bond (1998). This method allows feedback from current or past shocks (Eigner and Kunst, 2009). In addition, the method removes country specific fixed effects. It does the removal by transforming regressors using difference generalized method of moments (GMM). Finally, with this method we are able to use lagged dependent variable to instrument with its past levels.

Roodman (2009) showed this method to be ideal for data sets, which have shorter time dimensions and a larger country dimension. Having such properties, this is the ideal method for our data set. A two-step system GMM estimator is used to run the estimation.

3. Data

Panel data for a set of 33 countries which have significant Muslim populations for the time period 2000-2013 is used. Countries and regions used in the estimation are listed in the table below.

Table 2. Countries used in the estimation and their regions

Country	Region	Country	Region	Country	Region	Country	Region	Country	Region
Afghanistan	1	Albania	2	Djibouti	4	Uganda	4	Kuwait	5
Azerbaijan	1	Bosnia and Herzegovina	2	Morocco	4	Libya	4	Syria	5
Kazakhstan	1	Macedonia, FYR	2	Gambia	4	Egypt	4	Saudi Arabia	5
Kyrgyz Republic	1	Turkey	2	Cameroon	4	United Arab Emirates	5	Jordan	5
Turkmenistan	1	Indonesia	3	Nigeria	4	Iraq	5	Yemen, Republic	5
Bangladesh	1	Malaysia	3	Somalia	4	Iran	5		
Pakistan	1	Algeria	4	Sudan	4	Qatar	5		
Region 1: Central and South Asia, Region 2: Europe, Region 3: East Asia, Region 4: Africa, Region 5: Middle East									

Source: own compilation.

Fertility, income, labor force participation and unemployment data are gathered from the World Bank Data Bank (http://data.worldbank.org/indicator, (referred on 16/03/2015)). For gender equality and mean years of schooling data UNDP Human Development Reports are used (http://hdr.undp.org/en/data, (referred on 18/03/2015)). Finally, the United Nations Data Bank is employed for pre-primary school enrollment rate, post high school (tertiary) education enrollment rate, contraceptive prevalence and first marriage age of women (http://data.un.org/Default.aspx, (referred on 19/03/2015)).[2] Summary statistics for the variables and fertility data for the representative years 2003, 2008 and 2013 are given in *Tables 5* and *6* in the *Appendix*.

The gender equation index is calculated by the UNDP based on three criteria: reproductive health (in terms of maternal mortality rate and adolescent birth rate) empowerment (in terms of proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years or older with at least some secondary

[2] Complementary projections are used if the sources do not provide regular data.

education) and economic status (in terms of labor market participation and measured by labor force participation rate of female and male populations aged 15 years or older). Since the UNDP uses labor force participation and education data for the calculation of this index, we suspect a significant correlation between these variables. The index has a correlation of 0.49 with the variable "labor force participation of women", 0.12 with the variable "labor force participation of men", 0.57 with the variable "mean years of schooling among women" and 0.47 with the variable "mean years of schooling among men." In addition, when the collinearity tests are applied eduw, edum, laborw and laborm have VIF scores of 17.67, 14.47, 14.08, 11.02 respectively (Other variables have VIF scores, which are, less than 10, hence no collinearity suspicion). These are not expected to create a significant problem in terms of estimation. Nevertheless, the estimation results excluding labor force participation and mean years of schooling are presented in the Results section as well.

As mentioned before, contraceptive prevalence data is taken from the United Nations Data Bank. Contraceptive prevalence is the ratio of the number of women who are currently using, or whose sexual partner is currently using, at least one method of contraception to the total number of women of reproductive age. The UNDP calculates this data by using the nationally representative household surveys of different countries which have questions on current contraceptive use. (A full list of the surveys used is available at: http://data.un.org/DocumentData.aspx?id=356, (referred on 19/03/2015).

4. Results

Table 3. Estimation Results

	(I)	(II)	(III)
F (L1)	.69580294*** (.31290478)	.6326959*** (.19727431)	.62644232*** (.18574072)
F (L2)	.36208574* (.16484626)	.44603064** (.19613998)	.31290478* (.17098658)
inc	-.00001413* (.000006269)	-.0000154207 (.000044347)	-.00001338* (.000006903)
eduw	-.03426707 (.04293209)	-.0229126 (.02016252)	
edum	-0.00739579 (.04236258)	-.0125167 .(01223703)	
laborw	-.00921613* (.00409465)	-.0094844 (.0086256)	
laborm	-.00050918 (.00761615)	-.00046393 (.00135707)	
unempw	.01305502 (.00808048)	.00832459 (.0098687)	.006914*** (.00098525)
unempm	-.004063964* (.001975347)	-.00485114 (0153357)	-0.00403493 (.000305427)
prep	.00035736 (.0031688)	.00073701* (.00037207)	0.0004906 (.00102916)
collegew	-.001220964 (.00429977)	-.00174807* (.00086049)	- .0015987*** (.00043514)
collegem	-0.00100714 -0.0010017	-.00085302*** -(.00007765)	-.00084060** -.00030586
contra	-.00339476* (.00149976)	-.00301651** (.00128268)	-.0031864** (.00140458)

gi	.01403637* (.00613647)		.0199735 (.01354627)
firstage	-.00447328 (.0469126)	-.00426621 (.00300214)	-.00441512 (.00773672)
marry	.00184728 (.01083263)	.00440407 (.00293886)	.00157709* (.00070744)
time	-.0227837* (.0102344)	-.0400576 (.0451741)	-.01059811** (.00388935)
N	495	495	495
AR(1)	-1.8757365***	-2.087560***	-1.9317587***
AR(2)	-.0014076644	-.002382991	-.0014721663
Hansen	19.804	18.109	24.048

Source: own calculation.

The above results reveal the importance of past realizations of fertility, income, college enrollment rate, contraceptive usage and time trend as the determinants of fertility among Muslim nations. The signs of the variables are as expected and in line with the theory. Before looking at the results of each independent variable employed, the results of the test for serial autocorrelation of residuals AR(1) and AR(2) must be noted. This confirms that moment conditions are valid. The difference of the residuals is characterized by a negative first-order serial correlation and no second-order serial correlation, hence $\varepsilon_{i,t}$ is not serially correlated. Hansen statistics show that the over identifying moment conditions are valid. This brings consistent estimates. The model is estimated in three distinct forms. The first estimation includes all the variables. The second estimation excludes the gender inequality variable due to its calculation method expressed in the data section which considers education, and labor force participation that we include as independent variables as well. The third estimation excludes education and labor force participation variables due to the collinearity suspicion mentioned before. The third estimation seems to provide the highest number of significant estimates. Time and region dummies are used in each form.

First, past realizations of fertility seems to be a very important determinant of current fertility. It is not surprising in the sense that humans are social beings and they are affected by the norms of the society they live in. It is not very easy to suddenly change the norms of a society, including the fertility norms. These norms can be affected from factors such as traditions, religiosity etc. However, the magnitudes of the effects of these factors on norms are out of the scope of this paper. A one-unit increase in the past realization of fertility increases current fertility around 0.6 units. It loses its significance as time passes.

Income is an important fertility determinant as well. Richer countries tend to have lower fertility rates. A one dollar increase in purchasing power causes a .000014 unit decrease in fertility. Following the literature, we estimated our fertility equation with "change in income" as an indicator of economic certainty as well, the results of which are presented in the Appendix. Higher growth rates bring higher fertility rates as expected.

Education (except the third estimation) has the expected negative sign. However, it does not seem to affect fertility in a significant manner. It may be because the average education level in the countries we study is very low and around 6 years. Incremental changes around this low level may not have a significant effect on fertility decisions. Even though it is not significant, women's education level has a bigger impact on the fertility rate than men's.

Labor force participation rates (except the third estimation), in line with the theory, have negative signs. In particular, the women's labor force participation rate emerges as a significant determinant of fertility. A one percentage point increase in the women's labor force participation rate decreases fertility by around .0092 unit. Women who participate in the

labor force have to sacrifice more in terms of foregone wages for child care (assuming women are the basic childcare providers in the countries we study). Hence, women's labor force participation rate has an inverse relationship with fertility rate.

Unemployment rate is an important fertility determinant as well. Interestingly, female unemployment has a positive impact on fertility, while male unemployment has a negative impact. Perhaps this is due to the fact that male unemployment leads to economic uncertainty and makes people less interested in having children, while female unemployment lowers the opportunity cost of raising a child resulting in a greater desire for children.

A one percentage point increase in pre-primary school enrollment increases the fertility rate of a country on average by .00073701 units. This is in line with the expectations of the theory that pre-primary schools help employed mothers by providing childcare, which increases their propensity to give birth.

College education (post high school) emerges as a very important determinant of fertility rate of a country. Not surprisingly, women's college enrollment rates affect fertility more than men's college enrollment rates for the countries we study. We should note that while average education level does not seem to be a significant determinant of fertility, college enrollment significantly affects the fertility decisions of people.

Contraceptive prevalence emerges from our all estimations as an important determinant of fertility. Intuitively, one expects a strong relation between contraceptive usage and fertility. All the estimations strengthen this expectation with the significant negative signs. A one percentage point increase in contraceptive usage lowers fertility around .003 units.

Gender inequality (except the second estimation) increases the fertility rate in the countries in this study. This is because when there is clear gender inequality in a country, as discussed in the literature review, raising a child becomes the primary responsibility of women. This guarantees the status of women in the family as well.

First marriage age and marriage rate have the expected negative and positive signs respectively even if they seem to be insignificant. If people marry later or do not marry at all the likelihood of having a child decreases. The majority of the countries have a young marriage age and high marriage ratio when compared to western countries. These two factors, even though they seem to be insignificant, may be playing a role in the higher fertility rate of Muslim countries around the world. Finally, the trend variable is significant with a negative sign meaning that people's tendency to give birth decreases as years pass.[3]

Conclusion

With the dynamic panel data estimation method used in this paper for a set of 33 Muslim countries, past realizations of fertility, income, college enrolment rate, contraceptive usage and time trend are found to be the significant determinants of fertility. In addition, even though they are not significant, education level, labor force participation rate, unemployment rate, pre-primary school enrolment rate, gender inequality, first marriage age and marriage rate have signs in line with the theory.

These findings are in line with the results of the studies that examine non-Muslim and mainly western countries. All the signs of the determinants are in line with the theory. However, in general, countries in this study have higher gender inequality, unemployment

[3] Among the region dummies, Africa and Europe are slightly significant with positive and negative signs respectively. Even though they are barely significant, this is another result that can be used to show that norms that dominate the nation may be affecting the fertility decisions more than any other reason. The countries of our analysis which are closer to West Europe have lower fertility rates then the countries studied n Africa or the Middle East even if they have predominately Muslim populations.

rates, marriage rates and lower education levels, college enrolment and first marriage ages all of which lead to higher fertility rates. Changes in these socioeconomic variables, which are already changing in the countries studied because of economic development, will unavoidably cause a decline in fertility rates in the coming years.

However, it should be noted that fertility decisions have a strong cultural aspect. This can be understood from the coefficients of past realizations of fertility in determining current fertility. The coefficient of past realization of fertility is as high as 0.6, where the coefficient of gender inequality is only around 0.15. Hence most of the variability in fertility is actually captured by the norms of the country about fertility. It should also be noted that norms of a country takes years to form. Hence, even with the improving socioeconomic conditions of the countries studied, the convergence of the fertility rates of the countries in our panel with that of western countries may not be very fast. Future research should further investigate the rates of change of fertility among different countries.

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Appendix

Table 4. Estimation results with income growth

	(IV)
F (L1)	.71555***
	(.1581006)
F (L2)	.2969609*
	(.1617359)
incg	.00032194**
	(.000013468)
eduw	-.050302
	(.0673838)
edum	-.00711037
	(.00756436)
laborw	-.0079892**
	(.0027916)
laborm	-.00088954
	(.00093817)
unempw	.0190007
	(.0107594)
unempm	-.0043102**
	(.00187144)
prep	.0003171
	(.0008752)
collegew	-.0173629
	(.2354848)
collegem	-.0104716
	(.0082816)
contra	-.0042444**
	(.0017133)
gi	-.0121583
	(.0105886)
firstage	-.00422721
	(.01009031)
marry	.0017253
	(.0079554)
time	-.0187476**
	(.0067197)
N	495
Hansen	29.112
AR(1)	-1.892346***
AR(2)	-.0014194647

Table 5. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
F	495	3.46373	1.621511	1.199	7.809
inc	459	17315.26	27698.2	1041.56	133734
eduw	423	5.545727	2.818553	0.384	10.5
edum	429	6.850602	2.136027	1.7	11.2
laborw	495	37.68162	18.1377	11	80.8
laborm	495	75.5297	7.636368	56.3	95.6

unempw	480	14.79312	10.26577	0.6	55.8
unempm	480	9.076042	6.904876	0.1	37
prep	380	31.79474	24.55181	1	93
collegew	342	19.60111	14.36997	1	67
collegem	361	21.80994	17.33241	1	68
contra	444	42.19888	20.27568	4.048	84.96
gi	162	3.266667	0.938877	1.5	8
firstage	448	23.80358	2.604556	18	32
marry	360	95.26861	2.645518	88.2	99.5

Table 6. Raw fertility data for selected years

Country	Region	2003	2008	2013
Afghanistan	1	7.321	6.196	4.9
Azerbaijan	1	1.9	1.9	2
Kazakhstan	1	2.03	2.7	2.64
Kyrgyz Republic	1	2.5	2.8	3.2
Turkmenistan	1	2.701	2.482	2.326
Bangladesh	1	2.802	2.377	2.177
Pakistan	1	3.986	3.581	3.185
Albania	2	2.097	1.761	1.771
Bosnia and Herzegovina	2	1.236	1.218	1.283
Macedonia, FYR	2	1.567	1.473	1.431
Turkey	2	2.311	2.147	2.041
Indonesia	3	2.479	2.479	2.338
Malaysia	3	2.418	2.052	1.964
Algeria	4	2.412	2.725	2.795
Djibouti	4	4.16	3.755	3.387
Morocco	4	2.47	2.443	2.735
Gambia	4	5.845	5.798	5.751
Cameroon	4	5.464	5.167	4.78
Nigeria	4	6.042	6.017	5.976
Somalia	4	7.429	7.056	6.563
Sudan	4	5.206	4.792	4.42
Uganda	4	6.716	6.338	5.867
Libya	4	2.882	2.637	2.356
Egypt, Arab Rep.	4	3.134	2.954	2.77
United Arab Emirates	5	2.329	1.948	1.801
Iraq	5	4.713	4.343	4.026
Iran, Islamic Rep.	5	1.934	1.88	1.92
Qatar	5	2.853	2.203	2.019
Kuwait	5	2.66	2.681	2.6
Syrian Arab Republic	5	3.61	3.173	2.964
Saudi Arabia	5	3.482	2.971	2.644
Jordan	5	3.832	3.586	3.244
Yemen, Rep.	5	5.782	4.829	4.075

Source: World Bank Data Bank (http://data.worldbank.org/indicator (referred on 16/03/2015).