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A Note on the Effect of Religiosity on Fertility

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Abstract
Very few studies have examined the effect of religiosity on fertility at the macro level. This note extends these studies by using a larger data set and more advanced econometric techniques. In addition, this note estimates the macro-level effect of religiosity on fertility both for a total sample of 25 Christian countries between 1925 and 2000 and for three subsamples: Catholic, Protestant, and mixed Catholic-Protestant countries. Results show that religiosity, in general, has a positive long-run effect on fertility. However, this effect is not significant for Catholic countries.

Keywords Fertility · Religiosity · Macro-level · Panel data · Panel cointegration

Introduction

In a widely cited book, Norris and Inglehart (2004:23) argued that "one of the most central injunctions of virtually all traditional religions is to strengthen the family, to encourage people to have children, to encourage women to stay home and raise children, and to forbid abortion, divorce, or anything that interferes with high rates of reproduction." Religiosity may therefore have a positive effect on fertility, provided that religious norms influence the fertility behavior of believers.

An important point in this context is that individuals often imitate the fertility patterns of their peers, such as coworkers, neighbors, friends, and relatives (see, e.g., Feyrer et al. 2008). An implication of this is that an increase (decline) in religiosity can substantially increase (decrease) both the number of children of religious parents and

[1]The existence of such peer effects implies that nonreligious people in more religious societies may have more children than nonreligious people in less religious societies, whereas religious people in less religious societies may have fewer children than religious people in more religious societies.

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the number of children of secular parents.[1] Thus, a change in religiosity that has a modest positive effect on fertility at the individual level can have a large positive effect at the macro level because of peer influences.

However, arguments also suggest that the macro-level effect of religiosity on fertility may be small or even negative—even if, as indicated by micro-level evidence (e.g., Frejka and Westoff 2008; Hayford and Morgan 2008), religious individuals have more children than nonreligious individuals. For example, in their minority group status hypothesis, Goldscheider and Uhlenberg (1969) postulated that because minority groups often face barriers to full social and economic integration into the dominant society, minority group individuals reduce their fertility in order to overcome these barriers, provided that the minority group seeks both acculturation and social and economic mobility and that the minority group has no strong pronatalist ideology. If, in contrast, acculturation is not desired and the minority group has a strong pronatalist ideology, minority status may encourage higher fertility to ensure group preservation. By implication, then, if the majority of the population is religious, declining religiosity may exert a positive effect on the fertility of the nonreligious minority group because the perceived level of discrimination of the minority group decreases when the relative size of the minority group increases. In contrast, if the minority of the population is religious, a decline in religiosity may have a positive effect on the fertility of the religious minority. Thus, a decline in religiosity may have direct negative effect on fertility by increasing the proportion of nonreligious individuals (whose fertility is low relative to religious individuals) as well as an indirect positive effect on fertility by increasing the fertility of the minority group. Depending on which effect dominates, total fertility may increase or decrease as a result of a decline in religiosity.

In addition, nonreligious people theoretically may choose to have fewer children in response to a fertility increase among religious people if they fear that the children of religious families compete with their children for access to scarce resources (such as childcare and schools) or if an increase in the number of children of religious people leads to a general increase in the cost of having children.

Another important point is that Catholics tend to have higher fertility than Protestants (e.g., McGregor and McKee 2016; Mosher and Hendershot 1984).[2] It therefore seems likely that religiosity affects fertility more in Catholic countries than in Protestant or mixed Catholic-Protestant countries. However, it could also be that the macro-level effect of religiosity on fertility is weaker in Catholic countries. The rationale is as follows.

Given that Catholics tend to be more pronatalist than Protestants, it can be assumed that Catholics are less likely to imitate their nonreligious peers in choosing their number of children than Protestants. Thus, in Protestant countries and (to a lesser extent) mixed Catholic-Protestant countries, where religiosity is relatively low, an increase in the proportion of nonreligious people may lead to peer effects that further reduce fertility among both nonreligious and religious individuals. In contrast, in Catholic countries, where the population share of religious individuals is relatively high, religious individuals may not reduce their fertility in response to the increasing proportion of nonreligious people, whereas many nonreligious people may still use their religious

[1] The existence of such peer effects implies that nonreligious people in more religious societies may have more children than nonreligious people in less religious societies, whereas religious people in less religious societies may have fewer children than religious people in more religious societies.

[2] The most plausible explanation for this is that the doctrine of the Catholic Church is pronatalist, whereas in Protestant religions, fertility is generally considered a matter of individual choice (e.g., Lehrer 1996).

peers as a cue to decide how many children to have. In Catholic countries, therefore, it is even quite possible that the proportion of nonreligious people with lower fertility preferences is too small to produce a significant fertility effect at the macro level.

Surprisingly, only two studies have investigated the effect of religiosity on fertility at the macro level. Norris and Inglehart (2004) used cross-sectional data for 73 countries to regress the total fertility rate in 2000 on a measure of the importance of religion between 1981 and 2001. They found a significant positive association between religiosity and fertility. However, this association might also reflect a causal effect of fertility on religiosity, given that having children may change people's attitudes toward religion and/or given that parents may attend church with their children because they believe it is useful for them to meet other children. Also possible is that the observed cross-country correlation between fertility and religiosity is due to unobserved variables, such as geography, culture, and history.

Berman et al. (2018) used panel data for 14 Christian countries at five-year intervals between 1960 and 1990 (and between 1940 and 1990) to estimate first-differenced regressions of the total fertility rate on the current church attendance rate of parents and first-differenced regressions of the total fertility rate on the lagged church attendance rate of parents. They found no significant association between church attendance and fertility. However, an interaction term between church attendance and the share of Catholics in the population was significantly positively related to fertility, suggesting that lower religiosity predicts lower fertility only among Catholics; however, the significance of the interaction term disappeared when nuns per capita were included in the regressions. Based on these findings, Berman et al. (2018:182) concluded that "declining social service provision by the Catholic church since the Second Vatican Council induced substantial decline in fertility among European Catholics. Declining religiosity as measured by rates of church attendance does not predict fertility decline." However, first-differenced models can produce misleading results if there is a long-run relationship between the levels of the variables of interest (e.g., Engle and Granger 1987). Another limitation of this study as well as that of Norris and Inglehart (2004) is the relatively small number of observations (between 73 and 104).

This note differs from these previous works in three ways. First, I use a macro-panel data set of up to 25 Christian countries for the period 1925–2000 with up to 377 observations, which provides more observations than in the aforementioned studies. Second, I not only estimate the average or pooled effect of religiosity on fertility for our total sample but also provide separate estimates for Catholic, Protestant, and mixed Catholic-Protestant countries. Third, I analyze the religiosity-fertility nexus using more advanced econometric methods.

Empirical Analysis

Model and Data

The baseline model is

$$FERT_{it} = \beta REL_{it} + \mu_i + \lambda_t + \varepsilon_{it}, \quad (1)$$

where $FERT_{it}$ is fertility, measured by the crude birth rate; REL_{it} stands for religiosity, measured by church attendance; β denotes the effect of an increase in religiosity on fertility; and μ_i represents fixed effects that control for time-invariant country characteristics (such as geography) and initial conditions (such as history and culture). I also control for time-varying common factors (such as global technological progress and global crises), λ_t, that can induce cross-sectional error dependence and lead to inconsistent estimates if they are correlated with both $FERT_{it}$ and REL_{it}.

The data on the crude birth rate come from Mitchell's (2007) International Historical Statistics. The data on church attendance are from Iannaccone (2003), who reported weekly church attendance rates for children and their parents at five-year intervals between 1925 and 1990 for 32 countries. Here, I use the childhood rate of church attendance, primarily because childhood church attendance may allow me to better capture the religiosity of individuals who do not already have children. These data were updated to 2000 for the purpose of this study using information from the most recent (2008) International Social Survey Programme (ISSP Research Group 2018).

The sample is an unbalanced panel covering 25 Christian countries at five-year intervals between 1925 and 2000. The countries with summary statistics are listed in Table S1 in the online appendix, which contains a detailed description of the data.

Long-Run Relationship

Results of panel unit root and cointegration tests, which are reported in the online appendix, suggest that the variables are nonstationary and cointegrated. When variables are cointegrated, the conventional fixed-effects (FE) estimator suffers from a second-order asymptotic bias arising from serial correlation and endogeneity, and its t statistic is not asymptotically standard normal.[3] In order to draw inference, I use Kao and Chiang's (2000) panel dynamic ordinary least squares (DOLS) estimator, whose t statistic is asymptotically standard normal even when the regressors are not exogenous.[4]

To account for potential error cross-sectional dependence, I de-mean the data by subtracting the average value of $x_t = \left(\sum_{i=1}^{N} x_{it}\right)/N$ from each x_{it} in each period t, $x_{it} - \left(\sum_{i=1}^{N} x_{it}\right)/N$, and use the de-meaned data in place of the original data (which is equivalent to using the residuals from regressions of each variable on the time dummy variables).

However, this procedure does not necessarily eliminate the cross-sectional error correlation problem when countries respond differently to common shocks. Therefore, I test whether the residuals are cross-sectionally correlated using the cross-sectional dependence (CD) test developed in Pesaran (2004).

The DOLS point estimate of β is reported in Table 1, along with the CD test. For comparison, I also present the results of a FE model with country and time dummy variables. In this model, the estimated coefficient on the religiosity variable is not statistically significant. However, the FE estimator does not provide valid inference in

[3] In the absence of panel cointegration, conventional panel regressions involving nonstationary variables are spurious, often producing statistics that suggest significant relationships, when in fact none exist (e.g., Kao 1999).

[4] The panel DOLS estimator corrects for endogeneity and serial correlation by including lead, lag, and current values of the differenced regressors in the regression.

Table 1 Fixed-effects (FE) and pooled dynamic ordinary least squares (DOLS) estimates

	FE	DOLS
REL_{it}	0.058	0.070**
	(1.46)	(2.93)
Predicted Effect of REL_{it} on $FERT_{it}$	16.47	19.88
Cross-Sectional Dependence (p value)	.061†	.538
Number of Observations	377	331

Notes: The dependent variable is $FERT_{it}$. Kao and Chiang's (2000) DOLS estimator is used. All regressions include country fixed effects. Time dummy variables are included in the FE regression to account for cross-sectional dependence. The DOLS regression is performed using de-meaned data to account for cross-sectional dependence. The number of leads and lags in the DOLS regression is determined by the Schwarz criterion, with a maximum of one lead and one lag. Pesaran's (2004) cross-sectional dependence test (adjusted for unbalanced panel data) is used; the null hypothesis is cross-sectional independence. t statistics are shown in parentheses; the t statistic for the FE model is based on a heteroskedasticity-consistent standard error; the DOLS t statistic is based on a heteroskedasticity- and autocorrelation-consistent standard error.

†$p < .10$; **$p < .01$

the case of nonstationary variables. Moreover, the CD test indicates the presence of cross-sectional dependence in the FE residuals.

In contrast, the DOLS results do not suffer from error cross-sectional dependence, and the estimated coefficient on REL_{it} is highly significant. More specifically, the point estimate implies that in the long run, a 1 percentage point decrease in the church attendance rate results in a reduction in the birth rate by 0.070 births per 1,000 population.

To get an idea of the magnitude of this effect, I also present the predicted effect of REL_{it} on $FERT_{it}$, computed by multiplying the DOLS coefficient on REL_{it} by the average value of REL_{it} in the sample and expressing it as a proportion of the mean of the birth rate. According to the predicted effect, the reduction in the church attendance rate between 1925 and 2000 is estimated to have reduced the crude birth rate by about 19.88 %, on average, in this sample. Thus, the estimated fertility effect is large but not implausible given the long period considered.[5]

Causality

The existence of cointegration implies long-run Granger causality in at least one direction but says nothing about the direction of this causality. To test the direction of long-run causality, I follow common practice and employ a two-step procedure. In the first step, the DOLS estimate of the coefficient β is used to construct an error-correction term. In the second step, this term (lagged one period) is used to estimate error-correction equations for $\Delta FERT_{it}$ and ΔREL_{it}. If the coefficient of the error-correction term in the $\Delta FERT_{it}$ equation (α_1) is nonzero and the coefficient of the error-correction term in the ΔREL_{it} equation (α_2) is zero, then long-run causality runs from

[5] Alternatively, the magnitude of the estimated effect can be evaluated by multiplying the DOLS coefficient on REL_{it} by the average change in the church attendance rate and dividing it by the average change in the birth rate. The resulting value is 0.222, implying that declining religiosity has been responsible for about 22.2 % of the fertility decline between 1925 and 2000.

Table 2 Long-run causality tests

	$\Delta FERT_{it}$ Equation	ΔREL_{it} Equation
Coefficient of the Error-Correction Term, α_1	–0.508**	
	(–11.37)	
Coefficient of the Error-Correction Term, α_2		–0.097
		(–0.86)
Number of Observations	327	327

Notes: The results are based on de-meaned data to account for cross-sectional dependence. Numbers in parentheses are heteroskedasticity- and autocorrelation-consistent *t* statistics.

$^{**}p < .01$

REL_{it} to $FERT_{it}$. If α_2 is nonzero and α_1 is zero, then long-run causality runs from $FERT_{it}$ to REL_{it}. If both α_1 and α_2 are nonzero, then long-run causality is bidirectional. Table 2 presents the results of the causality tests, which suggest that long-run causality is unidirectional from church attendance to fertility.

To calculate the time it takes for the fertility rate to reach its new long-run level after a change in the church attendance rate, I use the error-correction coefficient from the fertility equation. The half-life of a shock to $FERT_{it}$ is approximatively $-\ln(2) / \ln(1+\alpha_1)$. Thus, it takes about 0.977 five-year periods, or 4.886 years, for 50 % of the full effect to be realized and about 24.431 years for 97 % of the full effect to be realized.

Heterogeneity

The sample is reasonably representative of the Christian world, as discussed in more detail in the online appendix. Thus, the results for the total sample provide a reasonable indication of the general effect of religiosity on fertility in Christian countries.[6] Nevertheless, as discussed in the Introduction, this effect may differ between Catholic, Protestant, and mixed Catholic-Protestant countries. Table 3 presents results for these groups.[7] For completeness, I also report results for the remaining group of non-Catholic, non-Protestant Christian countries.[8]

[6] The online appendix presents a sensitivity analysis demonstrating that the positive (average) religiosity-fertility coefficient is robust to the use of alternative estimation techniques, the inclusion of additional variables, the use of an alternative measure of fertility, and to splitting the sample period into two equal periods (1925–1960 and 1965–2000).

[7] A precise definition of the subsamples is given in the online appendix.

[8] This group is relatively heterogeneous, consisting of two Eastern Orthodox countries (Bulgaria and Cyprus), one Anglican country (Great Britain), and two countries whose majority population is a mix of Catholics, Protestants, and Anglicans (Australia and New Zealand). Therefore, the effect of religiosity on fertility may well differ across these subgroups. Unfortunately, the number of countries in these subgroups is too small to further subdivide the group of non-Catholic, non-Protestant Christian countries. Note that the Anglican Communion considers itself to be both Catholic and Protestant. Following the classification of the World Religion Dataset (available at http://www.correlatesofwar.org/data-sets/world-religion-data), I therefore do not classify Anglicans as Protestants, as some studies have done, but I distinguish between Anglicans and Protestants.

Table 3 Dynamic ordinary least squares (DOLS) estimates for subsamples

	Catholic Countries	Protestant Countries	Mixed Catholic-Protestant Countries	Non-Catholic, Non-Protestant Countries
REL_{it}	0.032 (0.91) [0.040 (0.73)]	0.221** (4.96)	0.170** (3.06) [0.176** (2.85)]	0.053 (0.95) [0.040 (0.64)]
Predicted Effect of REL_{it} on $FERT_{it}$ (%)	10.89	22.78	17.00	11.72
Number of Countries	11	3	6	5
Number of Observations	145	43	78	65

Notes: The dependent variable is $FERT_{it}$. All regressions include country fixed effects. The DOLS regressions are performed using de-meaned data to account for cross-sectional dependence. The number of leads and lags is determined by the Schwarz criterion, with a maximum of one lead and one lag. Numbers not in brackets are results for all countries in the subsample; numbers in brackets are results excluding formerly socialist countries from the subsample of non-Catholic, non-Protestant countries (mixed Catholic-Protestant countries) [Catholic countries]; the subsample of Protestant countries does not include countries that were socialist after World War II. Numbers in parentheses are heteroskedasticity- and autocorrelation-consistent *t* statistics.

**$p < .01$

The coefficient on REL_{it} is positive across all subsamples but significant only for Protestant and mixed Catholic-Protestant countries. As can be seen from the results in brackets, this finding is robust to excluding formerly socialist countries.

Finally, the estimated coefficients and the predicted effects suggest that the effect of fertility on religiosity is stronger in Protestant than in mixed Catholic-Protestant countries.

Conclusions

My results lead to two conclusions. First, in general, religiosity has a positive long-run effect on fertility in Christian countries. Second, a decline in religiosity induces a decline in fertility in Protestant countries and (to a lesser extent) in mixed Catholic-Protestant countries but has no significant effect in Catholic countries.

Finally, two limitations of this study should be discussed. First, although religious doctrine can directly influence fertility by regulating sexual activity, birth control, and abortion, religious teachings may indirectly influence fertility by shaping norms about gender roles, marriage, and sexuality (e.g., Guetto et al. 2015). Unfortunately, the present study is unable to distinguish between these direct and indirect effects. Second, religious people may develop more conservative family and gender role attitudes, or more conservative people may be drawn to religion (e.g., Hayford and Morgan 2008). If people with more conservative family and gender attitudes are drawn to religion, and if these attitudinal differences account for fertility differences between religious and nonreligious people to some extent, it is not clear whether changes in religiosity or exogenous social changes in family and gender role attitudes are the main driver of the results of this study.

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