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HOW ROBUST ARE THE LINKAGES BETWEEN RELIGIOSITY AND ECONOMIC GROWTH?

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Abstract

Do variations in the degree of religiosity across countries translate into predictable differences in cross-country growth experiences? We apply a model averaging procedure to investigate the empirical robustness of linkages between religiosity and growth when other fundamental growth determinants, such as institutions, fractionalization, and geography, are simultaneously considered. Our results suggest that while religiosity variables such as belief in hell, belief in heaven, and monthly church attendance are potentially relevant to growth there is no evidence to suggest that they are either quantitatively significant or important.

1. Introduction

Do variations in the average degree of religiosity of citizens across the world translate into predictable differences in cross-country growth experiences? Recent work in the empirical growth literature has sought a clear link between religiosity and economic divergence. In an influential series of papers, Barro and McCleary (2003a, 2003b) examine the effects of religiosity, as measured by monthly church attendance and beliefs in hell, heaven, the existence of God, and an afterlife, on economic growth. They do so within the context of familiar "growth regressions". Barro and McCleary find that some aspects of religious beliefs (notably belief in hell) correlate positively with economic growth while church attendance correlates negatively with growth.

The finding that religious beliefs are positively correlated with growth presents some difficulty to these researchers. For instance, in their data, Muslim countries tend to register high values for religious beliefs compared to countries such as Britain and Japan, and those in Scandinavia. If religious beliefs were important to growth, we could reasonably expect to see Muslim countries outperform relatively secular countries like Britain, Japan, and Sweden economically. Clearly, this pattern of performance is not observed in the data. Barro and McCleary resolve this apparent counterfactual by observing that Muslims spend more time and resources in the act of religious participation than, for instance, Lutheran Swedes. That is, they posit religious participation to be an input in the production of beliefs, and interpret the negative partial correlation of church attendance with growth to mean that lower efficiency in the production of given levels of beliefs results in lower growth

There have been substantial disagreements over the interpretation of Barro and McCleary's results. We list below three key points. First, it is unclear whether the variables employed to proxy for religiosity actually capture what they are meant to. They may, in fact, be proxying for entirely

different underlying concepts. It is unclear, for instance, that religious participation, as measured by church attendance, is in fact an input in the production of religious beliefs. It could just as easily be the case that the church is simply a focal point for social interactions within a community. That is, for the purpose of developing "social capital", a church may be no different conceptually from a bowling alley. We are then left with the question of how higher levels of "social capital" could result in lower growth. However, that such an outcome is possible should come as no surprise. The notion of "social capital" captured by a variable such as church attendance relates only to the intensity of social interactions within the community. It does not necessarily tell us anything about the nature of the interactions or the implications for aggregate economic outcomes. For instance, Durlauf and Fafchamps (2004) point out many instances where a pattern of social interaction that is restricted to and benefits one group of people engenders disadvantages for other groups in society so that the combined benefit to society need not be positive.

A direct consequence of the above, therefore, is that the coefficients in the reduced form regression could admit alternative structural interpretations. One example focuses on the (voluntary) outcome nature of observed religious participation. It is certainly possible that church-going, being a choice variable, simply reflects an individual's predetermined degree of religious "fervor". If this were in fact the case, the negative partial correlation to church attendance would permit a more liberal–leaning interpretation. That is, all other things being equal, higher levels of religious fervor (religiosity for want of a better word) may in fact be detrimental to economic performance.

It is also unclear whether grouping potentially heterogeneous religious practices and doctrines under broad categories such as Protestant or Muslim is meaningful. For instance, are the doctrinal contents, or more specifically, are the cultural viewpoints embodied in the doctrines of, say, the evangelical movement in America and Scandinavian Lutheranism really homogenous? We do not observe a corresponding movement in support of "creationism", for instance, in Protestant

Europe. Is it possible therefore that these identically classified religious movements map into substantively different views on economically relevant objects like science and technology?

The second key objection relates to the fact that the posited mechanism taking religiosity to economic growth relies on a long string of causal logic with many linkages in-between. The intellectual motivation for this body of research draws explicitly (and heavily) from the canonical work of Weber (1904). Weber suggested that the initial impetus of the Protestant ethic in shaping views on hard work and saving behavior contributed critically to the development of capitalism[1]. It should be emphasized, however, that in Weber's view, the role of religion is limited to its initial influence on shaping cultural traits and attitudes. With time, Weber foresaw the withering away of the religious core but nevertheless saw the cultural consequences remaining intact and persistent over time. The link from religiosity to economic outcomes is therefore through religion's influence on cultural traits and behavior. Hence, we would expect to find evidence for systematic causal relations between (1) religiosity and cultural or behavioral traits, (2) culture and behavior, and (3) cultural traits and growth. In fact the evidence for all three cases is mixed at best.

Recent attempts to explore the link between religiosity and individual traits include Guiso, Sapienza, and Zingales (2003). Guiso et al. study the effect of religion on people's attitudes toward cooperation, government, women, legal rules, the market economy, and thriftiness using data from the World Values Survey. Although they find on average that religion is good for the development of attitudes that are conducive to economic growth, when comparing specific economic attitudes within Christian denominations, in both Protestant and Catholic cultures, they find mixed results. In a discussion of their paper, Keely (2003) further questions whether the effect on attitudes that Guido et al. attribute to differences in religious beliefs may actually have arisen from differences in

[1] Two famous critics of Weber, Tawney (1926) and Samuelson (1993) question the causal direction of Weber's theory, arguing that the early growth of capitalism preceded the Protestant Reformation.

religious institutions that govern the practice of religion. Keely contends that religious institutions and organizations are potentially responsive to economic incentives so that any observed correlation between attitudes and economic performance may be caused by factors that determine the latter on the former and not the reverse.

Existing research seeking to uncover a direct link between culture and behavior has also yielded mixed results. Fernandez and Fogli (2004), for example, find that culture may be an important determinant of female labor force participation and fertility decisions. To isolate culture from markets and institutions, Fernandez and Fogli restricted their study to individuals that share the same environment but differ in their cultural background. Specifically, they considered women born and living in the US but whose parents were born in foreign countries. By employing past values for female labor force participation and fertility rates in the country of ancestry as cultural proxies, Fernandez and Fogli show that individual decisions on participation and fertility varied systematically with culture.

In contrast, by carefully tracking the saving behavior of immigrants to, respectively, Canada and the U.S., Carroll, Rhee, and Rhee (1994, 1999) conclude that the saving patterns of immigrants do not vary significantly by place of origin. Their findings suggest that variation in culture does not explain variation in saving behavior across countries.

Attempts to explore the relationship between cultural attitudes and economic outcomes have been similarly inconclusive. For instance, Inglehart and Baker (2000) explore this relationship by employing a set of cultural archetypes which they construct using World Values Survey data. The first cultural archetype, "traditional" versus "secular-rational", describes the tendency for a society to emphasize the importance of religious values and belief over evidential-based descriptions of reality. The second, "survivalist" versus "self-expressionist", attempts to capture a society's willingness to

tolerate self expression and individualistic notions of subjective well-being rather than to emphasize social conformity.

Inglehart and Baker find that while economic development tends to push societies to become more archetypically "secular-rational" and "self-expressionist", a country's religious history and cultural heritage maintain enduring effects on its subsequent cultural development. For instance, they find that historically Protestant societies in Europe maintain distinctive slants in values and attitudes when compared to Catholic societies in Europe at similar stages of development.

However, in an important recent study, Cavalcanti, Parente, and Zhao (2004) show that culturally-derived behavioral differences between Catholics and Protestants cannot account for long delays to the start of industrialization. They do so by constructing and calibrating a model in which differences in religions lead to differences in capital accumulation behavior and work effort. They find at best only a 35-year delay to the start of industrialization.

The final objection is both technical and substantive and is the focus of this paper. Concerns over the effect of religiosity (or culture) on growth are part of an ongoing effort in the empirical growth literature to identify "fundamental" growth determinants. In the canonical neoclassical framework (see, Solow (1956) and Mankiw, Romer, and Weil (1992)), growth around steady state is characterized by rates of physical and human capital accumulation, fertility rates, and technological progress. The recent literature advocates the view that these "proximate" neoclassical growth determinants are themselves determined by slow-moving variables such as a country's geography, the quality of its institutions, the degree of fractionalization in its society, and culture. That is, like advocates of religiosity (culture), proponents of these other "fundamental" growth determinants view "proximate" quantities as outcomes of individual decisions that respond to incentives and constraints defined by growth "fundamentals".

As Brock and Durlauf (2001) argue, however, exploring the quantitative consequences of theories in growth presents unique challenges to researchers. These difficulties arise to a large extent because the nature of growth theories is such that they are inherently *open-ended*. By theory open-endedness, Brock and Durlauf are referring to the fact that typically the a priori statement that a particular theory of growth is relevant does not preclude other theories of growth from also being relevant. That is, a causal relationship between culture and growth has no implications for whether a causal relationship exists between geography and growth. Therefore, researchers interested in the quantitative relationship between religiosity and growth, for instance, inherently have to deal with questions of theory uncertainty. Given that the set of observations is typically small, researchers have to make decisions about which additional theories to control for and which proxy variables to include or leave out. The consequence of theory uncertainty is that changing the variables in the set of additional controls potentially renders coefficient estimates to religiosity variables fragile (see Leamer (1983)). This is particularly likely to be the case since religiosity variables tend not to be orthogonal to other "fundamental" determinant variables.

Dealing with theory uncertainty is therefore of first-order importance if we are concerned with the robustness of the link between religiosity variables and growth. The contribution of this paper is to implement a model averaging strategy articulated in Brock, Durlauf and West (2003) to this purpose. Other examples of model averaging in the context of cross-country growth studies include Brock and Durlauf (2001), Fernandez, Ley, and Steel (2001), and Sala-i-Martin, Doppelhofer, and Miller (2004). Our results suggest that while religiosity variables such as belief in hell, belief in heaven, and church attendance are potentially relevant to growth there is no evidence to suggest that they are quantitatively important.

The remainder of the paper is organized as follows. Section 2 of this paper provides a description of Bayesian model averaging with hierarchical model priors. Section 3 describes the data while Section 4 provides a discussion of the results. Finally, Section 5 concludes.

2. Bayesian Model Averaging (BMA) with Hierarchical Model Priors

2.1 Basic Bayesian Model Averaging Framework

We will analyze the robustness of the link between religiosity and growth within the (extended) canonical growth regression framework:

$$g_j = X_j\pi + z_j\beta_z + S_j\gamma + \varepsilon_j,\ j = 1,...,n.$$

In this framework, g_j is the average growth rate of per capita income for country j across a time period $[t, t+T]$, X_j is the set of Solow variables, z_j is the set of religiosity variables, and S_j is the set of variables over which averaging takes place. The dimensions of S_j are $(n \times p)$. We will refer to a *model* as a growth regression with regressors X_j, z_j, and some combination of the variables in S_j. The *model space*, therefore, consists of a total of 2^p such models; i.e., all possible combinations of variables in S_j.

Our aim is to derive estimates and standard errors for the coefficients to the religiosity variables, β_z, once uncertainty over models has been properly accounted for. The key idea behind the BMA approach is to "integrate out" uncertainty across models using the posterior probability for models. Bayes' rule tells us that the posterior probability for model M_m is proportional to the

likelihood under model M_m multiplied by the prior probability of the model being the "true" model. That is,

$$\mu(M_m \mid D) \propto \mu(D \mid M_m)\mu(M_m)$$

where $\mu(.)$ is a probability measure and D is the data obtained by random sampling. We will discuss the important issue of how to appropriately specify prior model probabilities (i.e., $\mu(M_m)$) in the next subsection.

The posterior expectation and variance of any parameter θ that retains its interpretation across models (say, an element of β_z) are then given respectively by:

$$E(\theta \mid D) = \sum_{m=1}^{2^p} \mu(M_m \mid D) E(\theta \mid D, M_m)$$

and,

$$Var(\theta \mid D) = \sum_{m=1}^{2^p} \mu(M_m \mid D) Var(\theta \mid D, M_m) + \sum_{m=1}^{2^p} \mu(M_m \mid D)(E(\theta \mid D, M_m) - E(\theta \mid D))^2 .$$

Here, $E(\theta \mid D, M_m)$ is the estimate of θ under model, M_m. The posterior expectation is therefore simply the average estimate for θ across models where the averaging employs posterior weights. As discussed in Leamer (1978) and Draper (1995), the posterior variance of the parameter estimate θ depends on the variance of the within-model estimates (the first term on the RHS) and the variance of the estimates across models (the second term on the RHS).

Following Raftery (1995), we replace $E(\theta \mid D, M_m)$ with the MLE estimator[2], $\hat{\theta}_{MLE, M_m}$, and approximate the log of the likelihood $\mu(M_m \mid D)$ by the BIC. As the number of observations increases, the model averaging procedure described above will converge in probability to the "true"

[2] Brock and Durlauf (2001), Fernandez et al (2001), and Sala-i-Martin et al. (2004) also follow Raftery's suggestion and use OLS estimates within models.

model if it is in the model space, or if no model is true, to that model in the model space that best approximates the data generation process (in the sense of minimizing Kullback-Leibler distance).

2.2 Hierarchical Model Priors

In this section, we focus on how to specify priors across models; i.e., $\{\mu(M_m)\}_{m=1}^{2^p}$. Recall that a model in our framework is simply one particular combination of regressor variables out of the possible 2^p combinations. The purpose of specifying model priors is to allow the researcher to insert into the model averaging process, in a systematic fashion, any a priori information she might have about the likelihood of models being "true". At first glance, it would appear reasonable that if a researcher does not have any a priori information to distinguish between models, she should assign equal prior weights to each model. This is, in fact, the standard practice in the literature; i.e., where there is uncertainty over which of the *p* regressors are present, each of the 2^p models in the model space is assigned probability 2^{-p}. This is equivalent to assuming that the prior probability that a given variable is present in the "true" model is 0.5 independent of the presence or absence of any of the other *p* regressors in the model.

This procedure, however, ignores interrelations between different models. As mentioned above, Brock and Durlauf (2001) have pointed out that theories about the growth process are typically *open-ended*. That is, the statement that one particular theory of growth is salient does not preclude the a priori possibility that some other theory of growth may also be relevant. For example, positing that climate affects growth may be logically distinct from hypothesizing that soil fertility affects growth, but that does not mean that the fact one matters has no implications for the likelihood that the other does.

There is a similar problem in the discrete choice literature; i.e., the independence of irrelevant alternatives (IIA). Under IIA, the probability that an individual chooses a red bus or a taxi is assumed not to be affected by the admission of another transport option, a blue bus. Specifically, in the logit model under IIA, the presence of the blue bus does not affect the ratio of the choice probabilities between a red bus and a taxi. However, this is not ideal since the blue bus is conceivably identical in all but color to the red bus (i.e., a close substitute). One solution to the IIA problem in the discrete choice literature is nested logit models. Here, choices are organized in a tree structure to reflect similarities.

We define model probabilities using an analogous nesting approach. We first classify the set of variables in S_j into *theories* (say, T of them). Priors are defined across theories and over variables within theories. The prior probability that a particular *theory* (instead of a particular variable) is included in the "true" model is then set to 0.5 to reflect non-information across theories. Given that a theory is a priori relevant, the probability of any particular combination of variables classified under this theory appearing in the "true" model is set at the inverse of the number of all possible combinations of these variables. Figure 1 shows model priors as represented by a hierarchical tree structure.

As a conclusion to our discussion on the difficulties of specifying appropriate model priors, we note that other proposals to deviate from "flat" model priors have been advanced in the literature. For instance, Sala-i-Martin, et al. (2004) alter the probability of variable inclusion in order to give greater weight to models with a small number of regressors. As another example, Brown, Vannucci, and Fearn (1998, 2002) assume that the probability a given variable is included is itself a random variable drawn from some distribution. This allows different variables to be included with different probabilities. However, in our reading at least, the IIA assumption remains common to these approaches.

3. Data

We use a balanced panel dataset for a total of 31 countries (see Table 1) over four periods 1965-74, 1975-84, 1985-94, 1995-99 based on a broad set of cross-country growth data and religiosity measures. The number of observations range from 116 to 124 across specifications (as detailed in the next section). See Table 1 for the list of countries for which data is available.

The dependent variable is the average growth rate of real per capita GDP corresponding to the four periods 1965-74, 1975- 84, 1985-94, and 1995-99. We distinguish between three classes of explanatory variables: variables that are always kept during model averaging, religiosity variables, and variables associated with other "fundamental" growth theories. This last class of variables corresponds to S_j in the previous section.

The set of explanatory variables that are always included during model averaging consist of time dummies for the above four time periods and the traditional Solow variables. The traditional Solow variables are the logarithm of the sum of average population growth plus 0.05 for net depreciation, the logarithm of the average proportion of real investments (including government) to real GDP, the logarithm of the average years of secondary schooling in the total population over age 25, and the logarithm of real per capita GDP for the initial year of the time period. The national accounting data used to construct these data series are obtained form Penn World Table 6.1 (see, Heston , Summers, and Aten (2002)), while schooling data comes from Barro and Lee (2000).

Following Barro and McCleary (2003), our religiosity measures consist of survey questions from the World Values Survey (WVS) on monthly church attendance, beliefs in heaven, and belief in hell. In this paper we employ data from the most recent wave of the World Values Survey (WVS 2002) which was released in August 2004. This latest WVS survey wave contains respondents from an expanded set of countries (compared to other waves), and is currently the most complete data

available. Like Barro and McCleary, we also include data for religious shares from Barrett (1982) for nine major religion categories: Catholic, Muslim, Protestant, Hindu, Buddhist, other Eastern religions, Jewish, Orthodox, and Other religions.

Finally, we include variables for three leading "fundamental" theories of growth; i.e., geography, institutions, and fractionalization. Following the seminal work of Diamond (1997), a line of research in the growth literature has strongly advocated the crucial role geography plays in determining long-run development. We include proxies for climate and geographic isolation. We proxy for climate using data from Harvard University's Center for International Development (CID) on the percentage of land area classified as tropical and subtropical via the in Koeppen-Geiger system (KGATRSTR). We also include the proportion of a country's land area that experiences more than 5 frost-days per month in winter (FROST5). This variable has been shown to play an important role in soil renewal as well as in the eradication of disease vectors (see Masters and McMillan (2001)). Frankel and Romer (1999), Radelet and Sachs (1998) and others have argued that geographic isolation is a significant barrier to achieving better trade integration and in the transition to industrialization. Our measure for geographical isolation is the percentage of a country's land area within 100 km of an ice-free coast to proxy for geographic isolation (LCR100KM). This variable was also obtained from the CID.

The importance of institutions to development has found strong support in the empirical growth literature (see for instance, Hall and Jones (1999), La Porta, de-Silanes, Shleifer, and Vishny (1999), Acemoglu, Johnson, and Robinson (2001), and Rodrik, Subramanian, and Trebbi (2002)). We consider two classes of institutions variables. The first group consists of three measures for the quality of a country's *economic* institutions. The international country risk rating (ICRG) is a comprehensive measure of institutional quality that aggregates across five variables measuring the quality of the bureaucracy, corruption in government, rule of law, expropriation risk, and

repudiation of contracts by government. We also include a more targeted measure of property rights protection; i.e., the risk of "outright confiscation and forced nationalization" of property (Expropriation Risk). Finally, we also consider a variable (Government Effectiveness) that measures the quality of the bureaucracy. All three variables come from the IRIS-3 dataset by Knack and Keefer. The variables are calculated as the average from 1982 through 1997.

The second set of institutions variables consists of three measures of the nature of a country's *political* institutions. These are an index for democracy, a measure of the independence of the judiciary, and a measure of the degree of constraints on the executive. The data for the democracy index (Democracy) was obtained from Freedom House. Democracy is an average of two variables – a measure of political rights enjoyed by citizens of a country and a measure of the extent of civil liberties. This variable is calculated as the averages over the corresponding growth periods. The Judicial Independence variable is computed as the sum of three variables. The first measures the tenure of Supreme Court judges (highest court in any country), the second measures the tenure of the highest ranked judges ruling on administrative cases, and the third measures the existence of case law. This variable is obtained from La Porta et al (2004) and is measured as of 1995. Finally, we consider a measure of the extent of institutionalized constraints on the decision making powers of the chief executive (Executive Constraints). The Executive Constraints variable is calculated as the average from 1960 through 2000, and is given in Glaeser et al. (2004).

There have been concerns, however, over the endogeneity of economic institutions to growth (Glaeser, La Porta, Lopez-De-Silanes, and Shleifer (2004)). We therefore consider economic and political institutions to be distinct theories of growth, and experiment with including and excluding economic institutions in our BMA exercises (described in the next section).

Finally, researchers have attributed under-development to the degree of fractionalization in society; defined by differences in such factors as racial features, language, and religion. For instance,

Easterly and Levine (1997) argue that high levels of ethnic fractionalization account for Sub-Saharan Africa's abysmal growth record. We employ three variables for fractionalization. The first two, ETHNIC and LANG are from Alesina, Devleeschauwer, Easterly, Kurlat, and Wacziarg (2003). Alesina et al. employ data from the Encyclopedia Britannica and other sources to construct measures of ethnic and ethno-linguistic fractionalization. The variable ETHNIC combines data on racial and linguistic characteristics while LANG is based on data for shares of languages spoken as "mother tongues". We also employ a Religious Pluralism index to measure the degree of religious fractionalization. The religious pluralism index equals one minus the Herfindahl index based on the fractions of adherents in 1980 to the nine major religions discussed above among persons expressing adherence to some religion.

We refer the reader to Table 2 for more details on the data and sources. Table 3 provides summary statistics for the variables described in this section.

4. Results

Tables 4 to 7 detail the results of our BMA exercises. The Solow variables as well as the variables for religious shares are always kept in the regression equation during model averaging. The differences across the tables are due to the inclusion or exclusion of economic institutions from the BMA exercises as well as whether religiosity variables are always kept in the regression equation during BMA. Our baseline results are shown in Table 4. For this BMA exercise, the religiosity variables were always included in the regression equation during model averaging along with the Solow and religious shares variables. As mentioned earlier, there have been concerns in the literature over the endogneity of economic institutions variables, so these variables were excluded from our baseline result. We show results for when the set of economic institutions are included to our

baseline setup in Table 5 instead. In Table 6, we modify our baseline specification to allow religiosity variables to vary across regressions during model averaging. In this case, therefore, religiosity variables are treated just like variables for any of the other "fundamental" growth theories. Finally, in Table 7, we expand the set of political institutions to include two variables that measure government influences on the religion market. Specifically, we use a dummy variable for the presence of an official state religion and a dummy variable for state regulation of religion as additional variables. What is more we replace the variable Democracy with both Civil Liberties and Political Rights. The purpose of Table 7 is simply to check the robustness of our baseline results to additional variables.

The key finding is that none of the religiosity variables are significant at the 5% level under any of the specifications. The only case where a religiosity variable turns up as being marginally significant (at the 10% level) is in Table 5 when economic institutions are included in the model averaging exercise. However, even in this case, we find that our results differ from those obtained by Barro and McCleary since it is belief in heaven (and not in hell) that appears to be marginally important. In Table 6 when we treat religiosity variables like the other fundamental variables and allow them to vary across regressions, we find that the posterior probabilities that belief in heaven, belief in hell, and church attendance are non-zero are 0.174, 0.292, and 0.098, respectively. These probabilities are moderately large and are only topped by the corresponding value for the climate variable, FROST5. Taken together, these results suggest that religiosity variables are potentially relevant to growth but are highly unlikely to be quantitatively important.

However, while the degree of religiosity appears to have little explanatory power for growth, heterogeneity across countries defined in terms of religious shares does appear to be important. We find the coefficient to the share of Muslims to be negative and highly significant at the 1% level across Tables with the exception of Table 5 where it is not significant. We also find evidence that the coefficient to the Eastern religion share is positive and significant at the 5% level. It is, however,

difficult to interpret these results in any meaningful way since these shares correspond closely to dummy variables for Middle Eastern and East Asian countries respectively. Any historical or cultural explanations for heterogeneity in growth experiences, and not necessarily ones related to religion, will therefore be consistent with the results.

We next turn to characterizing our results for the other "fundamental" growth determinants. Consistent with the literature, we find that climate variables tend to be significant and important when economic institutions are not included in the regression equation. In Tables 4, 6, and 7, our climate variable, FROST5, is the only variable that is significant with a posterior probability of being non-zero of virtually 1. However, when economic institutions are included during model averaging (Table 5), climate becomes insignificant. This is again consistent with existing findings in the literature. However, even in Table 5, we find that the posterior probabilities that climate and economic institutions variables are non-zero are high at 0.646 for FROST5, and 0.486 and 0.353 for Expropriation Risk and ICRG, respectively.

Finally, we turn to our results for the set of Solow variables. We find the coefficient to initial income per capita to be highly significant at the 1% level and negative across tables. A negative coefficient on log initial income per capita is typically taken as evidence in the literature that poorer countries are catching up with richer countries after controlling for heterogeneity. We also find that the coefficient to investment is highly significant and positive across all tables, while there is strong evidence that population growth is significant and negative. These results accord with the predictions of the traditional Solow growth model. We find, however, that the coefficient to schooling is insignificant across tables and frequently of the wrong sign (negative).

5. Conclusion

In this paper, we evaluate the robustness of the link between religiosity and economic performance using Bayesian model averaging methods to account for model uncertainty. In contrast to work in the literature, we find no evidence that the degree of religiosity is quantitatively important to growth.

It is difficult to overstate the stakes in the outcome of the debate over religion's role in economic performance. The advocacy value of this new area of work owes in no small measure to its potential for (mis-)application to important and ongoing public policy controversies. Rightly or wrongly, empirical results from research in this area will be proposed as keen answers to counterfactual questions such as "What would the growth experiences of the U.S. have been compared to the rest of the world under a different history of religiosity?"

Justified or not, these results will provide ammunition to proponents of various policy positions on topics ranging from the value of faith-based initiatives in the U.S. to whether international aid efforts should occur hand-in-hand with the propagation of (religious or pseudo-religious) "values". For instance, should the disbursement of aid be contingent on a pro-life policy regime being in place? We see no humanitarian purpose in reviving a previously discredited version of modernization theory that holds underdevelopment in poor countries as being directly contingent on the failure to adopt "western" (now replaced with "religious") values. Getting the empirics right on this matter is therefore of first-order importance. We view this paper as a first step in that direction.

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Table 1: List of Countries

Code	Country
ARG	Argentina
AUT	Austria
BEL	Belgium
BGD	Bangladesh
CAN	Canada
DNK	Denmark
DZA	Algeria
ESP	Spain
FIN	Finland
FRA	France
GBR	United Kingdom
GRC	Greece
IDN	Indonesia
IND	India
IRL	Ireland
IRN	Iran, Islamic Rep.
ITA	Italy
JOR	Jordan
MEX	Mexico
JPN	Japan
NLD	Netherlands
PAK	Pakistan
PER	Peru
PHL	Philippines
PRT	Portugal
SWE	Sweden
TUR	Turkey
UGA	Uganda
USA	United States
ZWE	Zimbabwe
ZAF	South frica

Table 2: Description and sources of the data

VARIABLE	DESCRIPTION AND SOURCE
Average Growth Rates of Real Per Capita GDP	Average growth rates for the periods 1965-74, 1975-84, 1985-94, 1995-99. Source: Penn World Tables 6.1
Population Growth Rates	Average population growth rates for the periods 1965-74, 1975-84, 1985-94, 1995-99. Source: Penn World Tables 6.1
Investments	Averages for investments for the periods 1965-74, 1975-84, 1985-94, 1995-99. Source: Penn World Tables 6.1
Schooling	Years of total secondary school attainment for 1965, 1975, 1985, and 1995. Source: Barro and Lee (2000)
Initial Income	Log of per capita GDP at 1965,1975,1985,1995. Source: Penn World Tables 6.1
Dummy 1960	Dummy variable for 1965-74
Dymmy 1970	Dummy variable for 1975-84
Dummy 1980	Dummy variable for 1985-94
Dummy 1990	Dummy variable for 1995-99
Believe in Hell	Fraction of the population who believe in Hell. All the religiosity variables as well as the religion shares variables are transformed by log[x/1-x], which x is the original series. Source: WVS02
Believe in Heaven	Fraction of the population who believe in Heaven. Source: WVS02
Monthly Church Attendance	Population averages of monthly church attendance. Source: WVS02
Eastern Religion Share	Fraction of people adhering to Eastern religions among persons who expressed adherence to some religion. From Barrett (1982).
Hindu Share	Fraction of people adhering to Hindu religion among persons who expressed adherence to some religion. From Barrett (1982).
Jewish Share	Fraction of people adhering to Jewish religion among persons who expressed adherence to some religion. From Barrett (1982).
Muslim Share	Fraction of people adhering to Muslim religion among persons who expressed adherence to some religion. From Barrett (1982).
Orthodox Share	Fraction of people adhering to Orthodox religion among persons who expressed adherence to some religion. From Barrett (1982).
Protestant Share	Fraction of people adhering to Protestant religion among persons who expressed adherence to some religion. From Barrett (1982).
Other Religion Share	Fraction of people adhering to other religions among persons who expressed adherence to some religion. From Barrett (1982).
KGATRSTR	Percentage of land area classified as tropical and subtropical via the in Koeppen-Geiger system. From CID. From Barrett (1982).
FROST5	Proportion of a country's land area that experiences more than 5 frost days per month as a proxy for climate. Source: Masters and McMillan (2000)
LCR100km	Percentage of a country's land area within 100km of an ice- free coast. From CID.
ETHNIC	Variable which combines racial and linguistic characteristics. From Alesina et (2003).
LANG	Variable which is based on data for shares of languages spoken as "mother tongues". From Alesina et (2003).
Religious Pluralism	Is based on the fractions of adherents in 1980 to nine major religions among persons expressing adherence to some religion. Source: Barro and McCleary (2003a)

State Religion	Refers to the situation circa 1970, as designated by Barret ,Kurian and Johnson ,where we assigned the value 1 if only Barret et al. designated an individual religion , not if they classified the state as favoring religion in general. Source: Barro and McCleary (2003a).
State Regulation of Regulation	State religion (=1) refers to a situation in which the state appoints or approves church leaders. Source: Barro and McCleary (2003a).
Civil Liberties	Averages of Civil Liberties over the corresponding growth periods. Source: Freedom House
Political Rights	Period averages of Political Rights over the corresponding growth periods. Source: Freedom House
Democracy	Democracy is the average of Political Rights and Civil Liberties over the corresponding growth periods.
Judicial Independence	Constitutional review is computed as the sum of two variables. The first variable measures the extent to which judges (either Supreme Court or constitutional court) have the power to review the constitutionality of laws in a given country. The variable takes three values: 2- if there is full review of constitutionality of laws, 1 - if there is limited review of constitutionality of laws, 0 - if there is no review of constitutionality of laws. The second variable measures (on a scale from 1 to 4) how hard it is to change the constitution in a given country. This variable is measured as of 1995. Source: Glaeser et al (2004) and La Porta et al. (2004):
Executive Constraints	A measure of the extent of institutionalized constraints on the decision making powers of chief executives. This variable ranges from one to seven where higher values equal a greater extent of institutionalized constraints on the power of chief executives. This variable is calculated as the average from 1960 through 2000, or for specific years as needed in the tables. Source: Glaeser et al (2004).
ICRG	It measures institutional quality across 1984-1997 that aggregates across five variables measuring the quality of the bureaucracy, corruption in government, rule of law, expropriation risk, and repudiation of contracts by government. Source: IRIS-3 dataset by Knack and Keefer.
Expropriation Risk	Risk of "outright confiscation and forced nationalization" of property. This variable ranges from zero to ten where higher values are equals a lower probability of expropriation. This variable is calculated as the average from 1982 through 1997, or for specific years as needed in the tables. Source: International Country Risk Guide at http://www.countrydata.com/datasets/.
Government Effectiveness	This variable measures the quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressures, and the credibility of the government's commitment to policies. This variable ranges from -2.5 to 2.5 where higher values equal higher government effectiveness. This variable is measured as the average from 1998 through 2000. Source: Kaufman et al. (2003).

Table 3: Descriptive Statistics

Variable	Mean	Median	Standard	Min	Max
Average Growth Rates	0.021	0.022	0.017	-0.020	0.084
Population Growth Rates	-2.754	-2.770	0.167	-3.015	-2.330
Investments	2.861	2.959	0.512	0.331	3.683
Schooling	0.085	0.253	1.010	-3.218	1.609
Initial Income	2.164	2.196	0.120	1.850	2.327
Believe in Hell	0.577	0.554	0.303	0.090	1.00
Believe in Heaven	0.710	0.800	0.258	0.184	1.00
Monthly Church Attendance	0.481	0.466	0.243	0.091	0.912
Eastern Religion Share	0.019	0.000	0.075	0.000	0.383
Hindu Share	0.034	0.000	0.147	0.000	0.165
Jewish Share	0.003	0.001	0.007	0.000	0.033
Muslim Share	0.207	0.009	0.373	0.000	0.991
Orthodox Share	0.034	0.001	0.166	0.000	0.942
Protestant Share	0.166	0.014	0.276	0.000	0.949
Other Religion Share	0.026	0.002	0.066	0.000	0.250
KGATRSTR	0.193	0.000	0.339	0.000	1.00
FROST5	0.712	0.962	0.383	0.000	1.00
LCR100km	51.29	39.00	36.94	0.000	100.0
ETHNIC	0.352	0.320	0.265	0.011	0.930
LANG	0.346	0.221	0.298	0.017	0.922
Religious Pluralism	0.265	0.130	0.253	0.015	0.757
State Religion	0.516	1.000	0.501	0.000	1.000
State Regulation of Regulation	0.387	0.000	0.489	0.000	1.000
Civil Liberties	0.684	0.761	0.346	0.000	1.000
Political Rights	0.732	0.895	0.343	0.000	1.000
DEMOC	0.701	0.828	0.339	0.000	1.000
Judicial Independence	0.817	1.000	0.266	0.000	1.000
Executive Constraints	5.198	5.400	1.848	1.538	7.000
ICRG	6.803	7.635	2.626	2.740	9.813
Expropriation Risk	8.139	9.00	1.692	4.800	-0.843
Government Effectiveness	0.792	0.850	0.954	9.978	2.170

Table 4

Variable	Posterior Inclusion Probability	Posterior Mean	Posterior Standard Deviation	Least Squares Estimate	Least Squares Standard Error
Intercept	-	0.270529	0.095786	0.3909	0.1271
Dummy for 1975-84	-	-0.004644	0.003958	-0.0025	0.0042
Dummy for 1985-94	-	-0.000417	0.004971	0.0034	0.0054
Dummy for 1995-99	-	0.010593*	0.0059653	0.0157**	0.0067
Solow Variables					
Population Growth Rates	-	-0.057818***	0.017333	-0.0425**	0.0211
Investments	-	0.021942***	0.004495	0.0245***	0.0052
Schooling	-	-0.002480	0.002990	-0.0028	0.0035
Initial Income	-	-0.238644***	0.043267	-0.283***	0.0516
Religion Shares					
Eastern Religion Share	-	0.041420**	0.019300	0.0453*	0.0244
Hindu Share	-	-0.007352	0.012451	-0.0224	0.0168
Jewish Share	-	0.226444	0.239728	0.3622	0.3139
Muslim Share	-	0.028395***	0.010287	-0.0264**	0.0114
Orthodox Share	-	-0.011039	0.008358	-0.0084	0.0087
Protestant Share	-	0.003915	0.006252	0.0078	0.0072
Other Religion Share	-	-0.031839	0.032045	-0.0463	0.0429
Religiosity					
Believe in Hell	-	0.004072	0.022435	-0.0125	0.0253
Believe in Heaven	-	0.020008	0.021237	0.0358	0.0262
Monthly Church Attendance	-	0.002667	0.014343	0.0007	0.0171
Geography					
KGATRSTR	0.096	0.000624	0.004424	0.0086	0.0163
FROST5	1	0.044210***	0.008517	0.0438***	0.0138
LCR100km	0.096	0.000002	0.000018	0.0000	0.0001
Fractionalization					
ETHNIC	0.016	-0.000009	0.000945	0.0056	0.0112
LANG	0.016	0.000026	0.000780	-0.0065	0.0089
Religious Pluralism	0.025	0.000209	0.001948	0.0014	0.0114
Political Institutions					
Democracy	0.019	0.000028	0.000892	-0.0008	0.0066
Judicial Independence	0.047	-0.000494	0.002828	-0.0175*	0.0089
Executive Constraints	0.049	0.000120	0.000669	0.0038*	0.0021

Note: * p<0.1 **p<0.05 ***p<0.01

Table 5

Variable	Posterior Inclusion Probability	Posterior Mean	Posterior Standard Deviation	Least Squares Estimate	Least Squares Standard Error
Intercept	-	0.340730	0.112368	0.4936	0.1421
Dummy for 1975-84	-	-0.001919	0.004130	0.0014	0.0042
Dummy for 1985-94	-	0.002414	0.005280	0.0079	0.0054
Dummy for 1995-99	-	0.014234**	0.006482	0.0214***	0.0068
Solow Variables					
Population Growth Rates	-	-0.032877	0.023434	-0.0112	0.0261
Investments	-	0.021602***	0.005079	0.0286***	0.0058
Schooling	-	-0.003409	0.003196	-0.0042	0.0038
Initial Income	-	-0.256863***	0.047746	-0.3139***	0.0577
Religion Shares					
Eastern Religion Share	-	0.017706	0.028459	0.0507	0.0629
Hindu Share	-	-0.078912	0.063753	-0.1389	0.0882
Jewish Share	-	0.240909	0.271230	0.8201**	0.3539
Muslim Share	-	-0.016722	0.013561	-0.0044	0.0157
Orthodox Share	-	0.006763	0.013902	0.0054	0.012
Protestant Share	-	-0.000770	0.007431	0.0071	0.0088
Other Religion Share	-	-0.041318	0.040600	0.0322	0.0736
Religiosity					
Believe in Hell	-	-0.018729	0.026417	-0.0353	0.0366
Believe in Heaven	-	0.041979*	0.025023	0.0545*	0.0303
Monthly Church Attendance	-	-0.003688	0.015582	0.0005	0.0181
Geography					
KGATRSTR	0.169	0.003991	0.012014	0.0216	0.0262
FROST5	0.646	0.023261	0.020905	0.0277	0.0267
LCR100km	0.112	0.000007	0.000028	0.000	0.0001
Fractionalization					
ETHNIC	0.02	-0.000066	0.001245	0.006	0.0113
LANG	0.026	-0.000125	0.001448	-0.011	0.0107
Religious Pluralism	0.04	-0.000626	0.005090	-0.0162	0.0212
Political Institutions					
Democracy	0.031	0.000175	0.001533	0.0031	0.0065
Judicial Independence	0.056	-0.000878	0.004852	-0.0295*	0.0165
Executive Constraints	0.077	0.000284	0.001247	0.0066*	0.0038
Economic Institutions					
ICRG	0.353	0.001961	0.003199	-0.0025	0.0058
Expropriation Risk	0.486	0.004582	0.005593	0.0054	0.0115
Government Effectiveness	0.14	0.000187	0.004536	0.0099	0.0179

Table 6

Variable	Posterior Inclusion Probability	Posterior Mean	Posterior Standard Deviation	Least Squares Estimate	Least Squares Standard Error
Intercept	-	0.317574	0.097050	0.3909	0.1271
Dummy for 1975-84	-	-0.004061	0.004002	-0.0025	0.0042
Dummy for 1985-94	-	0.000617	0.005066	0.0034	0.0054
Dummy for 1995-99	-	0.012138	0.006119**	0.0157**	0.0067
Solow Variables					
Population Growth Rates	-	-0.047981	0.018289***	-0.0425**	0.0211
Investments	-	0.021782	0.004501***	0.0245***	0.0052
Schooling	-	-0.002746	0.002951	-0.0028	0.0035
Initial Income	-	-0.242972	0.040664***	-0.2830***	0.0516
Religion Shares	-				
Eastern Religion Share	-	0.040483	0.018169**	0.0453*	0.0244
Hindu Share	-	-0.011258	0.012083	-0.0224	0.0168
Jewish Share	-	0.344056	0.247781	0.3622	0.3139
Muslim Share	-	-0.026454***	0.008209	-0.0264**	0.0114
Orthodox Share	-	-0.011588	0.007956	-0.0084	0.0087
Protestant Share	-	0.002501	0.005819	0.0078	0.0072
Other Religion Share	-	-0.033771	0.032312	-0.0463	0.0429
Religiosity					
Believe in Hell	0.174	0.003733	0.010211	-0.0125	0.0253
Believe in Heaven	0.292	0.007222	0.012909	0.0358	0.0262
Monthly Church Attendance	0.098	0.001294	0.005782	0.0007	0.0171
Geography					
KGATRSTR	0.092	0.000441	0.003961	0.0086	0.0163
FROST5	0.999	0.041782***	0.008600	0.0438***	0.0138
LCR100km	0.089	0.000001	0.000016	0.0000	0.0001
Fractionalization					
ETHNIC	0.016	0.000015	0.000959	0.0056	0.0112
LANG	0.017	0.000026	0.000781	-0.0065	0.0089
Religious Pluralism	0.032	0.000331	0.002462	0.0014	0.0114
Political Institutions					
Democracy	0.02	0.000033	0.000934	-0.0008	-0.0066
Judicial Independence	0.036	-0.000287	0.002105	-0.0175*	-0.0089
Executive Constraints	0.068	0.000181	0.000798	0.0038*	0.0021

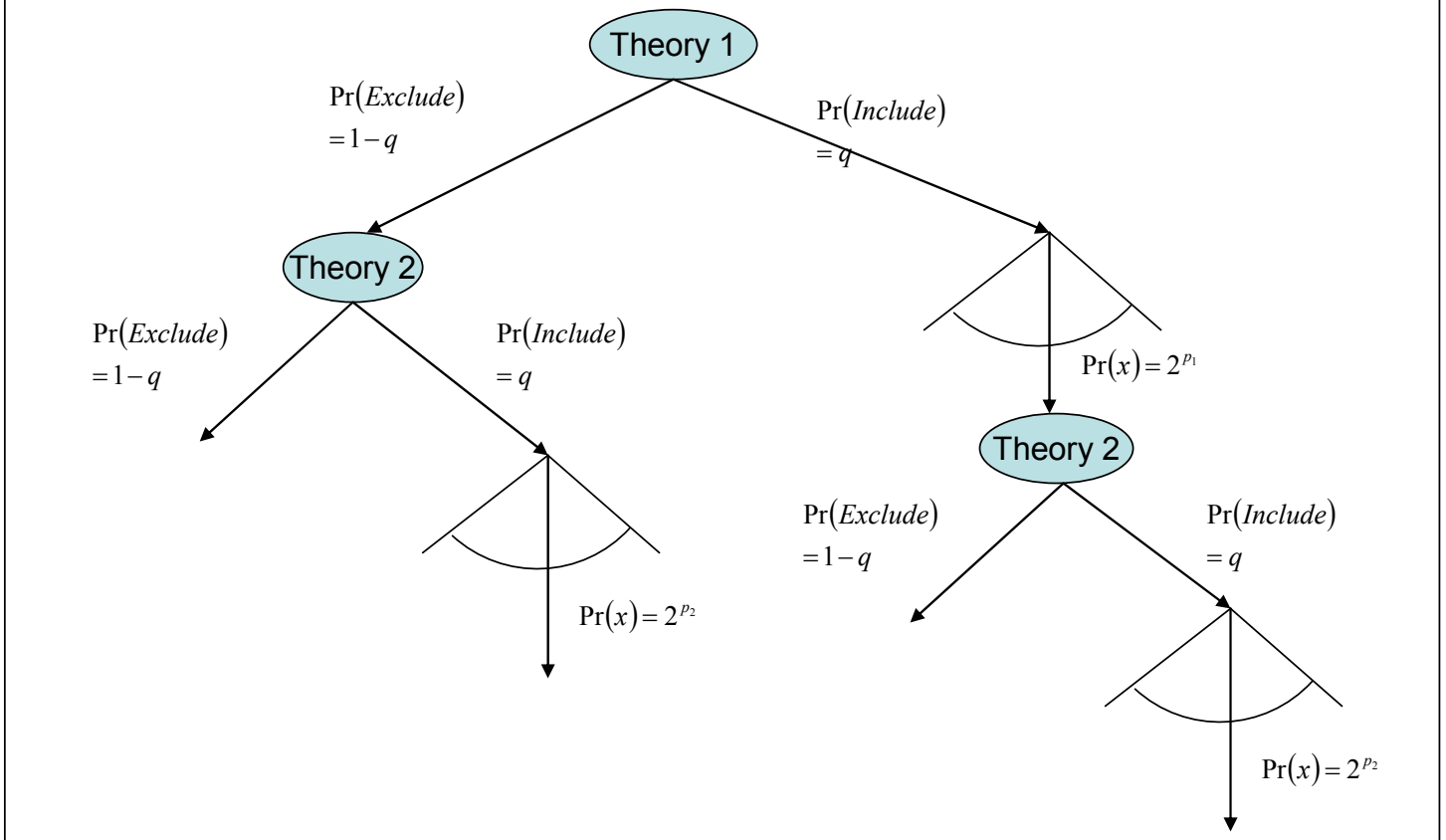
Note: * p<0.1 **p<0.05 ***p<0.01

Table 7

Variable	Posterior Inclusion Probability	Posterior Mean	Posterior Standard Deviation	Least Squares Estimate	Least Squares Standard Error
Intercept	-	0.266410	0.093232	0.421	0.1363
Dummy for 1975-84	-	-0.004712	0.003938	-0.0017	0.0043
Dummy for 1985-94	-	-0.000528	0.004921	0.0051	0.0058
Dummy for 1995-99	-	0.010439*	0.005882	0.0183**	0.0072
Solow Variables					
Population Growth Rates	-	-0.058341	0.017117	-0.0447*	0.0232
Investments	-	0.021913***	0.004493	0.0233***	0.0054
Schooling	-	-0.002475	0.002957	-0.0035	0.0036
Initial Income	-	-0.237274***	0.042576	-0.299***	0.0544
Religion Shares					
Eastern Religion Share	-	0.0411593**	0.01928	0.0415	0.0254
Hindu Share	-	-0.006815	0.011956	-0.0319	0.0208
Jewish Share	-	0.222230	0.239036	0.5369	0.3605
Muslim Share	-	-0.028334***	0.010290	-0.027**	0.0118
Orthodox Share	-	-0.011106	0.008353	-0.0052	0.0096
Protestant Share	-	0.003870	0.006200	0.0049	0.0082
Other Religion Share	-	-0.031285	0.031806	-0.0371	0.045
Religiosity	-				
Believe in Hell	-	0.004358	0.022360	-0.0131	0.0268
Believe in Heaven	-	0.019657	0.021104	0.043	0.0288
Monthly Church Attendance	-	0.002838	0.014317	-0.0127	0.021
Geography					
KGATRSTR	0.096	0.000617	0.004401	0.0133	0.0186
FROST5	1	0.044328***	0.008463	0.0424***	0.0142
LCR100km	0.096	0.000002	0.000018	0	0.0001
Fractionalization					
ETHNIC	0.016	-0.000010	0.000946	0.006	0.0118
LANG	0.016	0.000027	0.00078	-0.0074	0.0095
Religious Pluralism	0.025	0.000214	0.00196	-0.0053	0.0132
Political Institutions					
State Religion	0.008	-0.000034	0.000506	0.0016	0.0056
State Regulation of Religion	0.004	-0.000005	0.000236	-0.0047	0.0051
Civil Liberties	0.004	0.000015	0.000572	0.0109	0.014
Political Rights	0.003	-0.000008	0.000573	-0.0132	0.0153
Judicial Independence	0.008	-0.000080	0.001157	-0.0199*	0.0108
Executive Constraints	0.008	0.000019	0.000275	0.0055*	0.003

Note: * p<0.1 **p<0.05 ***p<0.01

Figure 1: Hierarchical Model Priors



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