

The religious transition

A long-run perspective

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Abstract:

The paper develops a measure of religiosity as the intensity of any religion, and demonstrates that religiosity falls by no less than 50 % when countries pass through the transition from being a low income country to become a developed country. A formal test shows that long run causality is predominantly from income to religiosity. Most components of the demand for religious goods are reduced by rising income. The supply of core collective goods by religious institutions is also reduced by rising income. A simple growth model shows how the substitution of science for religion is related to the estimated religious transition.

Keywords Religiosity, economic development, transition, substitution, biogeography

JEL: O11, Z12

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1. Introduction: Religiosity and development

Religiosity is defined as the intensity of any religion, namely the weight given to religious beliefs in everyday decision making. The paper develops a robust macro measure of religiosity and demonstrates that it falls by no less than 50 % when countries pass through the transition from being a low income country to become a developed country.³

While religiosity falls with the level of development, religions and religious belief systems as such stay remarkably stable over time. Strong path dependency and differences across various religions add considerable variation to the relation between income and religiosity, but the transition generalizes. It is a part of the *Grand Transition* (GT) whereby long-run economic growth causes a transition from a traditional to a modern socio-economic equilibrium. The GT-process consists of interacting transitions in most fields of society. The religious transition is just one of these transitions, and it surely interacts with some of the other transitions such as the transitions of human capital, mortality, and democracy. The paper bypasses most of the interactions within the GT-process by concentrating on the transition path, which is estimated as the reduced form relation between income and religiosity.

Our religiosity measure is a compilation of 14 items from the *World Values Surveys*. The WVS questionnaire was developed as an English master version that has been translated into many languages and cultural environments by experts including experienced pollsters in each country. This is surely a difficult task: Key concepts, such as *God* and *church*, which have clear meanings in monotheistic belief systems, may apply less well in other belief systems. The paper uses the terms of the English master version.

Three problems might generate biases in the estimated slope of the transition path: (1) If different religions give different slopes, the country selection should be representative. (2) The responses to the questionnaire may have measurement errors in some countries, e.g., in religious autocracies or in anti-religious communist states. (3) We study causality from income to religiosity, but the results may be influenced by reverse causality.

We control for these problems in several ways: Problems (1) and (2) are controlled by including binary dummies for country groups and religions, and by systematically analyzing the effect of deleting individual countries and groups. Simultaneity (3) is analyzed by a formal causality test showing that the long run fall in religiosity is caused by the rise in income. Taken together, these methods show that the slope of the estimated transition path is robust, even to the two outliers China and the United States.

The paper discusses a process that is presumed to evolve over 50 to 300 years in countries with persistent economic development. Our data sample only has 240 data-points, which spans over 24 years, for 95 countries. These data seems inadequate for the task at hand, but the pattern in the data is amazingly strong. It is as predicted by the hypothesis of a religious transition – and we know of no alternative explanation.

The paper proceeds as follows: Section 2 defines our concept of religiosity and discusses how our findings relate to two main controversies of the literature. (C1) The secularization debate: Does rising income cause religiosity to fall? This is our main theme. (C2) Do individual religions help or harm development? This is the simultaneity problem (3). It is analyzed only so far as to study if simultaneity influences our estimates of the transition path.

Sections 3 to 5 deal with the empirics of the religious transition. Section 3 derives our religiosity measure and shows its robustness. Section 4 presents the GT framework of the analysis and reports the long-run causality test. Section 5 looks at trends over the 24 year period and demonstrates that the estimated transition slope is robust to sample selection and to measurement error.

Sections 6 and 7 discuss the economic mechanisms behind the observed religious transition. As systematic measurement is scarce, the evidence mainly consists of examples and case studies. Section 6 looks at the demand for religion, mainly as a factor of production. Demand falls with rising income through a process of substitution towards an alternative factor input, namely science.

Section 7 presents the *loss-of-channels theory*. Religious goods are supplied directly by churches and through the three additional channels that used to be controlled by churches: Education, healthcare, and social security. The Grand Transition has had two effects on the additional channels. They increase in volume, but ownership and hereby control shifts from church to state. The shift of control is normally gradual and takes a century or more, but we also consider two historical experiments where a rapid loss of channels took place.

Section 8 uses a simple growth model to explain the observed religious transition. Our measure of religiosity is interpreted as the factor share of religion in a CES production function. The model demonstrates that the substitution of science for religion is an endogenous engine of growth in itself. It is shown how the substitution parameter of the growth model can be related to the estimated transition slope of the regression models. Section 9 concludes.

An appendix with documentation and extra tests is posted on the home page of the authors. Especially the robustness tests are bulky and have overflowed into the Appendix.

2. Our concept of religiosity and the literature

We want to study the link from income to religiosity independent of the actual religious affiliation and to interpret the empirical results using the language of economics.⁴ The literature in the field struggles with two unsettled controversies; (C1 and C2) and with conceptual problems, notably the distinction between religion and religiosity.

2.1 *Religion as a complex good, religiosity as a weight*

In economic terms *religion* is a complex good in both the supply and demand dimensions. It is produced in two ways, within families and by churches – sometimes jointly with other goods. It is used in two ways that are not always easy to sort out, as a consumption good and as a factor of production. All this compares with *education* which has similar complexities.

Religion is used as a factor of production in most societies, for instance when farmers pray for a good harvest,⁵ or political leaders are blessed by religious ceremonies. Religion is consumed where people go to places of worship to get peace at mind. Economics seems well suited to analyze the effects of rising income on the changing demand for religion as a factor of production and on the changing supply of collective goods by churches. It is more difficult to analyze the effect of income on the demand for religion as a consumption good.

In contrast to religion, *religiosity* is not considered to be a good or a factor input. We think of religiosity as the weight given to religious beliefs in everyday decision making, i.e. the intensity of the religion, which may be any religion. The stock of religious beliefs can probably be considered as constant, but the relevance of these beliefs for decision making may change depending on the level of development. In this sense, the decline of religiosity bears a similarity to the declining weight of agriculture in the process of development. In rich countries, the share of agriculture in GDP is low, but people still eat. Hence a low level of religiosity does not necessarily mean that people do not believe.

2.2 *The R-variable: A representative part of a larger complex*

Religiosity is defined as a latent variable, \hat{R} , measuring the importance of religion in all aspects of people's life. If the full aspect space of religiosity was measured by \hat{K} variables, \hat{R} would be the largest common factor in all \hat{K} variables.

The actual *R*-variable is estimated by a factor analysis of $K = 14$ items from the *World Values Surveys* (WVS).⁶ The items from the WVS are chosen to span as much of the aspect

space as possible. The items all disregard the specifics of a religion, but ask about its importance in a dozen fields of life. The number used from each poll is the fraction (in %) of the respondents giving the high importance answer. The aggregate R -score is in percent as well. Changes in R are thus in pp , percentage points.

Development is proxied by income, y , defined as the natural logarithm of GDP per capita, taken from the Maddison data. Changes in y are in lp , logarithmic points, where each lp is a change of GDP per capita of $e \approx 2.7$ times.⁷ Given these variables, the causal process $y \Rightarrow R$ is the transition path, with the slope $\lambda = \partial R / \partial y$ as the transition parameter measured in pp per lp .

The available five waves of the WVS span only 24 years, so the analysis hinges crucially upon the *equivalence assumption* that the long-run time-series pattern is the same as the cross-country pattern. The equivalence assumption has been confirmed for the agricultural and the democratic transitions, where long-run time-series data are available in addition to the cross-country data. The cross-country variation in income levels contains information about differences in the long-run path of development since all countries started from rather similar levels of development about 300 years ago. The long-run information contained in cross-country level data motivates our using of the equivalence assumption as the default until disproved.⁸

2.3 *The macro literature:*⁹ *Two controversial questions*

Our hypothesis of a religious transition is related to the secularization hypothesis,¹⁰ which is a component of the theory of *modernization*. Modernization theory goes back to Marx, Freud, Weber, Durkheim, and others. They predicted that economic development would cause religiosity to vanish. Their secularization theory may be interpreted as a qualitative version of the religious transition, i.e. as a theory that R would go to zero in the limit. This has apparently not happened up to now and perhaps this is why Stark and Iannaccone (1994) claim that “secularization is a myth”.

By contrast, McCleary and Barro (2006) apply a quantitative approach and find that the level of per capita income has a significantly negative effect on various indicators of religiosity. They do not provide an economic rationale for their results. We confirm and expand their results, and provide a frame of reference in section 8 to put our findings in perspective.

Hence one major controversy (C1) in the literature is whether secularization actually occurs. The WVS data show a clear transition path, but critics have pointed to problems with some of the polls. When complex issues are polled across many countries at different levels of

development, measurement errors may be substantial. A main effort in our paper is to study if such potential measurement errors can generate substantial biases in the estimate of the transition path – we find that this is not the case.

The other main controversy (C2) deals with the causal role of various religions for development. At present this is not our subject, but it is touched upon indirectly in two ways: The estimate of the transition slope, λ , is controlled for simultaneity,¹¹ and it is shown that λ is robust to controls for the main religious affiliations.

Our analysis reveals that development causes a fall in religiosity. Consequently, all religions have an interest in resisting development, notably science. This might help explain why the main religious institutions in a country often form alliances with conservative political institutions, and the many controversies between religion and science.¹²

Ever since Weber (1904) it has been discussed if certain religious minorities, precisely because they are in opposition to mainstream conservative religion, have had a causal role for economic development, notably for the rise of capitalism. It has further been discussed if some religions are more rigidly conservative than others. In the inter-war period it was discussed how the anti-developmental nature of traditional oriental systems of belief would prevent development in East Asia.¹³ For long, the oriental countries were remarkably conservative and resisted development, but then suddenly things changed.

Recently, a literature has emerged about Islam arguing that this belief system is less prone to generate development than other religions; see Paldam (2009) for a survey. It is arguable that Islam is a relatively rigid religion, with a solid base in the 7th century, preserving some belief-based traditions that have turned out to delay development. Several examples of such traditions can be given, including the rigid traditional gender roles that make it difficult to use half of the labor force in a number of Muslim countries. The connection between Islam and income may also work through other mechanisms.¹⁴ Our analysis suggests that belief-based traditions are transitory, but the transition may be quite slow.

2.4 The micro literature: Demand and supply

The demand side has seen several approaches. Azzi and Ehrenberg (1975) consider the time allocation to religious and non-religious activities at the household level in response to changes in the budget constraint. Durkin and Greely (1991) study the relationship between the demand for religion and the prevalence of risk in modern society. Lipford et al. (1993) investigate the link from religiosity to social behavior.

The supply side is dominated by the *competition theory*; see Finke and Iannaccone (1993), Stark and Iannaccone (1994). Here, religiosity is a function of the degree of competition on the market for religion, with competition increasing the efficient supply of religious goods that is generating its own demand. The theory explains why religiosity differs across countries at the same income level, but it does not address the religious transition. Section 7 presents the loss-of-channels theory which deals with the religious transition.

When religion is treated as a good that is demanded and supplied, the observed level of religiosity reflects the equilibrium of demand and supply. Economic theory suggests that the outcome will be conditional on the level of income, and the theory of economic growth, as presented in section 8, explains the dynamics of the equilibrium.

3. The religiosity variable, R

First the 14 religious items from the WVS are listed. Then the factor analysis is presented, followed by a brief analysis of the representativity of the sample. The key result in this section is the cross-sample stability of factor 1 in the factor analysis. It indicates that our measure of religiosity is robust.

3.1 *The items used and the availability of the polls*

Table 1 gives a short version of the question asked in the 14 items, and the number of times it has been asked in each of the 5 waves.

$M = 2331$ refers to the number of polled items in our sample; $j = 1, \dots, 14$ are the items, $i = 1, \dots, 95$ are the countries, and $t = 1, \dots, 5$ are the waves.

The two gray columns to the right give two important data. The first is the average A_{jit} of each of the items across all waves. The grand average of all average A_{jit} 's is 56.2 %, which is thus the grand average of the fraction (in %) of the respondents in all polls that declares themselves highly religious. The second gray column gives the coefficient of correlation of the A_{jit} 's and income y_{jit} for each j . The least significant of the correlations (item 14) just passes the 5 % level (in the two-way test), so all correlations are statistically significant and negative, and nearly all are substantial in size.

 Table 1

3.2 *Factor analysis: Factor 1 is termed religiosity. It has high cross-wave stability*

The factor analysis of the religiosity items presented in Table 2 is done independently for each wave. Our criteria for accepting one factor as the religiosity variable are that the factor loadings are positive and large to all items and stable across waves, as measured by the eigenvalues and the cross-wave t-ratio.

Table 2

The first three factors have average cross-wave eigenvalues of 7.4, 1.3, and 0.6, so the first factor dominates; also it has a cross-wave t-ratio of 5.3. The factor loadings to factor 1 are all positive and most are large. Hence factor 1 fulfills our criteria for a religiosity variable. The second factor is weak and unstable across waves. It mainly loads to the institutional items and will not be further discussed. The third and higher factors are of no consequence. Our results also show that the factor loadings tend to fall a little for more recent WVS waves.

It is important that the loadings to factor 1 have high cross-wave stability. This indicates that the items tap into a latent variable that is very salient for the respondents. In other words, our measure of the *R*-variable is robust.

The bottom line in the table shows that the first factor loads negatively to income. The loading is significant by the stability test, even if it tends to rise as the sample comes to cover more of the income range. Thus, our main finding is a dominant first factor that is negatively correlated with income. The calculations giving the right hand column in Table 1 and the bottom line in Table 2 are quite different. It is reassuring that the results are similar. This already suggests a strong religious transition.

The factor analysis is based on a balanced sample (within each wave), so it does not use all the data (in average about 80 %). Alternatively, the factor analysis has been run on the pairwise correlations, where each correlation uses as many observations as possible. The pairwise correlation factor analysis uses more data, but it is less consistent, so it is debatable which sample to prefer in principle. However, the alternative results are so close that they are not reported here. Also, an aggregate factor analyses has been made by joining the individual waves into one matrix. It also gives much the same results. The same apply to the average non-diagonal correlations.

The standard method to weight a set of correlated items is to use principal components. A table of principal components has been calculated in parallel to Table 2. The average

columns of the principal components are used as weights for the $N = 240$ religiosity scores R given in the Appendix.

3.3 *The changing composition of the sample*¹⁵

A complete sample for the 95 countries would hold 475 polls, with 6,650 polled items, but our sample only contains 240 polls and 2,331 polled items. As a result, the problems of sample composition and gaps are so large that it makes little sense to use the panel structure.¹⁶ In the regression analyses, we are confined to using the cross-country sample of 95 country averages of \underline{R} or the full sample with 240 R s and controls for waves and selected groups of countries and religions. The question is whether the shortcomings of the sample may bias the estimated transition slope.

For instance, the 1982 wave covered only 12 % of the countries of the world. These countries were mostly western countries which were almost twice as rich as the average country in the world. After the first wave, the samples came to contain many Post Communist (P-Com) countries and some LDCs (Others). As the transition from communism has progressed and largely succeeded, less P-Com countries are included in the most recent wave. However, the sample has now grown due to the inclusion of Muslim countries.

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Table 3
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Each wave of the WVS has a somewhat skewed sample distribution of countries relative to the true distribution of countries in the world. However, the picture looks much better once all waves are taken together. The last column of Table 3 reveals that our measure of R is based on a sample of 95 countries which hold almost 90 % of the world population and are only 13 % richer than the average country in the world economy. Thus, the data are adequate for a study of the transition path.

4. **The religious transition and long-run causality**

The GT (Grand Transition) framework claims that the process of long run development consists of interacting transitions in most fields of society that are driven by the level of income.¹⁷ Below it is tested if the presumed causality, $y \Rightarrow R$, also holds for the religious transition. This section controls for simultaneity, but only in the long run. We know from the

study of other transitions that the long-run pattern found may hide more complex patterns in the shorter run.

4.1 *The transition idea: A shift between two levels*

The GT normally takes one to two centuries to unfold, but some cases are known in which it has taken half a century only. The least controversial of the many transitions involved is the agricultural transition. Here plenty of data exists, and it is a fairly smooth process. It is sketched on Figure 1a, see Gundlach and Paldam (2011).

Figure 1

Figure 1b is a preview of our findings about the religious transition. Far less data are available and it is a much more noisy transition. Our hypothesis is that ideal data would reveal the typical form of a transition curve, shown as the dotted transition line. It has four features: (T1) A stable high traditional level, R^T , (T2) a transition with a negative slope, $\lambda < 0$, and (T3) a stable low modern level, R^M . The key feature is (T4) causality from income to religiosity. In order to estimate the causal income effect, a set of instrumental variables is needed.

4.2 *The DP-variables used as instruments in the long run causality test*

In the part of Europe where both authors live, the dominating religion has changed twice in the recorded history of the last dozen centuries. Religion has been similarly stable in most parts of the world. This suggests that religiosity may also change slowly which motivates the focus on the long run in the present paper.

The most comprehensive information on cross-country differences in long run growth is contained in present cross-country differences in the level of income. The question is how the potential causality from income (growth) to religiosity can be identified. To this end, we use instruments that measure the *development potential* (DP) of countries due to natural conditions prevailing in the regions of present-day countries at the time of the Neolithic Revolution. The DP-variables are inspired by Diamond (1997) and have been compiled by Olsson and Hibbs (2005). The Appendix gives the definitions and sources of the DP-variables and other measures of bio-geography that can be used to instrument modern incomes.

The *biological* variables count the number of domesticable animals and arable plants in various regions in those distant times. All biological variables are largely time-invariant and may identify exogenous cross-country differences in prosperity. The *geographical*

variables cover the more or less fortunate location of countries as regards movements of goods and ideas – it may matter for early agricultural development whether a country belongs to a large landmass or to a distant island, whether a landmass spreads out at an east-west axis or a north-south axis, whether a country is at the right distance from the equator, and whether it has access to long-distance trade via sea lanes. Two alternative variables used are a measure of the potential for malaria transmission and the average days with frost per winter.

On the face of it, it is inconceivable that these instrumental variables can possibly work, but they do, as shown in the papers referred to in footnote 17. Our instrumental variables are also in line with the unified growth theory of Galor (2005), who argues that modern economic development builds upon the deep changes in society that took place during the long period of very slow growth in the “Malthusian” era, which lasted till the onset of the Industrial Revolution.

4.3 The statistical causality test: Comparing OLS and IV estimates of the base model

The DP-instruments are available as cross-country data sets with 59 to 85 observations which can be merged with the cross-country data set for religiosity \underline{R}_i which has 95 observations. The income variable, \underline{y}_i , is averaged in the same way as the R -score. The two estimates are:

- (1) $\underline{R}_i = \alpha + \lambda_{OLS} \underline{y}_i + \varepsilon_i$, *base model*, i is an index for countries. The residuals are ε .
- (2) $\underline{R}_i = \alpha + \lambda_{IV} \underline{y}_i^{IV} + \nu_i$, which is a second stage estimate. The first stage instruments income \underline{y} with the DP-variables. The residuals are ν .

The test of the main direction of causality between religiosity and income compares estimates of the transition slopes, λ_{OLS} and λ_{IV} , for different combinations of the DP-instruments. The results are reported in Table 4.

Table 4

The first section of the table brings the OLS-estimates, which are another representation of the negative long-run correlation of income and religiosity discussed in section 3.2. The order of magnitude of the slope is $\lambda_{OLS} \approx -12$.

Next, the validity of the IV-estimates has to be considered: the first stage R^2 is high for all instrument combinations, columns (1) to (5). The Sargan test reveals that the instruments are valid and correctly excluded from the estimation equation in three out of five cases.

The Cragg-Donald (CD) test statistics are above or at the critical value. The instruments are thus reasonably strong.

Hence, the IV-results are statistically valid and identify the *causal* effect of income on religiosity, $\underline{y} \Rightarrow \underline{R}$. All five IV-estimates of the slope are highly significant and rather similar: $\lambda_{IV} \approx -14$. Our favorite combination of instruments is in column (1). It uses the principal components of the geographical variables and the biological variables as the two DP-variables, but statistically the test results are better in column (2).

It looks as if $\lambda_{OLS} < \lambda_{IV}$. This is formally tested by the Hausman C-test, which rejects the difference in three cases and accepts it in two.¹⁸ We conclude that the simultaneity bias in the OLS estimate of λ , is small and of a dubious significance.

This is further checked in the last section of Table 4 (shaded), where religiosity is used to explain income, $\underline{R} \Rightarrow \underline{y}$, and the DP variables instrument religiosity. Only the results of the CD test and the Hausman C-test are reported. The CD test statistics are lower than in the main regressions in all cases and higher than the critical value in one case only. The Hausman C-statistic shows that the difference in the coefficients on R is statistically significant. This confirms that our instruments show causality from income to religiosity, but not the other way.

The plausibility of the estimated transition slope can be assessed by calculating the implied orders of magnitudes. The full transition has an income range of 4 – 4½ lp. The size of the estimated slope $\lambda_{OLS} \approx \lambda_{IV} \approx -13$ pp for one lp income therefore corresponds to a fall of about 50 pp over the full range of the transition. The full transition normally takes 100-200 years. So the change per year is only 0.2-0.5 pp, which gives 1-2 pp over the 5 years between WVS waves. Hence the religious transition is easy to overlook in the perspective of 5-10 years, especially as religiosity data vary considerably across countries.¹⁹

The Appendix reports robustness checks of the estimates of Table 4 by including a set of controls for major religions and political systems. The estimated transition slope remains unaffected by the inclusion of controls, as in the next section.

5. The robustness of the transition slope λ

This section uses the data for all 240 polls, and takes it for granted that causality is from income y to R . Robustness of the estimate of λ is considered with regard to changes over time, outliers, and groups of countries with certain political regimes and religions. It is arguable that some of the 240 poll are done in countries where respondents are under some pressure to

declare themselves religious or non-religious. The analysis is made to allow the reader to see precisely what happens to the estimate of λ if one or more countries are deleted from the sample.

5.1 *A plot of R as a function of income*

Figure 2a shows the relation between religiosity and income based on all 240 data points. Figure 2b shows the same relation for the largest homogenous group: The Christian countries. Both graphs include a kernel-curve which represents a local polynomial smoothing of the data points with a fixed bandwidth, and as such, this is a good way to look for possible non-linearities in the data points.

Figure 2a

Figure 2b

The theoretical transition curve on Figure 1b features two stable levels and an adjustment path. The WVS covers relatively few countries near the traditional level in the bottom income percentile, but these countries have R s of about 80 pp. The measure of R can hardly be higher than 90 %, so the traditional level $R^T \approx 80$ % is well determined. The fall in the curve and hence the adjustment path is obvious, but the modern equilibrium level R^M is not well determined in the highest income percentile. It is clear that the modern level is below 40 %, but a stable level has not been reached. Maybe the fall is becoming slower, so perhaps it will cease, but it is difficult to predict if it will stabilize at 30 % or continue to fall even lower.

The data points scatter considerably around the average curve, so the religious transition only explains some of the observed variation in religiosity. China and the USA are depicted in black on Figure 2 since Section 5.3 below points to these countries as the most extreme ones. They are outliers reflecting inertia in religiosity. The general impression is that the cross-wave observations for a country are often quite similar relative to the general trend (but not as extreme as for the two outliers). This country inertia is confirmed by a more detailed analysis, see Appendix. The inertia can (often) be explained by historical events with strong path dependency.

The two scatter diagrams also give the correlation of the observations. For all $N = 240$ observations of Figure 2a the coefficient of correlation is $r = -0.52$, and for the $N = 124$

Christian countries of Figure 2b $r = -0.70$. A strict division into three main groups (not shown) also gives stable correlations. The $N = 82$ observations for the *West* $r = -0.48$; the $N = 63$ observations for *P-Com* $r = -0.53$; and for the $N = 95$ observations for *Others* $r = -0.47$. The same picture of stability will turn up in the multilateral regressions below.

5.2 Changes of religiosity over time, for $\Delta M = 906$ polled item changes

The analysis of the trends over time is based on first differences across waves. This is close to a fixed effect analysis of the “within-country” variation. But using first differences of the religiosity score would reduce the sample size by too much. Hence, we use the larger sample of $M = 2331$ polled items, where each of the items is taken as a proxy for the aggregated R-score. This sample gives $\Delta M = 906$ observations on item changes which are defined as $\Delta_{ijt} = R_{ijt} - R_{ijt-1}$ where i is country, j is item, and t is wave.

Table 5 summarizes the results for item changes. A negative trend is expected according to Table 4 and Figure 2a, but the average of all 906 cross-wave changes $\Delta_{ijt} = R_{ijt} - R_{ijt-1}$ is 0.34 which is statistically insignificant with a t-ratio of 1.1. Hence there is no statistically significant trend. But if the overrepresented Post-Communist (P-Com) countries are excluded, $N = 625$ observations remain and the average cross-wave change of the religiosity items is -1.0 with a t-ratio of -2.8. A change of -1 pp per 5-year period is precisely as predicted from Table 4.

Table 5

The average changes in the religiosity items for the *West* are significantly negative, and the fall is -1.2 pp on average per wave (i.e. over 5 years). Note that the fall gets gradually smaller, suggesting that the transition may converge to a stable level. For *Others* the fall is similar in size, but more erratic. It is often alleged that religiosity has increased in the Muslim world in the last quarter century, but this is not confirmed. Table 6 below shows that Muslim countries do have a relatively high level of religiosity relative to their income level, but it falls just as in other countries. The Latin American countries also have a large fall in religiosity items in 2000-2005. Religiosity falls by about -1.5 pp per wave in both of these country groups, just as predicted from all countries based on Table 4. However, the *P-Com* countries have a significant rise in religiosity items by 3.3 pp per wave from 1990 to 2005.

The P-Com countries are the big exception to the general pattern. Our interpretation is that the suppression of religiosity has ceased with the fall of communism, and so religiosity is returning to a normal level conditioned by the level of income. This interpretation implies that the suppression of religiosity by the communist regimes was temporarily successful, as will be further discussed in Sections 5.4 and 7.1.

5.3 Measurement error and outliers: The robustness of λ to the deletion of countries

The 240 polls have 1 to 5 polls for each country. The base model (1) becomes:

$$(3) \quad R_j = \alpha + \lambda y_j + \mu_j, \quad \text{for } j = 1, \dots, 240 \text{ and } \mu \text{ are the residuals.}$$

The base regression with all 240 observations gives the estimate λ_{all} . It is possible that the size of the estimated λ hinges upon the inclusion of one or a few outliers. It is also possible that the data for some countries are suspicious, so that one may like to see if they bias the results. Therefore, 95 estimates, $\lambda_1, \dots, \lambda_{95}$, are generated where λ_i is estimated on the sample after excluding the observations for country i . These estimates differ from λ_{all} by the percentage effect $\eta = 100 \cdot (\lambda_i / \lambda_{all} - 1)$. Figure 3 shows the distribution of the 95 effects.

Figure 3

The distribution of the η 's is nicely normal with a rather small standard deviation. For more than half of the 95 countries $-1 < \eta < 1$. This means that if there is some measurement error in the data for a country, this cannot influence the estimate of λ by more than 1 %. However, China and the USA are outliers with η 's of about -8 %. As seen on Figure 2a, China is (still) a relatively poor country with low religiosity and the USA is a rich country with high religiosity, so their effect on the estimate of λ is much the same. The exclusion of each country increases the numerical size of the parameter by 8 %. If the two outliers are both deleted from the sample the estimated transition becomes 16 % faster, so that it changes from -11 to $-12^{3/4}$. This is by far the strongest effect one can get by deleting two countries.

Figure 3 shows that the effect of excluding other countries is much smaller. If one take the polls from the MENA countries (Middle East and North Africa) to be suspicious, it is reassuring to note that if the single poll for Saudi Arabia is excluded the effect is -0.1 %, and if the three polls for Turkey are deleted the effect is $+0.3$ %. If all 17 polls from the 9 MENA

countries are deleted the effect is +6.8 %, which is numerically less than the effect (−8.2 %) of deleting the 4 polls from China.

More detailed results are included in Table A5 in the Appendix. The estimated η 's are approximately additive. For two to three countries the approximation is good, so that the effect of deleting two countries is the sum of the effect of the deletion of each. Table A5 shows that even with deleting up to 8-10 countries, summing up the single country effects still provides a rather good approximation. Thus, if the reader doubts the accuracy of the data for some countries, it is easy to see how much their exclusion from the sample may matter for the estimate of the transition slope.

The effect of a full deletion of a country is an upper bound for the effect of a possible measurement error in the polls for the country. The true effect of a measurement error affecting the data of the country is likely to be (much) smaller.

5.4 *Sample skewnesses: The robustness of λ to religions and country groups*

The robustness of the transition slope λ is also checked by including binary dummies for the main country groups and religions. The dummies are documented in the Appendix, but they should be self explanatory. The results are reported in Table 6 which has three parts. Part A is the point of reference using the base model (3) for the full sample with 240 polls.²⁰

Table 6

Part B reports results for ten independent regressions of religiosity on a constant and *one* of the country (group) dummies. Income is excluded in column (2) and included in column (3). The results for the base model in Part A are the averages of the ten estimates. Here the first t-ratio is the average from the ten regressions, and the second t-ratio indicates the cross-estimate stability of the ten regressions.

Part C gives the results of two pairs of regressions. Columns (4a) and (5a) include *all* country dummies, without and with income. The corresponding columns (4b) and (5b) give the tested-down versions, where the least significant country dummies have been excluded, one at a time, till only significant variables remain in the reported specification.

Parts B and C show that most of country dummies are statistically significant, and when they are jointly included the fit (R^2) is greatly improved from 0.267 to 0.626. However, this barely affects the estimate of λ . The top row of estimates in the table shows that $\lambda \approx -11$. This is in line with the results of Table 4 and the “within” result of Table 5. Thus, our

estimate of λ appears to be robust to the many controls tried, just as in section 5.3. A further set of regression specifications in Section 3 of the Appendix shows that the estimate of λ is also robust to the inclusion of variables measuring political regime types and main religious groups. In addition, Section 4 of the Appendix shows that an estimate of $\lambda \approx -11$ can be derived from the cross-country variation *and* from the within-country variation of the full sample.

5.5 *Detour: Stories of the estimated coefficients on the country dummies*

It is worth leaving the main story for a brief detour and look at the coefficients on some of the country groups in Table 6.

The *West* changes sign from negative significant to positive insignificant when controlled for income. The West is relatively rich, so these estimates say that *all* of the secularization of the West can be explained by the rise in income. The USA is only marginally more religious than the average of all countries, but it is much richer, so it is a very religious country when its religiosity level is adjusted for the level of income (positive significant without and with income). An unusually low level of religiosity is found in the Scandinavian countries (negative significant without and with income). They have almost the same level of income as the United States, but about 35 pp less religiosity.

The oriental group is less religious than other countries. China is extreme when unadjusted, and even more so, when adjusted for income.

The Muslim countries are relatively religious, but only by 10 to 11 pp when controlled for income. The Arab countries are marginally more religious than other Muslim countries (see Paldam 2008), but the difference is insignificant.²¹ If the Muslim countries became as rich as the West, they would be less religious than the USA.

The *P-Com* countries are relatively less religious by about 14 pp when controlled for income. These countries were not covered by the WVS when they were communist before 1990 (except Hungary). However, religiosity has increased by about 11.4 pp in these countries between 1990 and 2005. The average increase is thus about 6 pp by a 5-year period. By adding 14 pp and 6 pp, we assess that religiosity in the communist period was about 20 pp lower than in other countries with comparable levels of income. This assessment is further evaluated in section 7.1.

6. The demand side: A substitution of science for religion

People demand religion for many reasons. The following four, labeled D1-D4, seem to be the main ones: D1 as higher protection against risk to life and property, D2 for consolation if these risks materialize, D3 to explain the unknown, and D4 as existential explanation. While D1 to D3 deal with demand for an input into production, D4 is more of a consumption item.

6.1 Religion as a productive input

One of the functions of religion is to offer protection against risks to life (of self and family) and property (D1). The Grand Transition (GT) doubles the expected life span from about 40 to 80 years due to better healthcare, food, environmental control, etc. Thus the GT greatly reduces risks to life. The GT also allows many people to save enough for an adequate pension and it provides insurance services, public transfers etc. which all reduce the welfare loss due to economic misfortune. So the world becomes much less dangerous with rising levels of development. Accordingly, the need for religious protection is reduced. It follows that the demand for religion falls with rising levels of development.

In case protection against risk fails, people need consolation which is also provided by religion (D2).²² This is obviously an important factor in poor countries where the risk to life is high. However, modern society has reduced the frequency of such events and developed alternative ways to alleviate the pain they cause, so the demand for religion as providing consolation also tends to fall with rising levels of development.

Another function of religion is to provide an explanation of the unknown (D3). Science is an alternative, and it certainly has made progress in reducing the unknown. In the post-transition world people have largely ceased to associate diseases to evil spirits and magic spells.²³ It is no wonder that many churches have fought to uphold religious explanations against the onslaught of scientific explanations.

All three items D1-D3 are illustrated by the plight of a fisherman. Before the GT he had a dangerous and relatively short life due to the hazards of the sea. Thus, religion was highly needed. Now fishermen have a life expectancy that is close to everybody else. All fishermen know that what brought about the change was not better prayers, but better boats, weather forecasts, radio, radar, GPS, etc. In the rich countries, this seems to have reduced the previously high level of religiosity in fishing towns almost to national levels.

6.2 Religion as a consumption good

Three points are considered. They may be expressed in alternative ways and they have some overlap. They suggest that religion is a consumption good in positive demand.

The onion view. It is often said that the development in the last 400-500 years in the West has peeled of all the unimportant reasons to be religious and left the key reason, namely to provide existential explanations (D4). The philosophical school of existentialism discusses if this argument makes sense, i.e. if the onion has a core.

The extra view. Also, many people feel that the world is too dull when everything is given a rational explanation. Some people claim that they are wiser when they have metaphysical explanations of the world in addition to all the physical ones which they share with irreligious people. A certain terminology speaks of “simple” materialism versus “deep” insight.²⁴

The instinct view: Another argument is that people have a religious instinct which has to be satisfied. People defending religion sometimes argue that atheists behave like believers in certain ways. Instincts suggests a physical base in the brain, and the new field of brain scanning research looks at the reactions in the brain to religious stimuli to see if the reaction differs from other emotional stimuli, see e.g. Schjødt et al (2008). This research is in its infancy, but so far the results have been mainly negative.

A number of additional arguments can be added. Churches are often strongly integrated into national history and culture. Religious ceremonies are demanded by many as a way to attach their life to the traditions of society in connection with the stages in life such as birth, maturity, marriage, and death. This argument leads to the conjecture that the consumption component of religion may have some irreducible positive levels, meaning that a measure of religiosity would approach a positive constant. Our empirical findings suggest that the irreducible level of religiosity is likely to be less than half of the traditional level, but this conjecture cannot be falsified with the available data.

Two of the 14 items in the WVS deal with the demand for religion as a consumption good. One is item 7, dealing with moments of prayer/meditation and the other is item 13, asking if churches satisfy a spiritual need. In Table 1 both items have negative correlations to income that are fairly typical for all other items. This observation allows us to treat the whole of the demand side (D1-D4) as factor substitution in Section 8.

7. The supply side: Substituting secular for religious institutions

This section presents a theory of the supply of religious goods which falls during the transition. The argument is supported by evidence from two historical experiments.

7.1 *The loss-of-channels theory*²⁵

Churches and other religious institutions supply religious goods such as belief systems and religious ceremonies.²⁶ They are supplied directly to the religious customers by the churches. In addition, religious goods have also been supplied indirectly through three additional channels: education, social security, and healthcare which are three *core collective goods*.

Before the GT, the role of churches in the production of the three core goods was large, and hence the church controlled the three indirect channels for the provision of religious goods. This secured a high level of religiosity. The GT has affected the economy-wide production of the three core collective goods in two ways: (i) Their share in GDP has increased from about 5-10 % to about 30-40 %, and (ii) the production of these goods has moved from the church to the state.²⁷ When a secular state takes over, it is likely that it will use the channels to supply (much) less religion and instead its own ideology.

In passing, we note that the take-over by the state has been less complete in the USA than in other developed countries. This may contribute to the high R-scores in the USA.

The reason for the loss of control by the church over the three channels during the GT is simple and self-reinforcing. In poor societies, the tax base is relatively small and the tax revenue is mainly used to finance the external and internal power-structure that is holding together the state against internal and external enemies. Churches did not have the power to tax, but they collected a great deal in alms. These resources were used to pay for the production of the religious goods and for providing a minimum level of the three core goods.

When economic development necessitated a large expansion of education, and rising incomes allowed better healthcare and social security, the church was no longer able to provide, simply for financial reasons. The costs became too large to be financed by alms. At the same time, the state developed an ever greater ability to tax, and hereby it gained control over the provision of the core goods. This in turn undermined the ability of churches to collect alms. The result was a dynamic take-over of the three channels by the state and a subsequent decline in religiosity. Thus a transition occurs. Secular education contributes by forming the

values and beliefs of people. Social security and healthcare contribute by handling major risks to the individual. As discussed in section 6.1, risk is an aspect of life where religion enters.

Normally these take-over processes are gradual, lasting a century or more, but history has provided some cases where the take-over was fast and complete. We shall look at two such historical experiments that show that the loss of the core heights of control by the churches has had a substantial negative effect on our measure of religiosity, the *R*-score. This effect can be explained within the economics of the GT.²⁸

7.2 *A large scale historical experiment: Communist rule in East- and Central Europe*

The data contain 23 Post Communist countries, where all but two are in East and Central Europe. They are the successor states of eight Communist countries. The data also contain two East Asian countries that are still Communist. The pre-communist governments in the East European countries seemed to have behaved towards the church much like the typical government in the rest of Europe. When adjusted for income, the religiosity levels in these countries were probably similar to the levels in the rest of Europe.

These countries have had periods of 45 to 72 years of totalitarian communist rule. During the years of Communist rule, the state was actively anti-religious. Communism is a monopoly ideology that is hostile towards competing belief systems. Marx was an atheist himself, claiming that “religion is the opium of the people”. He thought religion would dull the minds of people and thereby expose them to capitalist exploitation.

Consequently, the Communist rulers made a systematic effort to replace religion by the secular communist ideology.²⁹ This was done by closing the three channels from the church, and actively using them for anti-church propaganda. Also, church organizations were systematically weakened by a multitude of administrative devices. Probably the most powerful one was that the party record (nomenclature) which was decisive for individual careers registered links to a church as negative information.³⁰

The estimates of Section 5 imply that the income-conditioned level of religiosity was smaller, by about 20 pp, in the communist countries.

After the fall of Communism in 1990, pressures against religion have ceased and the measures of religiosity have increased by no less than 11 pp, as shown. This is consistent with the expected reaction to the discontinuation of the anti religious policies. We conclude that the loss of control over the three core collective goods under Communism affected the level of religiosity negatively. A similar effect can also be seen from an altogether separate and much smaller historical experiment.

7.3 *A small scale historical experiment: The Southern Cone*

The three Latin American neighbors Argentina, Chile, and Uruguay (known as the Southern Cone) have much in common. They have approximately the same immigration history, with a dominating Spanish speaking population essentially from Spain and Italy. As in these homelands, the Catholic religion dominates in the Southern Cone as well. The three neighbors also have much the same history of economic development. Of course it is easy to mention many differences, but the level of religiosity would probably have been roughly the same across the Southern Cone, except for one historical event.

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Table 7

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In Uruguay, politics has been dominated by the Colorado party. Most of the political institutions of the country were formed during the early rule of that party, notably by José Batlle y Ordóñez (1856-1929), who served as president in 1899, 1903-1907, and 1911-1915. His policies greatly expanded the provision of the three core collective goods and placed them fully within state control. He also enforced a strict separation of state and church.³¹ Since then, this has been upheld as a main policy rationale of the country. Table 7 shows the differential effect on the *R*-score. Only one measure of *R* is available for Uruguay from the WVS, but it deviates substantially from the remaining nine measures for the Southern Cone. The difference is approximately 20 pp, like in the case of the P-Com countries.³²

7.4 *Summary of the supply side argument*

Both historical experiments deal with the effect of political change. However, the state already played a role in the production of the three public goods before the change. So the 20 pp fall of religiosity reached in the two examples is likely to be a minimum that can be expected from changing control over the three channels. As the observed total effect of the GT on religiosity is about 50 pp, this means that the loss of control may account for as much as half of the transition.

Sections 2.1 and 4.1 compare the fall in religiosity to the fall in the share of agriculture in GDP. The share falls, but it cannot become zero since everybody has to eat. Another parallel is that the agricultural sector changes from being a contributor of taxes in traditional society to become a receiver of subsidies in modern society, see Krueger (1996). In the same

way churches are net providers of collective goods in traditional society and net recipients of subsidies in modern society.

8. A model of the religious transition

The previous sections have presented evidence that rising levels of income cause a decline of the measure R of religiosity, most components of the demand for religious goods, and the supply of core collective goods by religious institutions. In this section, a simple growth model is used to explain the religious transition. It is demonstrated how the estimated transition slope, λ , relates to the two substitution effects.

8.1 The religious Solow model

The core of the transition process is substitution and hence the growth model uses CES technology.³³ The stocks of religious beliefs B and scientific knowledge Z are the only factors of production. B is produced by churches, and Z is produced by secular institutions. The two substitutable inputs are alternative ways of decision making. Each input has diminishing returns. Population is constant and normalized to 1. The model only considers the demand for religion as a factor of production, but it is assumed proportional to total demand. In the same way the substitution of science for religion is assumed to be proportional to the substitution of state provision of core collective goods for church provision. There is no exogenous technological change. The output of the economy at time t is produced by

$$(4) \quad Y_t = F(Z_t, B) = A \left[\delta Z_t^{-\rho} + (1 - \delta) B^{-\rho} \right]^{-1/\rho},$$

where Y_t is real output, Z_t is the stock of scientific knowledge, B is the stock of religious beliefs taken to be constant, and A , δ , and ρ are parameters of scale, distribution and substitution, respectively. They satisfy the conditions: $A > 0$, $0 < \delta < 1$, and $\rho \geq -1$. The elasticity of substitution is $\sigma = 1 / (1 + \rho)$.

Dividing both sides of equation (4) by B generates the intensive form as

$$(5) \quad \tilde{y}_t = f(z_t) = A \left[\delta z_t^{-\rho} + (1 - \delta) \right]^{-1/\rho}, \text{ with } \tilde{y}_t = Y_t / B \text{ and } z_t = Z_t / B$$

It is assumed that the stock of scientific knowledge can be accumulated and that the stock of religious beliefs is constant. A constant fraction of output $s_z = \dot{Z} / Y$ is saved and invested. The stock of scientific knowledge depreciates with a constant rate $d = D/Z$. The growth rate of the economy, γ_z , is given by the difference between the rate of knowledge accumulation and depreciation as

$$(6) \quad \gamma_z = s_z \cdot f'(z) / z - d$$

As z goes to infinity, the first term of equation (6) approaches a positive constant if the elasticity of substitution is larger than 1. As is well known,³⁴ the CES technology with $\sigma > 1$ generates endogenous income growth if the parameters satisfy the inequality condition

$$(7) \quad s_z A \delta^{-1/\rho} > d$$

Figure 4

This is shown in Figure 4. Whenever the marginal product of scientific knowledge (more generally, the marginal product of the cumulative, productive input) asymptotically achieves some lower bound that is greater than zero and larger than the value of the rate of depreciation, there will be a positive long-run growth rate. Thus, the model produces long-run endogenous growth by substitution and without exogenous technological progress.

8.2 *Relating the religious Solow model to the basic regression model*

We now show that this highly stylized framework captures important parts of the process of the religious transition.

The CES production function allows for output in the presence of only one of the inputs, in contrast to a Cobb-Douglas production function. With no scientific knowledge $Z \approx 0$, there is no substitution and hence no growth, but there could be output due to religious beliefs B . So the modeling framework is in line with the Malthusian stagnation before the Industrial Revolution and modern economic growth thereafter.

The R measure of religiosity is defined as the weight given to religious beliefs in everyday decision making. In the religious Solow model this is interpreted as the weight of B in the production process, which is the factor share π_B of B . Thus, we define $R \equiv \pi_B$. In a CES

specification, the factor shares depend on the value of the distribution parameter, the values of the factor inputs, and the substitution parameter. The factor shares of B and Z are given by:

$$(8) \quad R \equiv \pi_B = \frac{(1-\delta)B^{-\rho}}{\delta Z^{-\rho} + (1-\delta)B^{-\rho}} \quad \text{and} \quad \pi_Z = \frac{\delta Z^{-\rho}}{\delta Z^{-\rho} + (1-\delta)B^{-\rho}} .$$

With scientific knowledge Z rising to infinity and constant religious beliefs B , the factor share of scientific knowledge will approach 100 % in the limit if $-1 < \rho < 0$, i.e., if $\sigma > 1$. Hence the factor share of religious beliefs will approach zero in the limit ($R \equiv \pi_B \rightarrow 0$) with rising Z . Rising Z implies rising income, so the model predicts the observed decline of religiosity with rising levels of income.

This means that the transition path starts at a constant high R^T , when Z is zero (or constant and low), and it goes to $R^M \approx 0$, for $Z \rightarrow \infty$. R^M might be non-zero if the consumption demand for religion does not fall to zero, when Z increases. Thus, it produces a transition path that looks like Figure 1b.

Endogenous growth by a CES-model with $\sigma > 1$, has been considered an empirically implausible case, simply because the traditional factor shares for capital and labor appear to be bounded at around one third and two thirds. However, factor shares for scientific knowledge and religious beliefs are likely to have a far larger range.

Our interpretation of the R -score as π_B invites the question whether and how the parameters of the growth model (4) can be related to the transition slope of the regression models (1)-(3). Klump and de la Grandville (2000) show that the steady state factor share of a normalized CES production function depends on the saving-investment rate and other parameters, including the substitution parameter. The saving-investment rate can be proxied by the level of per capita income. Using our notation with population normalized to 1, the result of Klump and de la Grandville (2000, p. 290) reads

$$(9) \quad \pi_Z = \delta [A s_z]^{-1/\rho} .$$

Assuming that $\sigma > 1$ and hence $-1 < \rho < 0$, equation (9) predicts a positive relation between s_z and π_Z . By implication, there must be a negative relation between s_z and π_B for $\sigma > 1$ and hence a negative ρ . Using the level of income \tilde{y} as a proxy for s_z and taking logs, we find

$$(10) \quad \ln \pi_B = c + \frac{1}{\rho} \ln \tilde{y}, \text{ where } c = -\frac{1}{\rho} \ln A - \ln \delta \text{ is a constant.}$$

Comparing equation (10) with our regression models (1)-(3), it turns out that the estimated transition slope can be interpreted as the inverse of the substitution parameter, at least if the different scaling of the variables is ignored:

$$(11) \quad \lambda = 1/\rho .$$

Our conceptualization of the religious transition critically hinges on an elasticity of substitution that is larger than 1. Both the demand factors and the supply factors discussed in the previous sections motivate the hypothesis that the elasticity of substitution between science and religion is large. For instance, fishermen will easily substitute radar, sonar, and weather forecasts for prayers when going to the open sea. Similarly, the accumulation of scientific knowledge will help to substitute the state supply of education, social security, and healthcare for the same supply provided by the church. Thus, there should be a high degree of substitution between science and religion both on the demand side and on the supply side. Further research will show whether this elasticity is high enough to explain the observed decline in religiosity with the suggested model of endogenous growth.

9. Conclusion: A clear transition

The religious transition is the decline of religiosity caused by rising levels of development. The paper estimates the path of the transition and explains the underlying mechanisms.

The path is analyzed at a cross-country macro level by a new composite measure of religiosity, which is termed the *R*-score. In the transition the *R*-score falls from about 80 % to about 40 %. The transition is still not complete in the developed countries, though it has slowed down. It will probably continue to 30 % or go even lower. Thus the religious transition is a fall in religiosity of about 50 pp. A set of formal tests shows that causality from income to religiosity dominates the relation. The estimated slope of the transition, λ , proved rather robust. It is strange that parts of the literature deny that secularization happens.

To establish the micro foundations of a macro regularity is notoriously difficult, and the empirical basis of the micro theory presented is weaker and more narrative than we would have preferred. However, we have presented three mechanisms, which can explain the

transition. They are all substitution effects. Religion is demanded as a factor of production and for consumption. When income rises the demand for religion as a factor of production will converge to zero in the limit, while the demand for religion as a consumption good will probably converge to a level well above zero. Religious institutions (churches) supply religious goods directly and indirectly through the three channels education, social security, and healthcare. Before the transition the church controlled the three channels. The transition has caused the secular state to take over all three channels.

The substitution effects on the demand side and the supply side are largely away from religion and towards science. It is demonstrated that these substitution effects can be captured by the aggregate elasticity of substitution of a CES production function. This framework shows how a large elasticity of substitution may explain the observed religious transition.

Thus, we conclude that the religious transition is a substantial phenomenon that has general explanations even if many details of these explanations differ across countries, and, without doubt, also between the religions.

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A * after the publication year indicates a source for the data. It does not necessarily appear in text

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WVS*, World Values Survey, home page <http://www.worldvaluessurvey.org>

Notes:

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3. The paper uses the World Bank terminology of dividing countries into DCs (developed) and LDCs (less developed), which are further divided into LICs (low income) and MICs (middle income).
4. Religion is often discussed using other languages than the one of economics. We do not discuss how well our analysis translates. However, we do suspect that it does translate.
5. One of the authors has experienced a whole town in the Sahel zone united in a communal prayer for rain.
6. See Inglehart et al (1998) and (2004). The data are available at <http://www.worldvaluessurvey.org>.
7. Source Maddison (2003) and the Maddison homepage. A few observations are assessed using the WDI.
8. Our readings in history suggest that there is some evidence in favor of the equivalence assumptions as regards the religiosity transition. The retrospective data for church attendance given in Iannaccone (2003) provide a partial confirmation. The data covers 32 countries from 1925 to 1990. Average attendance is 35 pp as for the same countries in the WVS. In the 65 year period attendance falls by 22 pp and incomes increase by almost 1.5 lp, so the fall is 15 pp per lp, as in Table 4 below.
9. The literature is enormous and written by authors of many trades, see Iannaccone (1998) for a survey. Our aim is to integrate the findings into the GT framework, so only a few standard references are included. Furthermore, religion is an important issue for many, and churches are often powerful organizations, so the field is replete with strong priors and interests that generate controversies of the tornado type where the center keeps moving.
10. The term *secularization* has several meanings, especially as the concept is often embedded in various theories, which we do not want to presume; see e.g. the article in Wikipedia. The religious transition is probably what most participants in the debate have in mind, but to avoid confusion this term is only used sparingly.
11. Reverse causality, $R \Rightarrow y$, demands (C2), and in addition that (A) these potentials are positively correlated to religiosity levels. The analysis finds only weak signs of reverse causality, and do to sort out (C2) and (A).
12. Many stories can be told of controversies between religion and science, though some counter-examples are available as well. For instance, various churches did fight the theories of Charles Darwin (1809-82), but his contemporary Gregor Mendel (1822-84) was a Catholic monk. Darwin and Mendel did not know the work of each others, and Mendel's brilliant paper came to break no paths as it remained unknown, for the next 35 years.
13. The main argument was developed by J.H. Boeke, 1884-1956. His books are only partly translated (from Dutch), but a summary is available in Higgins (1959).

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14. Another example is the religious basis for the laws in the Muslim world, generating ferocious laws keeping society fixed in an iron grip. However, such an approach was known to Christian societies as well. Tocqueville (1835, Cpt 2, II) describes how the 1650 code of law for Connecticut used the Old Testament as the basis for paragraphs prescribing capital punishment for apostasy, blasphemy, adultery, etc., much as in contemporary Saudi Arabia. When Tocqueville wrote, a substantial secularization of Connecticut had already occurred. It has continued until the present day so that criminals are rarely executed, and certainly not for the said crimes.
15. The changing composition of the country sample probably reflects topics of public debate at the time of the wave. It is difficult to fund such a large project as the *WVS*, and funding possibilities depend on the relevance of topics for actual public debates.
16. The paper thus presents OLS-estimates only. In section 4 of Appendix we show that the results are virtually the same using panel regressions.
17. Broader aspects of the GT perspective are discussed in Paldam and Gundlach (2008). The long-run causality test is developed in Gundlach and Paldam (2009a), it is also used in Gundlach and Paldam (2009b).
18. The approximate equality of the estimates rejects an endogeneity bias in the OLS estimate. Normally the DP-instruments show causality one way only, but exceptions may occur; see Gundlach and Paldam (2011).
19. A comparison of Morocco and New Zealand is illustrative. The two countries are close to the 25 and the 75 percentiles of the income distribution in the sample. The income of the two countries differ by $lp \approx 1.76$ points. A transition parameter of $\lambda \approx -13$ thus predicts that religiosity differ by 23 points. The actual difference is 48 points, so the transition effect accounts for a little less than half of the observed difference.
20. All these regressions have also been made with 4 wave-dummies. They sometimes became significant, but had virtually no effects on the other estimated coefficients, so they are not reported. Section 4 in the Appendix shows a typical example of the effect of wave dummies.
21. Note that the Arab dummy is additional to the Muslim dummy to see if the Arab countries differ. The analysis does not distinguish between income as such and development. The two concepts are normally much the same, but they differ in the case of oil-countries which has income without development.
22. The contradiction between D1 and D2 is a part of the theodicy problem. When God is good and almighty, how come that the world is so full of misery? It is a main theological problem, and though many answers exist, it has often been discussed whether they are satisfactory.
23. This is visible in Catholic churches. In poor countries it is common to find chapels where the walls are covered with silver models of parts of the human body donated by people who have been cured in the said part of their body by the saint of the chapel. Such models are rarer in the rich countries. Also, modern man uses machines he knows are man-made even if he does not understand how they work. Though it might help to ascribe *bugs* in our computer to *jujus*, we do not call a witch doctor but a computer geek to have them cured.
24. This argument does not support generalizations, since it is suggesting some kind of quantitative relation between wisdom and the size and complexity of the metaphysical structure people believe in, e.g. astrologists would be held to be wiser than astronomers.
25. The argument in this section is inspired by Puchades-Navarro and Montero (2009).
26. This was certainly the case in the West, but also in most other civilizations as far as we know.
27. In most countries these sectors also have private firms, but they will be disregarded in our discussion in the interest of brevity.

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28. The nature of the transition is visible to the naked eye by looking for the most spectacular monument in the similarly sized towns of Vienna and Seattle: In the old European town it is the medieval cathedral, in the new American town it is the Central Public Library. Both monuments were built from donations.
 29. Bjørnskov and Paldam (2010) study the cross-country pattern in mass support for socialism, based on a WVS item about the preferences for public vs private ownership to business. They find that mass support for socialism in the P-Com countries are much the same as in Western Europe, when income is controlled for.
 30. Several studies have been made of the waves of prosecution and coexistence of churches and states during Communism, notably in the Soviet Union and Poland, see e.g. Anderson (1994) and Ramet (1987). During the Second World War, a period of Church-State cooperation occurred. But in general a secular totalitarian state could not tolerate an alternative hierarchy.
 31. The separation was so strict that religious symbols such as crosses were forbidden in schools and hospitals.
 32. The reader can confirm the information in Table 7 by checking the *religion* information in the CIA Factbook for the three countries. It gives the same striking difference. In Uruguay no less than 40 % of the population reported at the last census (2006) that they were “denominational” or “atheist or agnostic”. These categories are not present in Argentina and Chile.
 33. The CES production function was first suggested by Solow (1956); but the actual functional form of the production function was derived by Arrow et al. (1961).
 34. We shall present a number of formulas without the full derivation. Several textbooks (e.g., Barro and Sala-i-Martin 2004 pp 68-71) give the detailed derivations.
 35. We use the update of February 2010, posted one month before Maddison passed away.
 36. Reprinted 1920 in *Gesammelte Aufsätze zur Religionssoziologie*, 17-206. Mostly reprinted in that version.