11. The Religious Transition

The chapters until now have looked at transitions of institutions that are clearly related to the economy. I now turn to religion that, on the face of it, is quite far from the economy, but even then, religiosity has a highly significant transition. The chapter distinguishes between the qualitative variable religion and the quantitative variable religiosity:

Religion is a 'package good'. It is a binary choice whether people buy into the package. Most people know and readily say what their religion is. It has a large element of tradition – it is typically the same within a family for many generations. The package is complex, and it changes a little over time. Religions are produced in two ways: by Churches and within families. It is used as a factor of production and for consumption.

Religiosity is the *amount* of the good used/consumed, reflecting an intensity. It is the weight of (any) religion in all aspects of life. The stock of religious beliefs may be constant, but the relevance of these beliefs for decision-making changes depending on the level of development, which is also the level of education and knowledge.

Table 1. New variables and terms used in Chapter 11

Variable	Definition and source
	Main concepts
Church	Organization of a religion. Term used for want of a better one. Covers all religions.
church	Building used for religious services. May be a mosque, temple, synagogue, wat, etc.
Religion	Binary variable of belonging. People know which religion they belong to, if any.
Religiosity	Quantitative variable of intensity. The importance of religion in all aspects of life.
	Religiosity variable R, Sections 3-8.
Source	World Values Survey: http://www.worldvaluessurvey.org/wvs.jsp.
R	*Religiosity index* in percent, factor one in factor analysis of 14 religiosity items.
$\Pi^R(y)$	*Transition path*. The transition is 50 pp (percentage points), slope $\lambda^R = \partial\Pi^R/\partial y \approx -9.5$
$K^R(y, bw)$	*Kernel regression* with bandwidth *bw*. Estimate of transition curve, $K^R(y, bw) \approx \Pi^R(y)$.
	Church s-proxy for religiosity. Historical data, Sections 9-10 (a)
Source	Own compilation from several sources; see Paldam and Paldam (2017).
S, s	*Supply* of churches. The stock of churches, which per capita is termed *church density*.
D, d	*Demand* for churches Aggregate and per capita; d_t is unobserved
κ	*Capacity* utilization, relative to stock: $S_t = D_t(1 + \kappa)$, in equilibrium $S_t{}^* = D_t$
$d \approx aR$	Relation between the two measures of religiosity, where a is approximately constant.

Note (a). The church data are for every 5th year 1300 to 2016. For Denmark only.

Religiosity has been discussed from many perspectives. In this book, the perspective is growth and development economics. First, religiosity is attached to this frame of reference (s1), and the relevant literature is discussed (s2). The *R*-variable for religiosity follows from the definition of religiosity that is reached from a factor analysis of 14 items in the World Values Survey (s3). The 332 observations for the *R*-variable allow an estimate of the transition curve $R = \Pi^R(y)$ (s4). The DP-test shows that the main direction of causality is from income to *R* (s5). The changes in *R* over time show some cyclicality, especially in the post-socialist countries (s6). The slope of the transition-curve proves to be quite robust (s7), even when China and the United States are conspicuous outliers (s8). The per capita density of churches is a historical religiosity proxy. It is available for Denmark only, but for 7 centuries. From casual observation, I think that it may generalize. It confirms equivalence (s10).

11.1 Religiosity in the theory of growth and development

Religion is used as a ***consumption good*** when people pray/meditate (often in churches, i.e. places of worship) to achieve (existential) peace of mind. Chapter 10.3 discussed the theory of demand for intangible goods. When religion is seen as one such good, we need (at least) an income elasticity to understand how religiosity reacts to development. One explanation of the Religious Transition may be that the elasticity is negative. This tallies with the idea that religion is a necessity that becomes less important when the choice space widens due to rising income. This theory seems likely, but it is difficult to substantiate.

Religion is used as a ***factor of production*** when people pray for good health or a good harvest,[1] and when political leaders are blessed by religious ceremonies. The theory of growth and development sees the economy as Equation (1) a macro production function, *F*, which produces GDP, *Y*, by means of factors of production: labor, *L*, human capital, *H*, physical capital, *K*, and knowledge, *A*, which enters production through *K* and *H*. Religion/religiosity has an important, but rarely discussed, role in the theory. In the traditional steady state, A_t was stationary and dominated by traditions that were greatly influenced by religion. This is written as Equation (2), where A_t is the sum of: Ω the religious part and Z_t the secular one.

(1) $Y_t = A_t F(L_t, H_t, K_t)$, *t* is time.

(2) $A_t = \Omega + Z_t$, religious knowledge Ω has no time index.

[1] The author has experienced a whole town in the Sahel zone (in Africa) united in a communal prayer for rain, when the rainy season was delayed. In the Developed World, farmers drill boreholes and irrigate.

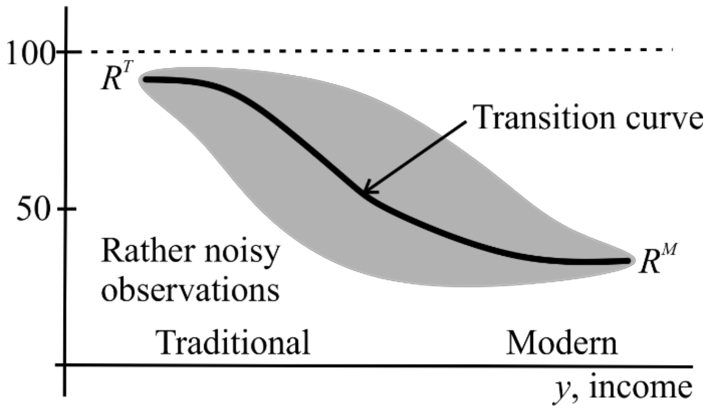
The importance of religion in knowledge is thus:

(3) $R^A = \Omega/A_t = \Omega/(\Omega + Z_t)$

Z_t grows rapidly in modern society, while Ω is roughly constant. Modern growth, therefore, is a process where the importance of religion in production falls relative to Z_t, the stock of secular knowledge, notably within science and technology. Equations (1) to (3) are developed into a full growth model in Gundlach and Paldam (2012). Technical progress is driven by knowledge that follows Equation (3). The model uses CES technology to catch the substitution process. Thanks to the productivity of scientific knowledge, it generates a transition path with an endogenous growth component that gives a link between the elasticity of substitution $\sigma_{\Omega Z}$ and the transition. If $\sigma_{\Omega Z}$ is sufficiently high, all growth becomes endogenous.

When causality is analyzed, the endogenous component means that causality becomes simultaneous. Development causes a falling share of Ω in knowledge as per Equation (3), but the substitution causes extra growth so that income rises. In the long run, it must be y that causes R, but within a medium time horizon causality between y and R becomes simultaneous.

Figure 1. A sketch of the Religious Transition



As before, the horizontal axis is income, i.e., the logarithm to GDP per capita. R is the measure of religiosity discussed in the text. The superscripts T and M designate the traditional and modern level.

Figure 1 is a preview of our findings about the Religious Transition. Though it is relatively noisy, it looks as any other transition. The decline of religiosity is similar to the decline of corruption in the process of development discussed in Chapter 10. To get some intuition as to the modern level, R^M, which may keep falling or converge to a steady level, we have to look at demand and supply at the micro level:

Religion is ***demanded*** for two main reasons that serve to give (practical) peace of mind:

(i) To give divine protection against risks to life and property. The Grand Transition has doubled the expected life span from about 40 to 80 years. It also allows people to save for pensions and insurance, public transfers appear, etc. All this reduces the risk and its effects. Thus, the need for divine protection falls, and so does the demand for religion.[2]

(ii) To provide explanations of the unknown. Here science has become an alternative as mentioned. Science has made substantial progress in reducing the unknown, hereby reducing the realm of religion. In the post-transition world, people have largely ceased to associate diseases with evil spirits and magic spells. Thus, there may also be a time index on Ω in Equation (2), so that Ω does not only fall relatively when Z increases, but even falls absolutely. It is no wonder that many churches have fought to uphold religious explanations against the onslaught of scientific explanations. It is likely that these components will level off, so that there may be convergence, but it is difficult to predict a steady state level.

The ***supply*** of religion takes place through several ***channels***. Churches supply religious goods *directly* by religious services, and in the form of high-quality ceremonies for the rites of passage in the stages in life: birth, maturity, marriage, and death. Religious goods have also been supplied *indirectly* as a joint product with the three big welfare goods: education, healthcare, and social protection, which consequently are three ***extra channels***.

In poor societies, the tax base is small, and most tax revenue is used mainly to finance the power structure holding the state together against internal and external enemies. Churches often owned a great deal of land and had a religious claim to taxes (tithes), but they typically managed to collect only parts of what they claimed. When income from the church land and bequests were added, the Church probably did succeed to collect something like 12% of GDP in taxes.[3] It financed the Church itself and the (small) production of the three welfare goods.

The Grand Transition changed the production of the three welfare goods. Their share in GDP increased about 5 times from about 3-5% to about 20-25%. That exceeded the financial capacity of Churches, and the state had to take over, and hence the control over the production moved from the church to the state. When the state took over, it used the provision of welfare goods to supply its own secular ideology. Thus, Churches lost the three extra channels.[4]

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[2] The demand for divine protection against an event e is proportional to $\rho \cdot W$, where $\rho(e)$ is the risk that the event occurs, and $W(e)$ is the welfare cost of the event if it occurs. If $W(e)$ is constant, the conclusion is as stated in the text, but if $W(e) = f(1-e)$, i.e., welfare is a function of non-occurrence, the conclusion no longer holds.

[3] See the detailed assessments/estimates in Paldam (2017).

[4] In most countries, these sectors also have private firms, but they will be disregarded. The take-over by the state varies greatly by country. See also Chapter 7.1 on the Three Pillars Model and Chapter 8.1 on the Transition of the Economic System. The channel argument is inspired by Puchades-Navarro and Montoro (2009).

11.2 Controversies on secularization and reverse causality (from R to y)

Religion is an emotional subject for many people, and Churches are (still) large organizations, so the Religious Transition is surrounded by controversies:[5]

A major controversy deals with the unclear concept of secularization.[6] It originated as a component of the theory of *modernization* that goes back to Marx, Freud, Weber, Durkheim, and others. They predicted that economic development would cause religions to vanish. Consequently, religiosity would vanish too. Religion has remained rather stable, 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 various indicators of religiosity fall with rising income. In this chapter, their results are generalized to much more data, and a rationalization is provided.

As religiosity falls with development, Churches have a (second) interest in resisting development. This leads to the second macro controversy: The family of theories that deals with the causal role of various religions for development, i.e., with the reverse causality.

Most reverse theories argue that a certain religion is socially conservative and hence delays development. For long, East Asian countries had no development, and in the interwar period, theories appeared about the anti-developmental nature of the belief systems in East Asia,[7] but then things changed. A more recent literature sees Islam as a rigid religion, preserving belief-based traditions from the 7th century, such as the traditional gender roles that keep women out of the labor market; see Paldam (2009). A different reverse theory was proposed by Weber (1904), who argued that certain religious minorities, precisely because they are in opposition to mainstream conservative religion, have had a causal role in economic development, notably in the rise of capitalism.

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 reverse causality and for the main religious affiliations. The results suggest that belief-based traditions do not have strong anti- or pro-developmental effects in the long run.

The micro theory of the economics of religiosity does not explicitly address the religious transition, although links may be developed on the demand side: Azzi and Ehrenberg (1975)

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[5] The literature is enormous and written by authors of many trades; see Iannaccone (1998) and Eklund *et al.* (2006) for surveys of the much more limited economics literature.

[6] Wikipedia lists about 10 definitions of secularization of which some are quite different. Secularization is a fact if the reader agrees that my analysis is an operational version of the secularization hypothesis.

[7] The theory was developed by J.H. Boeke, 1884-1956. The main argument was about backward bending labor supply curves. His books are only partly translated (from Dutch), but a summary is available in Higgins (1959).

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 connecting religiosity to social behavior.

The supply side is dominated by the *competition theory*; see Finke and Iannaccone (1993), Stark and Iannaccone (1994).[8] Here, religiosity is a function of the degree of competition in the market for religion, with competition increasing the efficient supply of religious goods that generates its own demand. The theory explains why religiosity differs across countries at the same income level, but it does not address the religious transition.

11.3 The religiosity variable, R: The factor analysis

The Religious Transition is the relation $R = \Pi^R(y)$, as in the previous chapters. Thus, one point of change in y is a change of *gdp* of e ≈ 2.7 times. The explained variable is religiosity, R. If K variables were used to measure the importance of religion in all aspects of life, R would be the largest common factor in all these variables. The actual R-variable is estimated by a factor analysis of K = 14 items from the *World Values Survey* (WVS); see Inglehart *et al.* (1998, 2004). The items are chosen to span as much of the aspect space as possible.

The WVS questionnaire was developed as an English master version, which defines the terminology used. Experts in each country have translated the master into their languages and cultural environments. Key concepts, such as *God* and *church*, are easy to translate for mono-theistic religions, but seem less relevant in other belief systems. However, the countries of South and East Asia fit well into the general pattern. All items disregard the respondent's religious affiliation, if any, but ask about religion's importance in various spheres of life. The number used from each poll is the fraction (as a percentage) of the respondents giving the high importance answer. The aggregate R-score is in percentages as well. Changes in R are thus in percentage points.

A complete panel for 111 countries and 6 waves would contain 666 polls, but our sample contains only 332 polls.[9] Thus, the gaps in the panel are substantial, which limits the gain from using the panel structure. The regression analysis uses either the cross-country sample of 111 country averages, $\underline{R}$, or the full sample of 332 Rs with controls for waves and selected groups of countries and religions.

[8] The theory was used to provide an explanation of the remarkably high religiosity of the United States, but Opfinger (2011) reports that the theory fails in a cross-country perspective, using our R-variable.

[9] In addition to countries that are dropped in the polls, some items are dropped. For 666 polls, a complete coverage would demand 9,324 polled items, but we only have 3,260, so 65% of the cells in the (111, 14, 6)-panel are empty.

Table 2. The representativity of the sample of *R*-data

	W1	W2	W3	W4	W5	W6	Polls	Countries
	Countries included: all and grouped in two ways							
All	24	43	68	78	58	60	332	111
West	18	20	23	24	16	8	109	27
Post-socialist	1	12	24	24	10	13	84	28
Others	5	11	21	31	32	39	139	56
Christian	22	37.5	57	55.5	39.5	32.5	244	72.5
Muslim		1.5	6	15.5	10	18.5	51.5	28
Others	2	4	5	7	8.5	9	35.5	10.5
	The share (in %) of the sample						Average	All
World Countries	13.6	22.1	34.9	40.0	29.4	30.5	28.4	57.0
World Population	20.1	58.6	71.5	74.8	72.3	69.0	61.1	86.2
	Excess income (in %) in countries of sample						Average	All
GDP per capita	219	161	96	74	64	54	111	57

In four countries, about half the population is Muslim: Ethiopia, Lebanon, Malaysia and Nigeria.

Table 2 shows that the missing observations are not random.[10] The 1982 wave covered countries, mainly in the West, which were three times as rich as the average country in the world. The next waves came to contain many post-socialist countries to catch the effects of the collapse of Communism. As time passed, the sample changed to include more Muslim countries. Consequently, each wave of the WVS has a skewed country sample of countries, and the skewness changes over time. The cross-wave stability of the R-factor is therefore quite remarkable. Representativity is better once all waves are taken together. The last column of the table reveals that the 111 countries included in at least one poll hold 86% of the world population and are only 57% richer than the average of all countries.

The time span is only 30 years, so the analysis hinges crucially upon the *equivalence hypothesis* that the *within* (time-series) slope is the same as the *between* (cross-country) slope. Thus, I assume that countries had a rather similar level of development about 300 years ago, so the cross-country differences in present income levels reflect the long-run path of development since then; see Section 9.

Table 3 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 five waves. The 3,260 polled items in the sample have three dimensions: $j = 1,\ldots 14$ are the items, $i = 1,\ldots, 111$ are the countries, and $t = 1,\ldots, 6$ are the waves. The aggregate answer for item j in country i and wave t, is A_{jit}. When aggregated across countries it is A_{jt}, and when further aggregated across waves it becomes A_j. Column (8) gives the

[10] The changing composition of the country sample probably reflects public concerns at the time of the wave. It is difficult to fund such a large project as the *WVS*, and funding depends on the public interest.

A_js, representing the average share of "high importance" attributed to each item by the respondents. The grand average of all A_js is 53.0%, which is thus the fraction of the respondents in all polls that declare themselves (rather) religious. Column (9) shows the coefficient of correlation of the A_{it}'s and income y_{it} for each *j*. All correlations – except the one to item 14 – are statistically significant, negative, and substantial in size.

Table 3. The 14 religiosity items: Short definitions and some counts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Content of item			Included in *N* polls					Avr.	Cor
Wave	W1	W2	W3	W4	W5	W6	All	A_j	(A_{it}, y_{it})
Period for polls in wave	81/84	90/94	95/98	99/04	05/09	10/14		%	(a)
1 God very important in life	23	39	67	76	58	58	321	57.5	**−0.51**
2 Family should teach children the faith	23	43	69	77	58	60	330	34.0	**−0.41**
3 Religion important in life	-	43	69	77	57	60	306	40.3	**−0.45**
4 Believes in God	23	37	66	73	-	54	253	83.3	**−0.39**
5 Has moments of prayer and meditation	16	37	33	65	50	0	201	67.9	**−0.37**
6 Non-believers are unfit for political office	-	-	33	72	49	0	154	33.0	**−0.67**
7 Churches answer family life problems	16	33	33	74	51	0	207	49.8	**−0.51**
8 Churches answer social problems	-	35	33	74	51	0	193	40.2	**−0.49**
9 Better if people are strongly religious	-	-	33	33	49	0	115	38.2	**−0.62**
10 Churches answer moral problems	8	35	33	74	51	0	201	55.0	**−0.57**
11 Churches answer spiritual needs	16	35	33	74	51	0	209	76.5	**−0.52**
12 Attends religious service regularly	24	40	67	76	57	57	321	40.2	**−0.44**
13 Is a religious person	23	42	66	74	58	59	322	68.5	**−0.43**
14 Belongs to religious denomination	16	40	33	45	-	0	134	76.5	0.01
Sum or averages	188	459	668	964	640	348	3,267	53.0	−0.45
Number of countries in wave	24	43	69	78	58	60	332(b)	111(c)	
Missing observations, in % of total possible	44.0	23.8	30.8	11.7	21.7	58.6	29.7		

The order of the 14 items is per the factor loading in Table 4. The variable is the answer that says that the respondent is (very) religious. The polls of each wave are paired with the average income for the period.
Notes: (a) correlation of all poll averages and income for each item. Thus in row (1) $N = 321$. (b) Number of polls. (c) Number of countries (or similar) included in at least one wave.

Table 4 reports a factor analysis of the religiosity items. The factor analysis is based on the pairwise correlations within each wave, so it uses as many observations as possible. I have also run the analysis on balanced samples. It is debatable which estimate is the best. However, the results are virtually the same. Also, an aggregate factor analysis has been made by joining the individual waves together in one matrix. It also gives much the same results. The factor analysis is done independently for each wave. Our criteria for accepting one factor as the religiosity variable are: Its loadings to all items are ***positive***, ***large*** and ***stable***. The stability is given by the cross-wave *t*-ratios in the right-hand column.

Table 4. A factor analysis of the 14 items

Content of item	Results for individual wave						Across waves	
Wave	W1	W2	W3	W4	W5	W6	Avg.	t-ratio
Eigenvalue for factor 1	7.16	7.80	9.27	10.58	9.33	4.86	**8.17**	10.8
Eigenvalue for factor 2	1.67	2.53	2.63	2.49	0.86	0.49	**1.78**	5.1
Eigenvalue for factor 3	1.35	0.50	0.73	0.93	0.50	0.35	**0.72**	5.3
	Factor 1 loading						Avg.	t-ratio
(1) God very important in life	0.95	0.95	0.96	0.97	0.90	0.91	**0.94**	88.7
(2) Family should teach children faith	0.94	0.91	0.89	0.93	0.92	0.88	**0.91**	118.8
(3) Religion important in life		0.93	0.87	0.82	0.94	0.92	**0.89**	45.9
(4) Believes in god	0.96	0.84	0.85	0.96		0.82	**0.88**	32.2
(5) Has moments of prayer and meditation	0.93	0.88	0.80	0.94	0.83		**0.88**	35.3
(6) Non-believers are unfit for political office			0.80	0.96	0.87		**0.88**	23.1
(7) Churches answer family life problems	0.86	0.75	0.84	0.90	0.90		**0.85**	33.6
(8) Churches answer social problems		0.74	0.84	0.87	0.83		**0.85**	22.9
(9) Better if people are strongly religious			0.79	0.80	0.93		**0.82**	35.3
(10) Churches answer moral problems	0.85	0.62	0.77	0.98	0.85		**0.81**	15.5
(11) Churches answer spiritual needs	0.88	0.65	0.77	0.87	0.73		**0.78**	20.5
(12) Attends religious service regularly	0.90	0.81	0.72	0.43	0.80	0.78	**0.73**	12.3
(13) Is a religious person	0.39	0.79	0.72	0.66	0.80	0.87	**0.70**	11.0
(14) Belongs to religious denomination	0.31	0.60	0.61	0.76			**0.57**	6.9
(15) Income (ln to GDP per capita)	−0.55	−0.42	−0.40	−0.56	−0.66	−0.62	**−0.53**	−13.7

The *t*-ratio given in the right-hand column measures the cross-wave stability of the factor loadings. When the cross-wave stability of the loadings to factor 2 and 3 is analyzed in the same way, only a couple of cross-wave estimates have *t*-ratios above 2, and hence they are bolded. A joint factor analysis of all 332 polls gives much the same results as the average column, though with slightly higher values throughout.

Factor 1 fulfils these criteria: It is the dominating factor with an average eigenvalue of 8.2 and a cross-wave *t*-statistic of 10.8. All items have positive and mostly large loadings to factor 1. The cross-wave *t*-ratios are in the range from 6.9 to 118.8. Factor 1 taps into a latent variable that is very salient for the respondents. Thus, factor 1 is our *R*-variable.

Factor 2 has an average eigenvalue of 1.74. However, all, but one, factor loadings are unstable across samples. It mainly loads to items that reflect the relations of the respondents to the organization of the Church, and will not be discussed further. The third and higher factors are of no consequence.

Row 15 in Table 4 shows that factor 1 always loads negatively to income. Even if it rises a little as the sample comes to cover more of the income range, the cross-wave stability is still −13.7. Thus, the correlation of income and the dominant first factor is robust and negative. The calculations given in row (15) of Table 4 and in column (9) in Table 3 are done quite differently. It is reassuring that the results are similar. This already suggests a strong religious transition – though it is still a measure of correlation only.

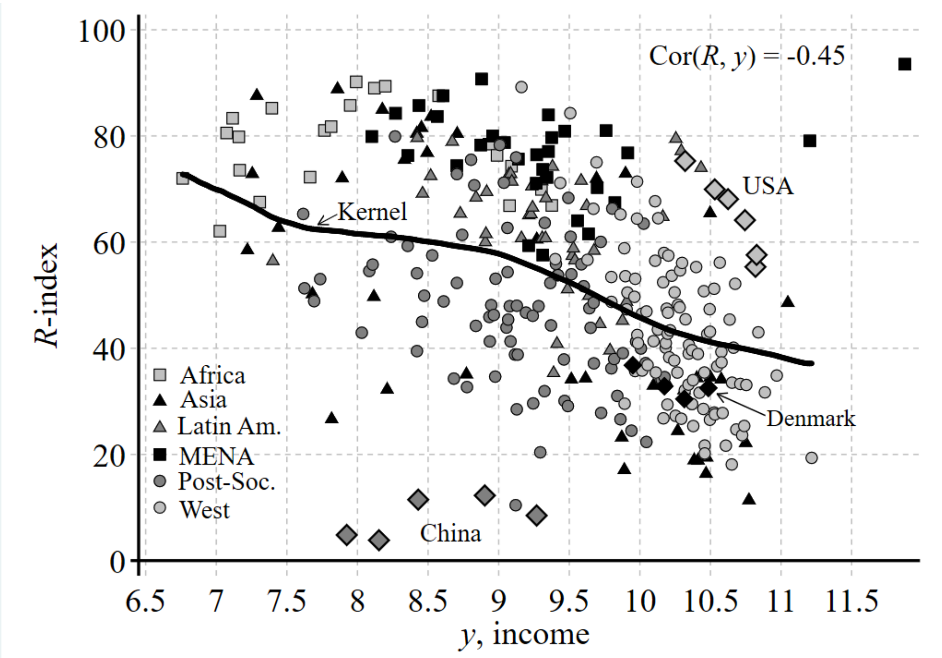
The standard method of weighting a set of correlated items is to use principal components. Parallel to Table 4, a table of principal components has been calculated. They are very similar, so I have just calculated the average of the percentage scores. The 68 factor loadings in Table 4 have an average of 0.82 with a standard error of 0.05, so the aggregate is rather robust to the weights used. Finally, it should be noted that the average wave contains 11.7 items, so by using the averages of the items, uncorrelated measurement errors are reduced by a division with $\sqrt{11.7} \approx 3.4$.

11.4 The transition curve Π^R

Figure 2 shows the (R, y)-scatter of the data points. The graph includes a kernel curve $R = K(y, 0.4)$ that is an estimate of the transition curve Π^R. It has a highly significant negative slope, and some convergence at both ends, but it is estimated on $N = 332$ only. Figure 3 shows the (satisfactory) robustness of the kernel curve to the bandwidth.

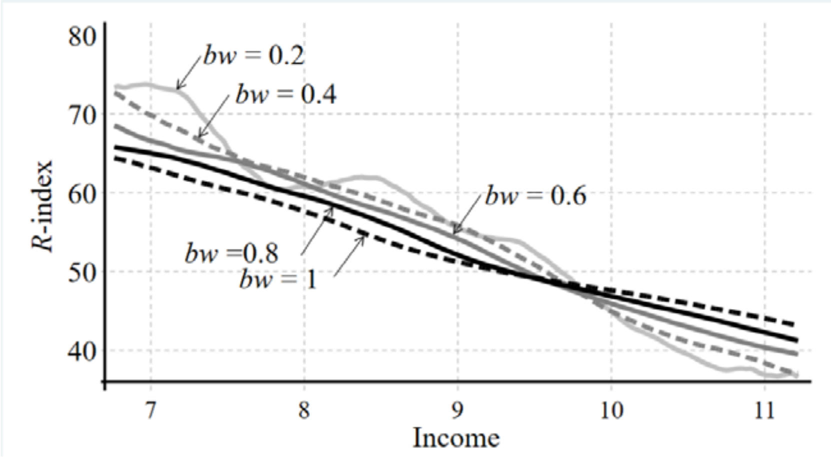
The few low-income countries in the sample have Rs of about 80 percentage points, and the measure of R can hardly be higher than 90%, so the traditional level $R^T \approx 80\%$ is well determined.

Figure 2. The transition path: $R = \Pi^R(y) \approx K(y, 0.4)$, $N = 332$ polls



The large diamonds are the 5 obs. for China, the 6 obs. for the USA; the small diamonds are the 4 obs. for Denmark referred to in Section 9. The correlation of R and income within the groups are: Africa −0.23 (22), Asia −0.44 (45), Latin America −0.21 (42), MENA −0.01 (30), post-socialist −0.40 (84) and West −0.45 (109) where the parentheses hold the number of observations.

Figure 3. Robustness of kernel from Figure 2 to the bandwidth



The decline in the curve and hence the adjustment path is obvious, but the modern equilibrium level R^M is not yet clear. It is surely below 40%, but stability has not yet been reached. Perhaps the decline has slowed down, so it will probably cease, but it is difficult to predict whether it will stabilize at 30% or fall below that.

The data points are considerably scattered around the average curve, so the religious transition explains only some of the observed variation. China and the United States are depicted as large diamonds. Section 8 below points to these countries as the most extreme ones. They are outliers reflecting inertia in religiosity. A more detailed study of the cross-wave observations for each country shows that they are often quite similar relative to the general trend, indicating path dependency.

11.5 The DP-test for long-run causality (see Chapter 2.8)

In the part of Europe where the author lives, the dominating religion has changed twice in the recorded history of the last dozen centuries. Religion has been similarly stable in most other parts of the world. This suggests that religiosity may also change slowly. Thus, the Grand Transition framework deals with the long-run relation $R = \Pi^R(y)$, where it has to be shown that y is causal to R. To this end, the long-run DP-causality test from Chapter 2 is used. The long-run results may hide more complex short-run interactions.

The limited sample is probably the main reason why the coefficient on y is about 30% larger in Table 5 than in the other tables; i.e. it is −12 in Table 5 vs −9.5 in the other tables. When the sample increases to $N = 94$ in column (5), the coefficient on y falls to the usual size.

Table 5. The DP-test for long-run causality from income to the *R*-index

	Dependent variable: *R*	Main model	Robustness of model to instrument variation			
	Estimate	(1)	(2)	(3)	(4)	(5)
	No. of countries	62	67	62	62	94
				OLS estimates		
(1)	Income, *y*	**−12.13**	**−12.04**	**−12.13**	**−12.13**	**−8.75**
	t-ratio	(−7.0)	(−7.3)	(−7.0)	(−7.0)	(−5.1)
(2)	Centered R^2	0.44	0.44	0.44	0.44	0.22
			IV estimates: *y* is instrumented			
(3)	Income, *y*	**−14.94**	**−17.33**	**−15.07**	**−14.30**	**−16.20**
	t-ratio	(−5.0)	(−6.4)	(−5.3)	(−5.4)	(−5.2)
(4)	Instruments	*biofpc, geofpc*	*bioavg, geoavg*	*animals, plants*	*axis, size, climate*	*coast, maleco*
(5)	First stage partial R^2	0.36	0.43	0.39	0.44	0.37
(6)	CD F-statistic	***16.49***	**23.73**	***18.74***	***15.15***	***17.32***
	CD critical value	19.93	19.93	19.93	22.30	22.30
(7)	Sargan test	5.57	**1.51**	**2.60**	**0.66**	7.32
	p-value	0.02	0.22	0.11	0.72	0.03
		Hausman test for parameter consistency of OLS and IV estimates				
(8)	C-statistic	**1.46**	7.67	**1.82**	**1.22**	11.05
	p-value	0.23	0.01	0.18	0.27	0.00
		Check for reverse causality (all are smaller but one works)				
(9)	CD F-statistic	12.15	**21.89**	11.95	7.33	***16.03***

The observations are averages of waves 2-6 of the World Values Survey, thus *N* = 62 - 94. All specifications include a constant term (not reported).

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.

All five IV-estimates of the slope are highly significant and rather similar: $\lambda_{IV} \approx -15$. As before, the 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. The conclusion is that the simultaneity bias in the OLS-estimate of λ is of a dubious significance. Finally, the section (9) of the table 5, test for reverse causality. The CD-test statistics are smaller than for the main causal direction in all cases and larger than the critical value in one case only. This confirms that our instruments show that the main direction of causality is from income to religiosity, but there appears to be some simultaneity, as expected from the theoretical discussion.

Table 6. Changes in religiosity items across waves, 1982-2005

	Difference	W1-W2	W2-W3	W3-W4	W4-W5	W5-W6	All
				Part A: Aggregate results			
All countries	Average	−2.53	**−2.73**	1.39	**−7.10**	3.16	**−1.29**
	N	23	42	59	40	37	201
				Part B: Divided in country-groups			
West	Average	−5.15	**−6.07**	−0.04	**−8.06**	2.76	**−3.67**
	N	17	19	21	13	8	78
Post-socialist	Average	22	1.29	**5.38**	**−7.06**	1.65	1.88
	N	1	12	22	10	7	52
Others	Average	1.19	−1.36	−2.22	**−6.38**	3.69	−0.88
	N	5	11	16	17	23	72
				Part C: A Muslim exception			
Muslim incl. 50%[a)]	Average		6.84	−5.40	**−5.00**	4.62	−1.15
	N		2	6	8	7	23

Averages in bold are significant at the 5% level. Averages in bold and italics are significant at the 10% level. The table uses all available observations on item changes. The first observation in the post-socialist row refers to a date before the fall of Communism. The Muslim group is quite thin, so I have included the four countries where about half the population is Muslim: Ethiopia, Lebanon, Malaysia and Nigeria.

11.6 An analysis of the 201 changes R from one wave to the next

The analysis of the trends over time is based on first differences across waves. With a growth of 2.4% per year, the growth from wave to wave is 13%. The *R*-changes are $\Delta R_{iw} = R_{iw} - R_{iw-1}$, where *i* is country, and *w* is the wave. The measure demands that an observation is available for both $R_{iw\text{-}1}$ and R_{iw}. This provides 201 changes. They have an average value of −1.3, which is the change of the *R*-variable from one wave to the next. This is difficult to observe. For the West, the average fall is three times larger. The post-socialist countries are particularly interesting, as the Communist regimes until Wave 2 were anti-religious and (often) suppressed religion. The first two waves after the end of Communism consequently showed a return to ‘normality’. However, the last two changes are much like other countries. Another interesting group is the Muslim group. It is often alleged that religiosity has increased in the Muslim world in the last quarter century, but this is not confirmed.

The average changes in the religiosity items for the *West* are significantly negative, and the decline is −3.7 percentage points, on average, per wave (i.e., over five years). The decline is somewhat erratic, but perhaps it slows, suggesting that the transition may converge to a stable level. For *Others*, the fall is smaller and (even) more erratic.

11.7 A regression analysis of the stability of the transition slope λ to country groups

The first part of the robustness analysis is reported in Table 7, which provides estimates of the slope λ after including binary dummies for the main country groups and religions. Row (1) is the *base model* for the full sample of 332 polls. It gives an estimate of $\lambda \approx -9.6$ (9.2). Row (13) gives the average of the 11 regressions (2)-(12) and two *t*-ratios: the average of the 11 t-ratios and the cross-regression *t*-ratios. For λ it is −9.3 (8.9), with a cross-regression *t*-ratio of 30. Thus, the transition slope of **−9.5** is very robust, and 13% of −9.5 is −1.24 as in Table 6.

Table 7. The effect on *R* of income and country groups, (2 *x* 11) + 1 regressions

N = 332	(A) Regressions with income included				(B) Regressions without income		
	(A1)	(A2)	(A3)	(A4)	(B1)	(B3)	(B4)
	Country group	Income	Constant	R^2	Country group	Constant	R^2
(1) Income	−	**−9.62** (−9.2)	**143.68** (14)	0.203	−	None	
(2) Africa	**4.52** (3.4)	**−7.95** (−7.0)	**126.95** (11)	0.231	**27.15** (6.6)	**50.75** (47)	0.117
(3) Asia	**−13.06** (−4.7)	**−10.27** (−10.0	**151.61** (15)	0.254	**−9.33** (−3.0)	**53.83** (46)	0.026
(4) Lat Am	**10.10** (3.5)	**−9.37** (−9.1)	**140.12** (14)	0.232	**11.89** (3.7)	**51.08** (44)	0.039
(5) MENA	**24.67** (7.9)	**−9.13** (−9.5)	**136.86** (14)	0.331	**26.54** (7.6)	**50.15** (47)	0.149
(6) Post-soc	**−11.57** (−5.3)	**−10.79** (−10.4	**157.69** (15)	0.265	**−6.63** (−2.7)	**54.24** (43)	0.021
(7) West	−1.85 (−0.7)	**−9.05** (−6.8)	**138.87** (11)	0.205	**−12.73** (−5.8)	**56.75** (44)	0.092
The Muslim exception – compare with estimate for Mena group							
(8) Muslim	**18.28** (6.8)	**−7.42** (−7.2)	**119.97** (12)	0.301	**24.37** (8.8)	**48.77** (45)	0.192
(9) Arab	**26.24** (7.4)	**−9.12** (−9.3)	**137.10** (14)	0.317	**28.56** (7.2)	**50.57** (48)	0.135
Other exceptions							
(10) China	**−55.10** (−7.4)	**−10.53** (−10.7	**153.13** (16)	0.317	**−45.06** (−5.3)	**53.24** (50)	0.077
(11) USA	**24.92** (3.4)	**−10.23** (−9.8)	**149.05** (15)	0.231	12.7 (1.6)	**52.33** (47)	0.007
(12) Nordic	**−11.78** (−3.1)	**−8.74** (−8.1)	**136.20** (13)	0.226	**−20.12** (−5.0)	**54.02** (49)	0.070
Cross-estimate stability							
(13) Average	2.31 (3.4)	**−9.33** (8.9)			3.40 (5.2)		
(14) *t*-ratio	(0.3)	(−30)			(0.5)		

The parentheses hold *t*-ratios. The bottom row gives the cross-regression *t*-ratio. Coefficient estimates with *t*-ratios above 2 are bolded. In Column (13) the average *t*-ratios are calculated for the numerical values. Note that while most group dummies get significant *t*-ratios, they are different, while both *t*-ratios for income are highly significant.

Rows (2) to (7) report results for six regressions of religiosity on a constant and *one* of the country (group) dummies. Column (A1) controls the estimate for income, but column (B1) is without this control. All of the country group dummies are significant in columns (A1) and (B1), except West in column (A1). This means that all of the low religiosity in the West can be explained by the high income. The reverse story applies to the USA. Here the coefficient to the country dummy is insignificant without income control, but it is significant when income is controlled for. Thus, the USA is a very religious country at its income level.

While row 13 shows that income has a very stable coefficient, this does not apply to the country group dummies; although most of the estimates are significant, they are, as they should, different both in columns (A1) and (B1).

11.8 The robustness of the transition slope λ to observations from individual countries

Table 8 is the multivariate regressions where (1) and (2) correspond to (A1), and (3) and (4) correspond to (B1). The results are much as expected, and it is nice to see that regression (2) gets an R^2 score of 0.57.

Table 8. The effect on *R* of income and country groups - four multiple regressions

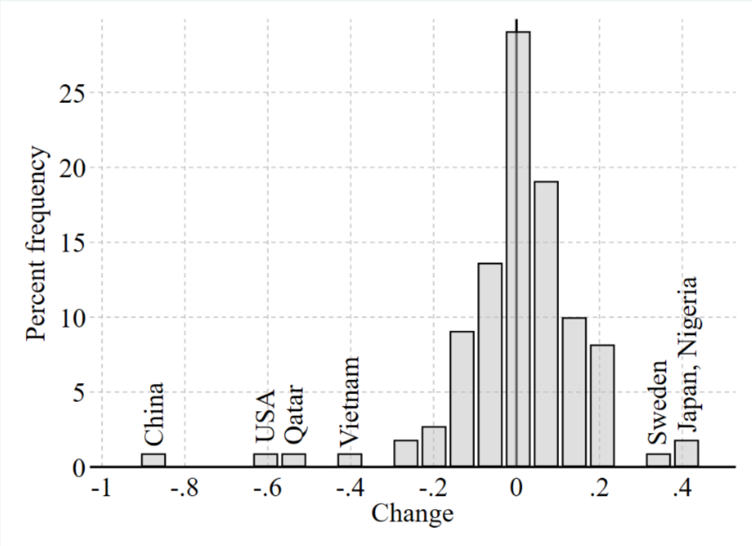
	Income	Asia	MENA	Post-soc	West	China	USA	Nordic	Constan	R^2
(1) Coef.	**−8.59**	**−21.01**	**12.29**	**−18.13**	**−11.86**				**144.16**	0.453
t-ratio	(−7.7)	(−7.2)	(3.7)	(−7.3)	(−4.2)				(14.3)	
(2) Coef.	**−9.63**	**−15.40**	**12.74**	**−17.84**	**−9.39**	**−47.62**	**23.55**	**−10.34**	**153.37**	0.574
t-ratio	(−9.6)	(−5.8)	(4.3)	(−8.1)	(−3.6)	(−7.6)	(4.2)	(−3.4)	(17.0)	
(3) Coef.		**−32.71**	**−14.23**	**−29.59**	**−33.18**				**77.20**	0.378
t-ratio		(−10.2)	(−4.3)	(−10.7)	(−12.5)				(35.4)	
(4) Coef.		**−28.17**	**−14.23**	**−29.59**	**−31.71**	**−40.85**	**19.56**	**−11.60**	**77.20**	0.77
t-ratio		(−9.3)	(−4.7)	(−11.6)	(−12.3)	(−6.0)	(3.2)	(−3.4)	(38.5)	

See Table 7. Both the African and Latin American country group become insignificant in the multiple regressions.

The 12 estimates of the transition slope, λ, in Table 7 have an average of about −9.5 and a std. of 8.6, and the results in Table 8 are very similar. Given that the causality issue is settled, it is possible to use all data for a more detailed and precise analysis. To confirm the robustness, I analyze how the estimate of λ reacts to the deletion of individual countries and in particular to suspicious countries. The 332 polls have one to six polls for each of the 111 countries. The base model (1) becomes:

(3) $R_j = \alpha + \lambda y_j + D_i + \mu$, for j = 1,…, 111 and μ are the residuals. D_i is a dummy for the observations for country *i*.

Figure 4. The distribution of the country-effect η_i on λ of the deletion of one country



The base regression with all 332 observations has no D-variable. It 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. Therefore, 111 estimates, $\lambda_1, \ldots, \lambda_{111}$, are generated, where λ_i is estimated on the sample after excluding the observations for country *i*, by means of the dummy D_i. These estimates differ from λ_{all} by the effect $\eta_i = \lambda_i - \lambda_{all}$. Figure 4 shows the distribution of the 111 estimates of the country effect η_i. Except for a few outliers – notably China and the United States – the distribution of the ηs is nicely normal with a rather small standard deviation. Only seven of the 111 countries exceed $-0.3 < \eta < 0.3$. This means that if there is some measurement error in the data for one country, this normally influences the estimate of λ by less than three percent. The estimated ηs are approximately additive, so that the effect of deleting two countries is the sum of the effect of the deletion of each.

The effect of deleting a country altogether places an upper bound on 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.

The two largest outliers have ηs of about −0.9 (China) and −0.6 (USA). As seen on Figure 2, China is (still) a relatively poor country with low religiosity, and the United States is a rich country with high religiosity, so their effects on the estimate of λ are much the same. If the two outliers are both deleted, the estimated transition becomes −1.4 points faster, so that λ changes from −9.5 to almost −11.[11]

Religiosity polls for some countries are *suspicious*. This applies to polls made under

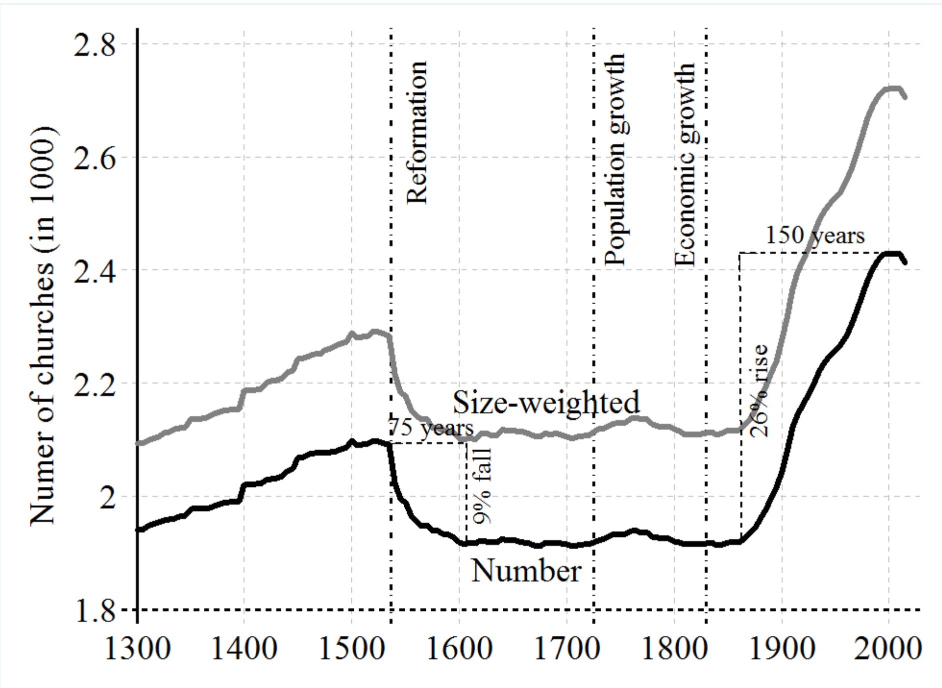
[11] The effect of excluding the one observation from Qatar is almost as large as excluding the six observations for the USA, so Qatar is really extreme.

authoritarian antireligious regimes, such as China and Vietnam, but note that the poll from Hong Kong is not much different from the one from China. In the same way, polls from authoritarian religious regimes, such as Iran and Saudi Arabia, may be suspected. If the two countries are excluded, the effect is to change the estimated transition slope by +0.4. If all 17 polls from the nine Middle Eastern and North African countries are deleted, the effect is +0.68, which is much the same as the effect of deleting the five polls from the United States. While some polls may have reporting skewness, I believe to have demonstrated that this can have only a minor effect on the main pattern found.

11.9 A pilot study of long time series: The proxy of church density

The *R*-variable is a theory-close measure. However, it only covers 30 years, and there are no such data before that. To find long time series, it is necessary to look for a proxy. The variable found is the per capita density of churches. The data compiled covers my country Denmark only, but over 700 years. I think it generalizes to other countries, but it needs to be confirmed.

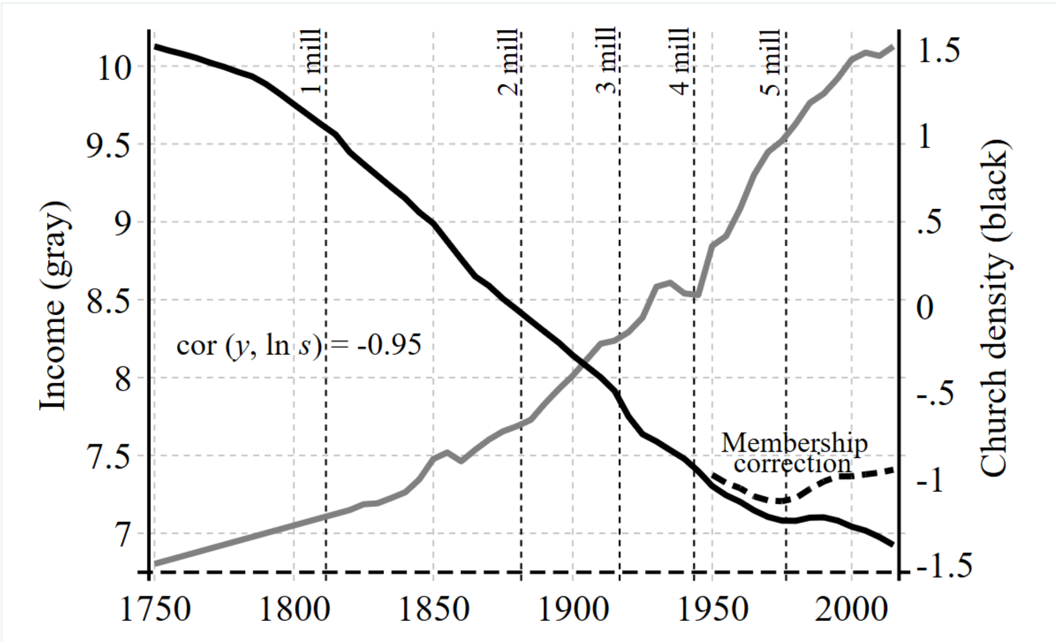
Figure 5. The church stock, *S*, in Denmark, 1300 2015



A large project 'Danmarks Kirker' (ref) at the Danish National Museum has until now covered 2/3 of all churches, including closed churches, in great detail. As the project uses a published sampling plan, and as the present churches are registered on a carefully updated home page run by the Church, it was possible to project the present ***church stock*** for the geographical area of present Denmark for every 5th year from 1300 to 2016. The data include the opening and closing of churches, their sizes and all changes of the buildings. [12]

Figure 5 shows the church stock both in plain numbers and size-weighted. The two curves are virtually parallel, and show a pattern of no trend from 1300 to 1850, where the population and income were rather stable. The reformation changed the religion from Catholicism to Lutheranism, which is less church intensive. This gave a drop in the density of 9%. From 1750 and until today, the church stock has increased by 26%. However, the population has increased by 6 times since 1750.[13] Thus, there has been a fall in the per capita ***church density*** during the Grand Transition. The fall is almost 5 times.

Figure 6. The church density, *s*, and income, *y*, 1750 to 2015



The church density is also in logs. Income data before 1820 are a trend only. The vertical lines show when the population reaches 1 million, 2 million, …, 5 million. The population will reach 6 million in 2030.

Figure 6 shows the church density and income from 1750 to 2016. The two series have a correlation of −0.95, so we are dealing with a strong relation. Before 1950, more than 98% of the population were members of the national church (Folkekirken), and it is still 75%. As the

[12] Paldam and Paldam (2017) gives references to the sources used, which are mainl in Danish. The project would have been impossibly large, without the 50 years of work by a dozen researchers in the 'Danske Kirker' project. It seems that the project is unique. Thus, it is luck that the project was possible for Denmark. Part of the luck is that old Danish Churches are sturdy stone buildings and that few wars have been fought in the Danish territory.
[13] It is a bit unclear when the Grand Transition started in Denmark, as data for the period 1750 to 1820 are weak.

average size of the churches has grown only marginally, there has been no increase in the efficiency of church use. However, there has been a large fall in the attendance rate at services. For all we know, the church capacity was fully used in 1750, while this is not the case in 2015, where only about 1.5% of the church members go to church the average Sunday.[14] Thus, the fall may be even larger than the 5 times shown. It should be intuitively clear that the church density is a fine proxy for religiosity in the longer run, but it is worth to formalize the connection. First, two claims are stated:

***Claim* (*C1*)**: The church stock is demand driven. The church stock is the capital used in the production of religion. The theory of production claims that with a given technology, the capital stock equals demand in equilibrium. The capital stock adjustment model (i.e. the accelerator model) shows how supply adjusts to demand. Thus, (C1) makes sense in the longer run

Claim (*C2*): A religion-package is consumed in fixed relations. Section 3 showed large factor loadings on the national *averages* for the items. The item 'attends religious service regularly' has an average factor loading of 0.73. This means that even though church attendance may not be a good measure at the individual level, it appears to be a good measure at the aggregate level. It follows that the demand for churches $d_t = a\ R_t$, where a is a 'technical' coefficient. Thus, (C2) makes sense at the aggregate level.

The two level variables are the church stock S_t, and the population Pop_t. The demand for services $d_t = d(R_t) \approx a\ R_t$. Thus, the macro demand for churches is $D_t = a\ R_t\ Pop_t$, which equals the desired church density $s_t{*} = a\ R_t$. However, the actual church density is the supply of churches $s_t = S^S{}_t\ /Pop_t$. Thus, in the short run, demand comes to equal supply $S_t = D_t(1 + \kappa)$, via κ, which is the capacity utilization for churches. If the supply is too small, κ represents the amount of queuing for seats at the services. If the supply is too large (as it is today), κ represents the fraction of vacant seats at the weekly service.

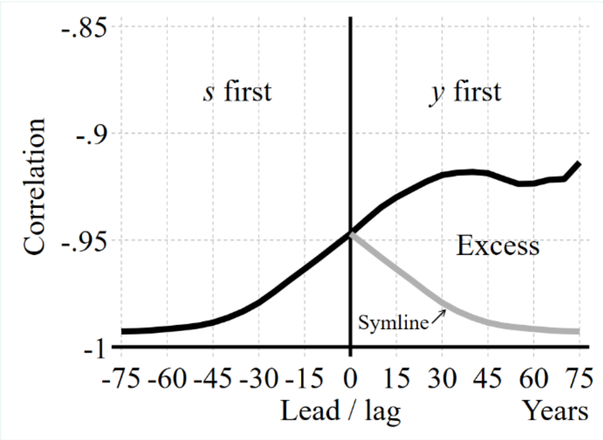
The capital stock adjustment model describes the adjustment process of supply to demand. In the short run, the church stock is fixed, for physical and institutional reasons. With under-capacity, $\kappa > 0$, more churches are built; with over-capacity, churches are closed. It easily takes 20 years from under-capacity is observed until a new church can be opened. It takes even more years of obvious overcapacity before a church can be closed.[15] The convergence to the long-run equilibrium causes the long-run stock to be demand driven. The demand is a function

[14] The rough numbers are: In 1750, the stock was 1,970 churches with app. 300,000 seats. The population was 850,000 and all were Lutheran. All seats would be full if 60% of the adult population went to the Sunday service. Today, the number of churches is 2,390 with about 400,000 seats. The population is 5,700,000 of which 75% are Lutheran. About 1.5% or 65'000 go to church the average Sunday. Thus, they occupy 16% of the available seats.

[15] The Danish national Church is reluctant to record church attendance.

of income and the religion.

Figure 7. The correlogram analysis of the (*s*, *y*)-data used for Figure 6



The format of the figure is discussed in Chapter 2.5. Note that the observations are 5 years apart, so the 31 leads/lags analyzed cover 150 years as indicated on the horizontal axis.

The Danish data gives the correlogram test for causality. It nicely confirms the DP-test in Table 5. There is no doubt that income, *y*, leads church density, *s*.

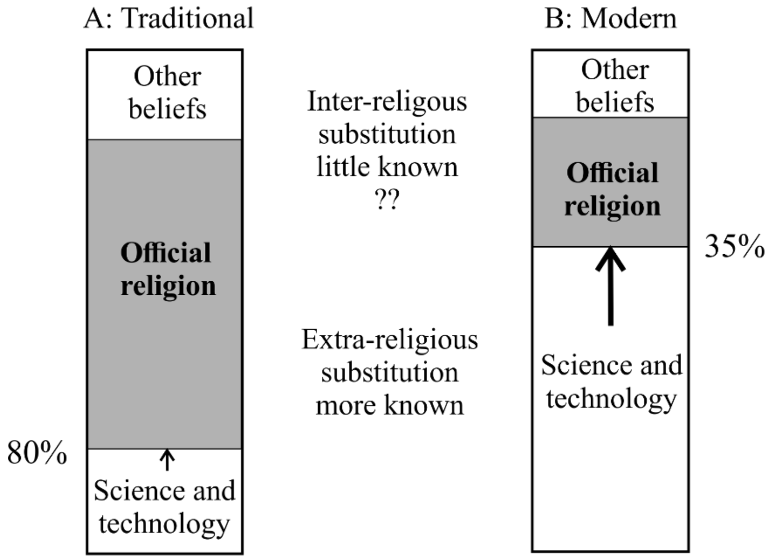
While the cross-country analysis based on Figure 2 showed a transition where religiosity falls about 3 times, the time-series analysis based on Figure 6 suggested a transition where religiosity falls by a factor of about 5 times. Part of the difference may be that the fall has been large in Denmark. Figure 2 shows that Denmark is below the average transition line. In addition, the *s*-proxy considers the national Church only, while *R* catches all religiosity, also non-official 'outside' beliefs that exist in addition to the official ones. The evidence about 'outside' beliefs is weak, but perhaps it has fallen less strongly. Outside beliefs are a mixed bag. It includes other religions than Lutheranism, and beliefs that are independent of formal religion. While folk superstitions fall during the transition, it is possible that spirituality increases.

A simple fact from the study of Danish churches is that 51% of the churches were already built in 1300. My subjective impression from many journeys in Europe is that a similar number would be reached in most countries. In some countries (such as Sweden), most churches are built of wood, so they have to be replaced from time to time. In other countries (such as Germany), many churches have been destroyed by war, but most have been rebuilt. It would surely be nice to have the data for a few more countries, but until then, the default is that the Danish story generalizes.

11.10 Conclusion: Equivalence confirmed

As far as the historical data show, equivalence is confirmed. This can be interpreted by the substitution process discussed in Section 2, and to the growth model in Gundlach and Paldam (2012). Maybe the increase in scientific and technological ideas driving out traditional (religious) beliefs is a driver of development.

Figure 8. A stylized picture of the transition, as measured by the *R*-variable



Drawn to visualize how a reduction in the *R*-variable from 80% to 35% looks.

Figure 8 is an illustration of the story told in this chapter. The two columns are drawn for *R* that covers everything religion may be used for. By the percentage scale of *R,* the two columns are equally high. The *R*-index measure covers all religion, while the church-density proxy only covers the official church use. The large change on the figure is the increased trust in science and technology. In the past and in most poor countries today, people tend to use traditional beliefs based on religion to explain things they don't understand, where people in wealthy countries today use modern science, which they know is developed by humans.

The religious transition is the decline of religiosity caused by development. Most of the analyses use a new composite index of religiosity *R*, but supporting evidence from studies using long time-series is also reported.

The transition causes *R* to fall from about 80% to about 35%. The transition is still not complete in the developed countries, although it has slowed down. It will probably continue to reach 30% or go even lower. The estimated slope of the transition, $\lambda \approx -9.5$, proved robust. The full transition normally takes one to two centuries, so the change per year is only 0.2-0.5 percentage points, which gives 1-2 percentage points over the five years between WVS-waves. Hence, the religious transition is easy to overlook in the perspective of five to ten years, especially as religiosity data vary considerably across countries.

To establish the micro foundations of a macro regularity is notoriously difficult. When income rises, the demand for religion as a factor of production may converge to zero in the limit, while the demand for religion as a consumption good may converge to a level well above zero. The loss of control by religious institutions over the provision of collective goods also appears to be a powerful mechanism in the religious transition.

I conclude that the religious transition is a substantial phenomenon that has general explanations, even if many details of these explanations differ across countries and between religions. As argued in Chapter 7, the Religious Transition is a key part in the Three Pillars Model, which explains why traditional political systems turn into democracies.