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The religious transition. A long-run perspective

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Note: All references to the main paper, including references to tables and figures, are labeled with ***P&G12***.

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Contents

1. Documentation tables and two extra figures

Table 1a. The 240 calculated *R*-scores for 95 countries

		1982	1990	1995	2000	2005			1982	1990	1995	2000	2005
1	Albania			54.39	57.77		39	Indonesia				87.46	85.02
2	Algeria				83.54		40	Iran				79.41	72.33
3	Andorra					23.17	41	Iraq				83.17	75.11
4	Argentina	61.90	58.78	64.48	63.15	47.72	42	Ireland	70.85	64.44		56.19	
5	Armenia			51.15			43	Israel				62.03	
6	Australia	55.77		45.73		36.64	44	Italy	58.96	57.65		58.48	55.55
7	Austria		51.86		47.58		45	Japan	34.51	23.99	23.26	25.05	21.70
8	Azerbaijan			59.16			46	Jordan				79.93	81.74
9	Bangladesh			89.25	78.63		47	Korea, S	43.46	41.62	27.95	37.11	36.72
10	Belarus		21.32	42.23	38.76		48	Kyrgistan				55.76	
11	Belgium	53.50	42.71		38.95		49	Latvia		44.01	39.52	44.43	
12	Bosnia			54.79	52.18		50	Lithuania		35.44	51.21	57.85	
13	Brazil		64.86	80.24		68.59	51	Luxemburg				37.92	
14	Bulgaria		28.82	36.12	37.62	32.25	52	Macedonia			48.66	54.64	
15	Burkina F.					76.05	53	Malaysia					74.02
16	Canada	64.85	55.81		55.55		54	Mali					82.01
17	Chile		73.24	67.45	63.78	53.66	55	Malta	84.44	82.64		76.58	
18	China		2.41	3.84	39.30	13.62	56	Mexico		65.39	65.20	72.57	61.43
19	Colombia			74.84		73.55	57	Moldova			55.40	64.64	58.22
20	Croatia			51.16	61.23		58	Morocco				89.99	85.05
21	Cyprus					46.98	59	Netherlands	45.75	38.47		33.67	26.17
22	Czech Re		35.65	25.30	27.78		60	New Zeal.			43.11		35.31
23	Denmark	34.71	30.79		30.67		61	Nigeria		86.03	91.29	87.62	
24	Dom Re			72.16			62	Norway	45.09	35.69	35.86		
25	Egypt				88.89	73.46	63	Pakistan			90.74	79.26	
26	El Salvad.			86.22			64	Peru			75.34	75.96	63.98
27	Estonia		9.73	22.68	29.32		65	Philippines			86.49	78.01	
28	Ethiopia					75.46	66	Poland		78.69	75.12	67.99	63.65
29	Finland		36.31	41.36	42.63	38.88	67	Portugal		56.32		56.85	
30	France	40.56	34.38		30.83	21.90	68	Puerto Rico			81.99	78.37	
31	Georgia			63.20			69	Romania		59.85	68.85	74.04	72.47
32	Germany	48.85	41.01	29.96	33.87	30.08	70	Russia		43.32	35.15	43.21	30.24
33	Ghana					83.42	71	Rwanda					63.75
34	Greece				54.65		72	Saudi Arabia				80.07	
35	Hong K.					12.70	73	Serbia			40.58	48.20	51.94
36	Hungary	38.27	51.74	39.96	39.05		74	Singapore				69.20	
37	Iceland	46.93	48.10		43.12		75	Slovakia		52.98	55.49	57.48	
38	India		57.33	68.53	58.62	54.84							

Table 1a. continued

		1982	1990	1995	2000	2005			1982	1990	1995	2000	2005
76	Slovenia		48.63	42.80	41.95	36.12	86	Uganda				84.72	
77	S. Africa		74.65	80.60	77.82	73.31	87	UK	45.89	41.06	27.13	36.53	30.06
78	Spain	55.54	48.29	53.90	44.48	27.76	88	Ukraine			42.99	52.42	50.83
79	Sweden	33.30	25.04	28.86	27.19	22.65	89	Ulster	65.68	65.07		54.39	
80	Switzerland		48.58	48.32		41.37	90	Uruguay			44.64		
81	Taiwan			39.68		37.73	91	USA	75.14	70.19	72.15	68.34	56.79
82	Tanzania				86.38		92	Venezuela			73.79	67.08	
83	Thailand					67.84	93	Vietnam				30.48	34.88
84	Trinidad					67.33	94	Zambia					75.40
85	Turkey		60.93	73.59	71.57	65.84	95	Zimbabwe				83.56	

Note: The observations are weighted using the average principal components from all five waves. Missing observations are filled in proportionally.

Table 1b. Descriptive statistics for each wave and all 240 *R*-scores

	1982	1990	1995	2000	2005	All
N, number of polls	21	43	54	70	52	240
Average	52.57	48.69	54.52	58.25	52.83	54.03
Standard deviation	13.75	18.33	20.44	18.72	20.94	19.46
Standard error	3.00	2.80	2.78	2.24	2.90	1.26
Median	48.85	48.58	52.56	57.63	55.20	54.52

Table 2. The text of the items in the original English version

Nr	Code	Content: The question asked	Answer used
4	a006	Item in set of what is important in life: Religion important in life	Very
3	a040	Item about what it is important to teach children	Faith
14	f024	Belongs to religious denomination	Yes
8	f028	Attend religious service	At least once per month
12	f034	Are a religious person	Yes
9	f035	Churches answer moral problems	Yes
5	f036	Churches answer family life problems	Yes
13	f037	Churches answer spiritual needs	Yes
11	f038	Churches answer social problems	Yes
6	f050	Believes in god	Yes
1	f063	God very important in life	7 to 10 on 10 point scale
7	f065	Has moments of prayer and meditation	Yes
2	f102	Better if more people are strongly religious	Agree and agree strongly
10	f104	Politicians who don't believe are unfit for office	Agree and agree strongly

Note: The text as given in the Stata file downloaded from http://www.worldvaluessurvey.org. The numbers given are the numbers used in the tables in ***P&G12***, which are sorted by size of factor loading.

Table 3. Country classifications

1	Albania	PC, M	26	El Salvador	Ot, LA	51	Luxemburg	W	76 Slovenia	PC
2	Algeria	Ot, M, Ar	27	Estonia	PC	52	Macedonia	PC	77 South Africa	Ot
3	Andorra	W	28	Ethiopia	Ot	53	Malaysia	Ot, M	78 Spain	W
4	Argentina	Ot, LA	29	Finland	W, Sc	54	Mali	Ot, M	79 Sweden	W, Sc
5	Armenia	PC, Obs	30	France	W	55	Malta	W	80 Switzerland	W
6	Australia	W	31	Georgia	PC, Obs	56	Mexico	Ot, LA	81 Taiwan	Ot, EA
7	Austria	W	32	Germany	W	57	Moldova	PC	82 Tanzania	Ot
8	Azerbaijan	PC, M	33	Ghana	Ot	58	Morocco	Ot, M, Ar	83 Thailand	Ot, EA
9	Bangladesh	Ot, M	34	Greece	W	59	Netherlands	W	84 Trinidad	Ot, LA
10	Belarus	PC	35	Hong Kong	Ot, EA	60	New Zealand	W	85 Turkey	Ot, M
11	Belgium	W	36	Hungary	PC	61	Nigeria	Ot	86 Uganda	Ot
12	Bosnia	PC	37	Iceland	W, Sc	62	Norway	W, Sc	87 UK	W
13	Brazil	Ot, LA	38	India	Ot	63	Pakistan	Ot, M	88 Ukraine	PC
14	Bulgaria	PC	39	Indonesia	Ot, M	64	Peru	Ot, LA	89 Ulster	W
15	Burkina Faso	Ot, M	40	Iran	Ot, M	65	Philippines	Ot, EA	90 Uruguay	Ot
16	Canada	W	41	Iraq	Ot, M, Ar	66	Poland	PC	91 USA	W
17	Chile	Ot, LA	42	Ireland	W	67	Portugal	W	92 Venezuela	Ot, LA
18	China	Ot, EA	43	Israel	W, Obs	68	Puerto Rico	Ot, LA	93 Vietnam	Ot, EA
19	Colombia	Ot, LA	44	Italy	W	69	Romania	PC	94 Zambia	Ot
20	Croatia	PC	45	Japan	Ot, EA	70	Russia	PC	95 Zimbabwe	Ot
21	Cyprus	W	46	Jordan	Ot, M, Ar	71	Rwanda	Ot		
22	Czech R.	PC	47	Korea, South	Ot, EA	72	Saudi Arabia	Ot, M, Ar		
23	Denmark	W, Sc	48	Kyrgistan	PC, M	73	Serbia	PC		
24	Domenican R.	Ot, LA	49	Latvia	PC	74	Singapore	Ot, EA		
25	Egypt	Ot, M, Ar	50	Lithuania	PC	75	Slovakia	PC		

The following 8 countries are the MENA group (Middle East and North Africa): Algeria, Egypt, Iran, Iraq, Jordan, Saudi Arabia and Turkey.
Obs: Three countries are difficult to classify: Armenia and Georgia are classified as European and Israel is put in the West, though geographically it belongs in the MENA group.

All countries are divided into 3 groups: W (*West*), PC (*P-Com*, for Post-Communist) and Ot (*Others*).

The countries of *West* have the subgroup of Sc (Scandinavian); the United States is also used as a group. Some *P-Com* and many *Other* countries are M (Muslim). Some Muslim countries are Ar (Arab). Some *Other* countries are EA (East Asian and non-Muslim Southeast Asian); China is also used as a group. The MENA region (Middle East and North Africa) includes six Arab countries plus Iran and Turkey. Israel (only one poll) is coded as *West*.

Figures 1 and 2 break up Figure 2 of ***P&G12*** into two parts. Figure 1 covers the Christian countries except the *P-Com* countries. Figure 2 for *Others* looks much like Figure 2 in ***P&G12***; Figure 1 for *Christians* looks different. The kernel-curve looks as full transition curve, but the point-scatter suggests that the high end of the curve is poorly determined.

Figure 1. Religiosity of *Christian* countries explained by income, *N* = 124 polls

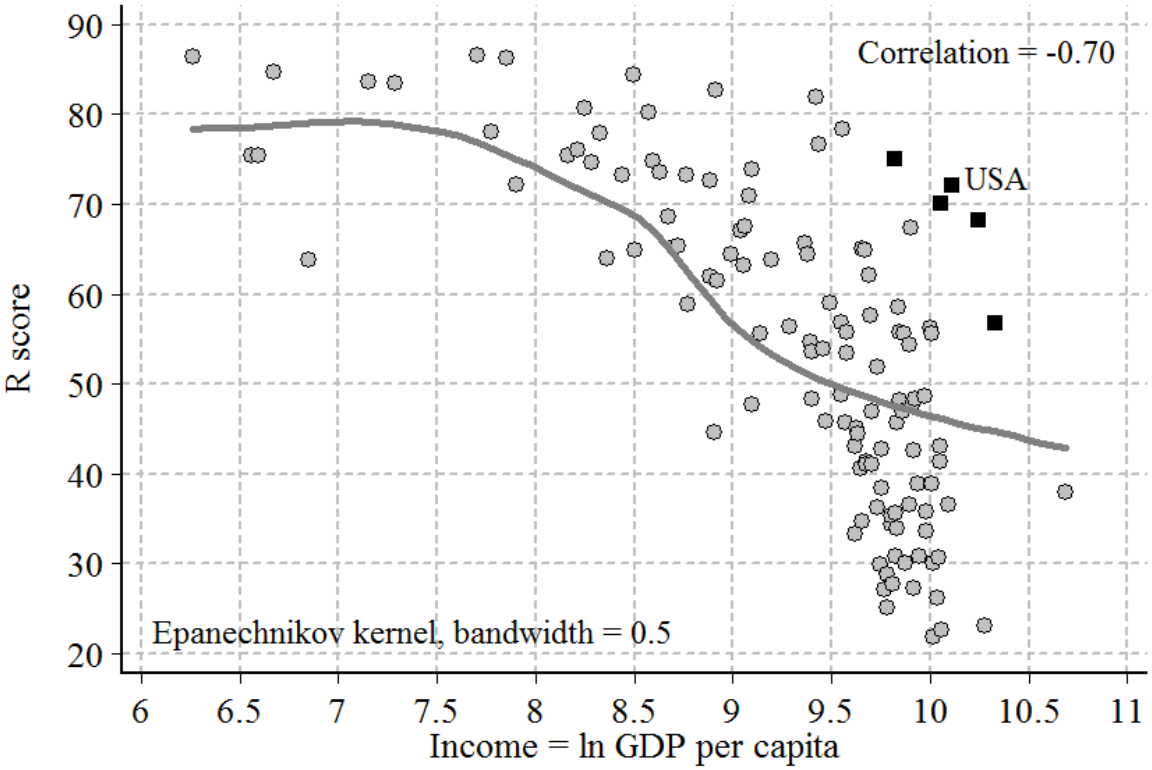


Figure 2. Religiosity of *Other* countries explained by income, *N* = 116 polls

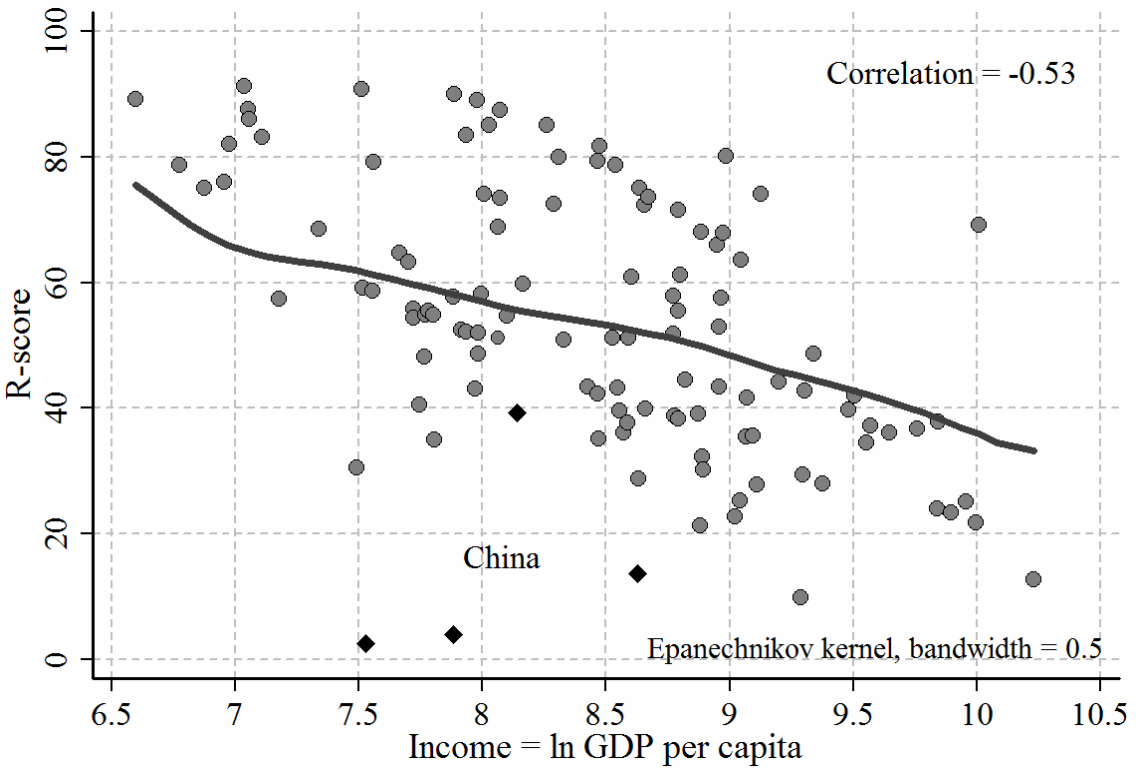


Table 4. The DP-instruments and control variables

The biological variables used as DP-instruments – used in Table 4 in *P&D12* and in Table 10 below	
animals	Number of domesticable big mammals, weighing more than 45 kilos, which are believed to have been present in prehistory in various regions of the world. Source: Olsson and Hibbs (2005).
plants	Number of annual perennial wild grasses known to have existed in various regions of the world in prehistory, with a mean kernel weight exceeding 10 milligrams. Source: Olsson and Hibbs (2005).
bioavg	Average of *plants* and *animals*, where each variable was first normalized by dividing by its maximum value. Source: Hibbs and Olsson (2004).
biofpc	The first principal component of *plants* and *animals*. Source: Olsson and Hibbs (2005).
maleco	Index of malaria ecology; combines climatic factors and biological properties of the regionally dominant malaria vector. Source: Kiszewski and Sachs et al. (2004).
The geographical variables used as DP-instruments– used in Table 4 in *P&D12* and in Table 10 below	
axis	Relative east-west orientation of a country, measured as east-west distance (longitudinal degrees) divided by north-south distance (latitudinal degrees). Source: Olsson and Hibbs (2005).
climate	A ranking of climates according to how favorable they are to agriculture, based on the Köppen classification. Source: Olsson and Hibbs (2005).
coast	Proportion of land area within 100 km of the sea coast. Source: McArthur and Sachs (2001).
frost	Proportion of a country's land receiving five or more frost days in that country's winter, defined as December through February in the northern hemisphere and June through August in the southern hemisphere. Source: Masters and McMillan (2001).
lat	Distance from the equator as measured by the absolute value of country-specific latitude in degrees divided by 90 to place it on a [0,1] scale. Source: Hall and Jones (1999).
size	The size of the landmass to which the country belongs, in millions of square kilometers. Source: Olsson and Hibbs (2005).
geoavg	Average of *climate*, *lat*, and *axis*, where each variable was first normalized by dividing by its maximum value. Source: Hibbs and Olsson (2004).
geofpc	The first principal component of *climate*, *lat*, *axis* and *size*. Source: Olsson and Hibbs (2005).
Control variables – used in Table 10 below	
autoc	Measure of the degree of autocracy, negative values excluded. Source: Marshall and Jaggers (2009).
communist	Dummy variable for communist countries, coded according to a Wikipedia article on "List of socialist countries". Source: Wikipedia (2011).
muslim	Share of the population with Muslim religious belief. Source: La Porta et al. (1998).
prot	Share of the population with protestant religious belief. Source: La Porta et al. (1998).
romcat	Share of the population with roman-catholic religious belief. Source: La Porta et al. (1998).

2. Robustness to the exclusion of countries and country groups

As a robustness test, we have re-estimated the base model of Table 6 in ***P&G12*** in 95 versions, where λ_i is the estimate of the transition slope when country *i* is excluded from the regression. Table 5 shows the resulting effect, $\eta = 100 \cdot (1 - \lambda_i / \lambda_{all})$, as defined in ***P&G12***; for the calculation of the ηs, see also Table 8 below.

Table 5. The effect η (in %) of excluding one country from the sample

Country	η	Country	η	Country	η	Country	η
Albania	-0.9	El Salvador	1.0	Luxemburg	-0.2	Slovenia	0.7
Algeria	0.9	Estonia	1.3	Macedonia	-0.8	South Africa	1.7
Andorra	1.0	Ethiopia	-0.3	Malaysia	-0.2	Spain	0.6
Argentina	-0.0	Finland	0.7	Mali	0.7	Sweden	3.7
Armenia	-0.4	France	2.2	Malta	-0.2	Switzerland	-0.5
Australia	-0.1	Georgia	-0.1	Mexico	0.2	Taiwan	0.5
Austria	-0.4	Germany	1.8	Moldova	-0.9	Tanzania	0.5
Azerbaijan	-0.6	Ghana	0.9	Morocco	2.0	Thailand	-0.0
Bangladesh	1.3	Greece	-0.1	Netherlands	1.6	Trinidad	-1.1
Belarus	-0.4	Hong Kong	1.7	New Zealand	0.5	Turkey	0.3
Belgium	0.1	Hungary	-0.2	Nigeria	3.8	Uganda	0.7
Bosnia	-1.0	Iceland	-0.3	Norway	0.7	UK	1.9
Brazil	0.6	India	-2.5	Pakistan	2.1	Ukraine	-1.6
Bulgaria	-0.8	Indonesia	1.6	Peru	1.0	Ulster	-1.5
Burkina Faso	0.1	Iran	0.6	Philippines	1.0	Uruguay	0.1
Canada	-1.9	Iraq	0.8	Poland	0.5	USA	-7.8
Chile	-0.3	Ireland	-1.2	Portugal	-0.4	Venezuela	-0.3
China	-8.2	Israel	-0.6	Puerto Rico	-1.7	Vietnam	-3.9
Colombia	0.5	Italy	-1.9	Romania	0.9	Zambia	-0.3
Croatia	-0.0	Japan	3.1	Russia	-0.6	Zimbabwe	0.9
Cyprus	-0.1	Jordan	1.0	Rwanda	-1.1		
Czech Rep.	0.6	Korea S	-1.4	Saudi Arabia	-0.1	Average	0.00
Denmark	1.6	Kyrgistan	-0.5	Serbia	-2.7	Median	0.03
Domincan Rep.	0.4	Latvia	-0.2	Singapore	-1.3	Std	1.70
Egypt	1.5	Lithuanea	0.1	Slovakia	0.0	Se	0.17

Table 6 summarizes the 95 estimates. The un-shaded middle section reports the average estimate of the transition slope, λ. The average estimate is practically the same as the estimate of the base model reported in Table 6 of ***P&G12***. The average standard error based on the 95

estimates is 0.019, so the cross-estimate has a t-ratio of 570. The lowest t-ratio of the 95 estimates is 8.76, which also confirms the robustness of the base model estimate of λ.

Table 6. Average and range of the 95 estimates each missing one country

	Constant		Transition slope, λ		R^2 adj
	Estimate	(t-ratio)	Estimate	(t-ratio)	
Average	150.172	(14.46)	-10.822	(-9.31)	0.266
Se	0.171	(0.029)	0.019	(0.024)	0.001
Max	158.842	(16.49)	-10.412	(-8.76)	0.333
Min	146.337	(13.76)	-11.704	(-10.87)	0.243
Range	12.504	(2.73)	1.292	(2.11)	0.090

The range of the 95 estimates is 1.29, which is 12% of the average estimate. The distribution of the 95 estimates of η is shown in Figure 3. It looks fairly normal, with a small variation, except for two extreme countries: China and the United States.

Figure 3. Probit diagram showing the distribution of the 95 ηs

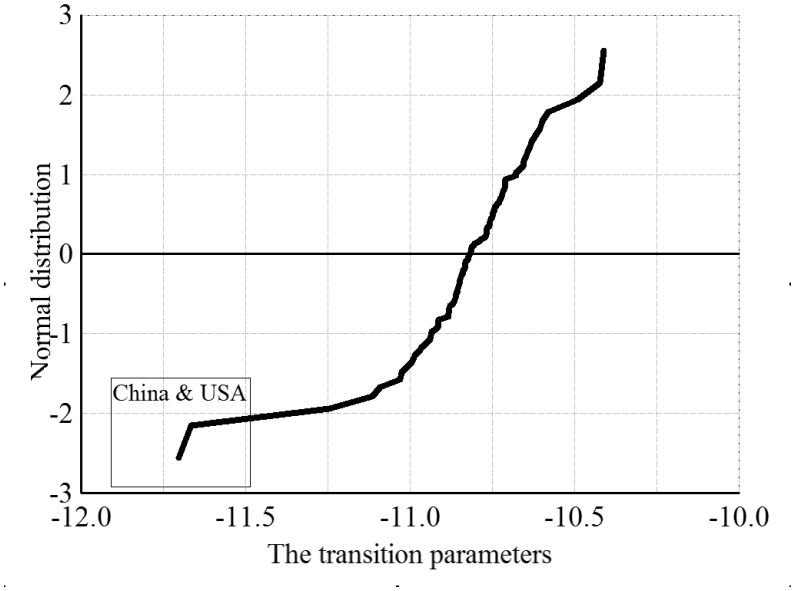


Table 6 and Figure 3 summarize the effects of excluding one country. The estimates reported in Table 5 can also be used to assess what happens when two countries are excluded instead of one, which generates $\binom{95}{2}$ = 4465 cases. For each pair of excluded countries, the effect on

the estimated transition slope can be approximated by *adding* the respective ηs from Table 5. For instance, if Saudi Arabia and Turkey were both excluded from the sample, the resulting effect on the estimated transition slope would be about -0.1% + 0.3% = 0.2%. The biggest effect would necessarily result from excluding the two countries with the largest (equally signed) deviations from the average transition slope, namely China and the United States. By simple addition from Table 5, the approximated deviation from the transition slope would be about -16.0%. Table 8 below shows that the simple addition of individual effects works reasonably well even in the case of two countries with large individual deviations. However, the approximation gradually becomes less precise if more than three countries are excluded from the sample.

The two outliers: China and the United States

As seen on Figure 3 and on Figures 2 and 3 in ***P&G12***, China and the United States display rather extreme religiosity observations. Table 7 confirms that the two countries are outliers. Normality of the distribution is rejected if China and the United States are included, but not when they are excluded.

Table 7. Normality tests of the distributions of the 95 ηs

Tests for normality	Statistic	For all 95 observations		Without China and USA	
		Test-value	P-value %	Test-value	P-value %
Skewness/Kurtosis	Adj $\chi^2(2)$	43.86	0.00	4.63	9.87
Shapiro-Wilk W	z	5.729	0.00	1.06	14.39
Shapiro-Francia W'	z	5.197	0.00	1.59	5.60

The upper panel of Table 8 documents the effect on the transition slope when the two outliers are excluded from the sample. The un-shaded section of the table shows that the estimated transition slope increases (in absolute value) by 0.8-0.9 points for each case individually and by 1.7 points jointly. In percentage terms (column (η)), the latter effect resembles the effect derived by simple addition of the individual effects reported in Table 5. The R^2 of the regression increases by about 11 percentage points if both outliers are excluded.

The lower panel of Table 8 reports the effect of the exclusion of all MENA countries from the sample. The effect of the group-wise exclusion is comparable in size to the exclusion of the Unites States, but remains within the 95% confidence interval of the estimate of the transition slope for the full sample.

Table 8. The effect of excluding the two outliers and MENA countries

	Constant	Transition slope, λ	$\Delta\lambda$ [a)]	η (%)	N	R^2 adj	ΔR^2 adj
All	150.134 (14.52)	-10.818 (-9.35)	-	-	240	0.266	-
Excluding the outliers							
Exclude China	158.842 (16.49)	-11.704 (-10.87)	-0.886	-8.19	236	0.333	0.067
Exclude USA	157.064 (15.28)	-11.667 (-10.11)	-0.849	-7.85	235	0.302	0.036
Exclude both	165.883 (17.44)	-12.566 (-11.79)	-1.748	-16.16	231	0.375	0.109
Excluding the MENA countries (see note to Table 3)							
All 8 countries	141.738 (13.37)	-10.012 (-8.48)	0.806	7.45	224	0.241	-0.025
All incl. Israel	142.264 (13.41)	-10.079 (-8.53)	0.739	6.83	223	0.244	-0.022

a. The difference is $\Delta\lambda = \lambda_i - \lambda_{all}$ and $\eta = 100 \cdot \Delta\lambda / \lambda_{all}$.

Suspicious religiosity data for selected countries?

At various presentations, the results reported in ***P&G12*** have been questioned by discussants pointing out that self-reported levels of religious activities might be systematically biased in some sample countries. The argument has typically been made for two cases. In anti-religious communist autocracies like China and Vietnam people may fear to declare themselves as being religious at polls. In religious autocracies like Iran and Saudi Arabia people may fear to declare themselves as not being religious at polls. This seems to be a plausible argument, which is examined in Table 9.

A further argument that has been raised against the results presented in ***P&G12*** is that the respondents in countries like Armenia, Poland, and Ulster may also misreport their true level of religious activities, say, for fear of being identified as outsiders in a predominantly religious society. This argument looks less plausible to us, but these three cases are also examined in Table 9. Interestingly, a corresponding argument has not been raised (so far) about misreported levels of religious activities in Scandinavian countries.

Table 9. Estimates of the effect of potentially misreported religiosity levels

Communist countries			Religious autocracies			Other possible biases		
Country	Polls	η (%)	Country	Polls	η %	Country	Polls	η %
China	4	−8.2	Saudi Arabia	1	−0.1	Armenia	1	−0.4
Hungary	4[a)]	−0.2	Iran	2	+0.6	Poland	4	+0.5
Vietnam	2	−3.9				Ulster	3	−1.5
Sum	10	−12.3		3	+0.5		4	−1.4
Upper bound for bias		−1.2			+0.1			−0.2

Notes: The upper bound is the sum of the ηs/100 multiplied with the average transition slope of −11.
[a] Only the first poll is from the Communist period.

Table 9 shows that the countries which are presumed to have suspicious religiosity data do not have a large effect on the estimated transition slope, even when considered as groups. An upper bound for the potential bias of the estimated transition slope that is due to misreported religiosity data appears to be in the range of 1 percentage point.

One could also argue that not only Iran and Saudi Arabia but all countries of the MENA region have suspicious religiosity data, as implied by the estimates presented in the last row of Table 8. The 16 polls from these countries affect the results slightly less (in percentage terms) than the five polls from the United States. Adding-up the effects for the MENA countries in Table 5 gives a change of 7.0%, which is somewhat lower but still close to the estimated coefficient reported in the last row of Table 8.

Obviously, it is extreme to exclude countries from the sample in order to assess the size of a potential bias in the estimated transition slope. We have also experimented with substituting the data for suspicious countries with the data for neighboring countries. For instance, we know that China is a country with low levels of religiosity, but maybe the respondents are underreporting due to political pressure. Hence if we look at South Korea, Taiwan, and Singapore, we may get a point of reference for an unbiased estimate of the level of religiosity in China. The imputed estimate would of course be higher than the reported estimate, but then the previously reported effect of excluding China would be reduced by more than half.

Overall, we conclude that our estimation results for the transition slope are *not* driven by outliers, by countries with suspicious religiosity data, or by the MENA countries as a group. We can be confident that the transition slope is rather robustly estimated at $\lambda = -11$ with a standard error of ± 1.5.

3. Alternative robustness tests based on Table 4 in *P&G12*

Another concern with the estimates of the transition slope is the potential bias that may result from omitted variables. One possibility is a systematic bias in the measured level of religiosity in autocracies, as already highlighted in the previous section. Similarly, adherents of monotheistic religious groups may respond differently to the WVS questionnaire than adherents of eastern religions, especially when asked about the role of the church. That is, the prevailing political system or specific religious affiliations may also affect the self reported level of religiosity – and hence may lead to biased estimates of the transition slope when ignored as control variables.

However, omitted variables bias should not be a problem for the IV estimates in Table 4 of ***P&G12***. The statistical tests suggest the validity of the instruments. With valid instruments, the estimated regression coefficients in Table 4 of ***P&G12*** should not be affected by the inclusion of controls for say, autocracy, communism, or main monotheistic religious groups, even if these controls influence our measure of religiosity in a statistically significant way.

To see if this presumption holds, we re-estimate specification (1) of Table 4 of ***P&G12*** with various controls, such as the degree of autocracy (*autoc*), a dummy for communist countries (*communist*), and the shares of the population with protestant (*prot*), roman catholic (*romcat*), or muslim (*muslim*) religious belief. The results are reported in Table 10.

To allow for a direct comparison, the first column reproduces the first column of Table 4 in ***P&G12***. It turns out that the controls (except *autoc*) have a statistically significant effect with the expected sign (columns (2) and (3)), also when the political and the religious controls are jointly included (column 4). The latter result holds for alternative instrumental variables as well (column 5).

As expected in the presence of valid instruments, the estimated transition slope is only marginally affected by the inclusion of the controls, despite their statistical significance. All estimates in columns (2)-(5) remain in the range of the transition slope reported in Sections 4 and 5 of ***P&G12***. In Table 10, the variation in the dependent variable is substantially reduced due to the inclusion of the controls, but the test statistics still largely confirm the validity of the instruments and the similarity of the IV and OLS estimates.

Table 10. Estimates of the transition slope with various controls

Instruments		*biofpc* and *geofpc*			*coast, frost, maleco*
	(1)	(2)	(3)	(4)	(5)
No. of countries	59	59	59	59	84
	OLS estimates (same controls as in IV regression)				
Transition slope, λ_{OLS}	**-12.34**	**-11.08**	**-10.37**	**-11.41**	**-10.60**
(t-ratio)	(-7.5)	(-6.15)	(-6.47)	(-8.43)	(-7.94)
Centered R^2	0.49	0.66	0.63	0.72	0.66
	IV estimates				
Transition slope λ_{IV}	**-14.99**	**-11.87**	**-13.21**	**-12.84**	**-14.22**
(t-ratio)	(-5.7)	(-3.71)	(-5.73)	(-7.00)	(-7.24)
Autoc	-	1.45	-	-	-
		(1.00)			
Communist	**-**	**-59.45**	-	**-45.35**	**-41.55**
		(-5.37)		(-4.68)	(-5.01)
Prot	-	-	3.26	-	-
			(0.41)		
Romcat	-	-	**17.21**	**12.24**	**15.15**
			(3.42)	(3.11)	(3.82)
Muslim	-	-	**22.87**	**18.03**	**17.26**
			(3.26)	(3.04)	(3.40)
	Hausman test for parameter consistency of OLS and IV estimate				
C-statistic (p-value)	0.18	0.76	0.07	0.24	0.01
	Tests of validity of the IV-procedure				
First stage partial R^2	0.41	0.32	0.51	0.56	0.50
Sargan test (p-value)	0.05(!)	0.21	0.11	0.33	0.01(!)
	Cragg-Donald test for weak instruments				
Main causality: $y \Rightarrow \underline{R}$	19.42(?)	12.55(!)	27.53	33.11	25.81
CD critical value	19.93	19.93	19.93	19.93	22.30

Notes: Estimates based on averaged cross-country data for 1982-2005. The dependent variable is the religiosity score, $\underline{R}_i$. See also notes to Table 4 in ***P&G12***.

Thus, we can confirm that the aggregated religiosity data based on the WVS questionnaire are indeed affected by the main religious affiliation and by the political system of a country, but these variables do not bias the estimated size of the slope of the religious transition. Like in the previous section, we conclude that the transition slope is rather robustly estimated at $\lambda = -11$ with a standard error of ± 1.5.

4. Using the panel structure of the data: Within- and between-estimates

Our sample includes 95 countries, which account for the *between* variation of the panel variable, and five *WVS* waves, which account for the *within* variation of the time variable (see Table 1a). This panel structure has 475 cells, but we only have 240 observations of the religiosity score. With only half of all cells (50.5 %) filled, the panel structure is rather unbalanced and has been disregarded for further analysis in ***P&G12***. Nevertheless, the panel structure may be used for estimates with a simple specification, where income is used as the only regressor. The results are shown in Table 11.

To allow for direct comparison, column (1) reproduces the estimated transition slope reported for the base model of Table 6 in ***P&G12***. It disregards the panel structure and uses pooled OLS (POLS) on all 240 available observations. Column (2) reports results based on the BE (between) estimator. The BE estimator collapses the time dimension of the panel into one averaged observation per country, i.e., it produces a time-averaged OLS-estimate based on 95 observations. Different from the approach employed in Table 4 of ***P&G12***, no instruments are used in Table 10 and hence the full country sample can be used. The estimates presented in columns (3) and (4) impose restrictions on the panel data by way of the FE (country-fixed effects) and the RE (random effects) estimator. This gives us four alternative estimates of the transition slope: $\lambda_{POLS}, \lambda_{BE}, \lambda_{FE}$ and λ_{RE}.[1]

Figure 4 compares the size of the four estimated transition slopes and their respective 95% confidence intervals. There is some variation in size across the estimates, but the confidence intervals overlap considerably. Thus, we presume that the four estimates all catch the same underlying transition slope, λ.

Theoretically the most different estimates should be λ_{BE} and λ_{FE}. The BE estimate is between countries, i.e., it is the cross-country effect. The FE estimate is within countries, i.e., it is the time-series effect. The POLS and the RE estimates should be in between. We note that $\lambda_{FE} < \lambda_{RE} < \lambda_{POLS} < \lambda_{BE}$ holds, as expected. By the equivalence assumption from section 2.2 in ***P&G12***[2], we expect that $\lambda_{BE} \approx \lambda_{FE}$. We note that even though they are the two most

1. The three R^2's for the panel regressions should be noted. The overall variation explained is only half of the sum of the within- and the between-variation explained. This means that (at least some) outliers are *persistent*. Put differently, some outliers appear to display within-transition slopes at a level that differs from the average level of the transition slope, as shown for the case of the United States in Figure 2 of ***P&G12***.

2. The equivalence assumption is that the long-run time-series estimate and the cross-country estimate are the same. In case of the religiosity data, one may argue that the five waves of the WVS do not generate enough long-run time series variation to allow for a consistent FE-estimate in line with perfect equivalence.

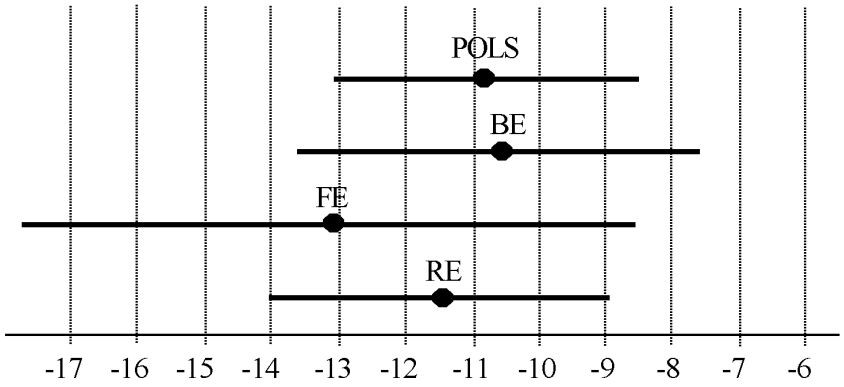
different estimates of the transition slope, both are within the 95% confidence interval of each other. Hence we proceed with a formal test of the null hypothesis H_0: $\lambda_{BE} \neq \lambda_{FE}$.

Table 11. The consistency of between- and within-estimates of the transition slope

Dependent variable: *R*	(1)	(2)	(3)	(4)
Estimator	POLS	BE	FE	RE
	λ_{POLS}	λ_{BE}	λ_{FE}	λ_{RE}
λ on income	-10.82	-10.64	-13.14	-11.43
(t-ratio)	(-9.4)	(-6.8)	(-5.6)	(-8.8)
Number of obs.	240	-	240	240
Number of countries	-	95	95	95
R^2 overall	0.267		0.269	
R^2 between		0.335	0.335	
R^2 within			0.179	
F-test fixed effects (*p*-val.)			0.00	
Hausmann test statistic		-0.39		
Gould test statistic (*p*-val.)		0.77 (0.38)		

Notes: The columns refer to results achieved with alternative estimation methods as discussed in the text. All specifications include an unreported constant term.

Figure 4. Confidence intervals (95%) for the estimated transition slopes



The last two rows of Table 11 report two tests of H_0. Gould (2001) proposes a coefficient test to check the efficiency of the RE estimator. The first step is to decompose each explanatory variable into a mean value (across countries) and a difference from the mean. Then a regression of the dependent variable on this set of explanatory variables produces the coefficients on the averaged and the demeaned variables that would be estimated separately by a BE and by a FE regression. The random effects estimator can be considered as efficient

if the coefficients on the averaged and the differenced variables are not statistically significantly different from each other. The advantage of this test is that it can be directly applied to the coefficients of interest, whereas the Hausman test for the efficiency of the RE estimator relies on moment conditions that are often not satisfied.

The latter holds for the present case as well, so the Hausman test result cannot be used to assess H_0 (but is reported nevertheless). The Gould test indicates that H_0 is rejected at the 5 % level of statistical significance. This result suggests that the equivalence assumption cannot be rejected, which implies that the RE estimator can be considered as efficient. However, it should be noted that the underlying panel structure is rather weak, so it is reassuring that the simple POLS estimator does not give significantly different results.

Moreover, our readings in history suggest that there is much additional evidence in favor of the equivalence assumption as regards the transition of religiosity. Some insight is provided by a set of retrospective data for church attendance (see Iannaccone 2003). The data covers 32 countries from 1925 to 1990. Average attendance is 35 percentage points. In the 65 year period covered by the Iannaccone data, attendance falls by 22 percentage points and income increases by almost 1.5 logarithmic points, so the fall in attendance is 15 percentage points per log point, similar to the fall of religiosity estimated from a pure cross-section of countries in Table 4 of ***P&G12***.

In the developed countries of the West, the per capita density of religious buildings, notably churches, may provide another piece of evidence in favor of the equivalence assumption. It appears that an amazing number of existing churches were founded way back in history even before Europeans learned about the Americas and Chinese inventions, at a time when European populations were much smaller and much poorer than at present. This suggests to us that along with rising levels of economic prosperity, there has been a strong long-run decline in the manifestation of religious symbols in Europe.

5. Dummy variables for the WVS waves

An earlier version of ***P&G12*** mentioned that year dummies for the five waves are statistically insignificant when included in the base model of Table 6 in ***P&G12***; see also column (1) of Table 11. This is documented in Table 12, which reports two versions of the specification of column (1) of Table 11: one excludes a year dummy for one of the waves, the other excludes the constant term.

The left column of Table 12 shows that all year dummies are statistically insignificant if a regression constant is included. The right column shows that once the regression constant is excluded, all year dummies display the same statistically significant coefficient that equals the regression constant of the left column. The estimated transition slope is much the same as in Table 11, independent of the inclusion of year dummies.

Table 12. The insignificance of year dummies

	No year dummy for wave 5	No regression constant
income	-10.93 (-9.2)	-10.93 (-9.2)
Wave 1	5.15 (1.2)	154.95 (13.3)
Wave 2	-1.24 (-0.4)	148.55 (13.4)
Wave 3	-0.99 (-0.3)	148.80 (14.2)
Wave 4	4.56 (1.5)	154.35 (14.5)
Wave 5	-	149.79 (13.9)
Constant	149.8 (13.9)	-
R^2	0.287	0.918

Note: t-ratios in parentheses.

6. Two historical experiments

The data contain 23 Post-Communist countries of which all but two are in East and Central Europe (see Table 3).[3] 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 Central and East European countries are likely 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 other European countries.

The Communist countries have had periods of 45 to 72 years of totalitarian rule. During these years, 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 allow them to endure capitalist exploitation. Consequently, the Communist rulers made a systematic effort to replace religion with the secular communist ideology.[4] This was done by closing the provision of collective goods like education, healthcare, and social security by the church and actively using the state provision of these collective goods for anti-church propaganda. Also, church organizations were systematically weakened by a multitude of administrative devices.[5] The assessment of Section 5.5 in ***P&G12*** is that the income-conditioned level of religiosity was smaller by about 20 percentage points in the Communist countries, as compared to non-Communist European 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 percentage points, as shown in ***P&G12***. This is consistent with the expected reaction to the discontinuation of the anti-religious policies. We conclude that the loss of control over the provision of the three collective goods under Communism negatively affected the level of religiosity. A quantitatively similar effect can also be seen from an altogether separate and much smaller historical experiment.

The three southern cone countries of Argentina, Chile, and Uruguay have much in common. They have a similar immigration history, with a dominating Catholic and Spanish-

[3] Four countries are borderline: Armenia, Azerbaijan, Georgia and Kyrgistan. We take Armenia and Georgia to to be European, while Azerbaijan and Kyrgistan are Asian.
[4] Bjørnskov and Paldam (2012) find that when income is controlled for, mass support for socialism in the P-Com countries is much the same as in Western Europe.
[5] 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).

speaking population, which came mostly from Spain and Italy. The three countries are also similar in their level of economic development. It is easy to mention differences between the countries, but levels of religiosity would probably have been roughly the same, except for one historical event.

In Uruguay, most of the political institutions were formed during the early rule of the Colorado 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 mentioned three collective goods and placed them fully within state control. He also enforced a strict separation of state and church. Since then, this has been upheld as a main policy rationale in Uruguay. Table 13 shows the presumed effect of the separation of church and state 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 other two southern cone countries. The difference is app. 20 percentage points, like in the case of the P-Com countries.[6]

Table 13. *R*-scores from the southern cone

	W1: 1982	W2: 1990	W3: 1995	W4: 2000	W5: 2005	All
Argentina	61.90	58.78	64.48	63.15	47.72	59.21
Chile		73.24	67.45	63.78	53.66	64.53
Uruguay			44.64			44.64
Difference[a]			21.33			17.23[b]

Note: [a]Average *R*-score for Argentina and Chile minus *R*-score for Uruguay. [b]The missing *R*-score for Chile in 1982 is likely to be high, so the calculated difference for all waves is probably downward biased.

[6] The *R*-scores in Table 13 are confirmed by information on *religion* in the CIA Factbook for these countries.

7. Concluding remarks

It is a big problem to fully report all the empirical analyses done for a paper such as ***P&G12***. Especially robustness tests tend to become pretty bulky and tedious to read. And since journal space is limited, it is probably not surprising that publication bias is a large problem in the economics literature. We try to solve this problem by the present online appendix.

That said, we have not even reported in this background paper everything we have done in addition to the results presented in ***P&G12***. However, we believe that nothing we actually report is biased relative to all results we have encountered. Guided by the advice of referees, we have made an effort to focus on the main findings in ***P&G12***. The results in this background paper support our main results. If we had found something contradicting our main results, it would have been reported in ***P&G12***. To the best of our knowledge, this is not the case.

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WVS, World Values Survey, URL: http://www.worldvaluessurvey.org