# Online Appendix C: Religious Conformity of Societal Laws

We extend here our framework to the case where the policies that religious agents value are not fiscal ones (subsidies, tax exemptions) but the conformity of society's laws to religious precepts and proscriptions. Let $\tilde{\tau} \leq 1$ measure how strictly these are enforced, resulting in an income loss of $\tilde{\tau}\theta$ for any individual with productivity $\theta$ (per unit of contemporary TFP). These losses may reflect the reduced time and talent available for production, the costs of unplanned pregnancies, the resources consumed by rituals or spent on circumventing the restrictions (black market, bribes, trips abroad, etc.), or all of the above. For religious agents and the Church, these societal strictures also represent a public good which they value at $bG$, where $G$ is now equal to $G = \tilde{R}(\tilde{\tau})$ and the technology $\tilde{R}$ for producing it has the following properties.

**Assumption 9** *The function $\tilde{R}$ is $\mathcal{C}^3$, strictly increasing and strictly concave, with $\tilde{R}(0) = 0$, $\tilde{R}'(0) = 1$ and $\tilde{R}'(1) > 0$. Furthermore, $\tilde{R}'''(\tilde{\tau}) \leq 0$ for all $\tilde{\tau} \in [0, 1]$.*

These properties are very similar to those of the tax revenue function $R(\tau)$, except that the latter is maximized at $\hat{\tau} < 1$ whereas $\tilde{R}(\tilde{\tau})$ is maximized above 1. The only fiscal public good provided by the government during agents' old age is now $T$, and the budget constraint (2) is replaced by $T = (1 - \tilde{\tau})R(\tau)$. The preferred policy of an agent with relative productivity $\theta$ and religious type $\beta \in \{0, 1\}$ is consequently given by

$$\max_{\tau,\tilde{\tau}} \left\{(1-\tilde{\tau})\left[(1-\tau)\theta + \nu R(\tau)\right] + \beta b \tilde{R}(\tilde{\tau})\right\}. \tag{C.1}$$

Clearly, secular agents always want $\tilde{\tau} = 0$ and their fiscal preferences are unchanged. Religious agents are examined below.

## C.1 Economy without income differences

• *Second-period policy outcome.* The unique distinction is between secular and religious agents so the latter, being in the majority, maximize (C.1) with $\theta = \beta = 1$, leading to:

$$\tau^*(\nu) = (R')^{-1}(1/\nu), \tag{C.2}$$

$$\tilde{\tau}^*(b) = \begin{cases} 0 & \text{for} \quad b < \tilde{\nu} \\ (\tilde{R}')^{-1}(\tilde{\nu}/b) & \text{for} \quad \tilde{\nu} \leq b \leq 1/\tilde{R}'(1) \\ 1 & \text{for} \quad 1/\tilde{R}'(1) < b, \end{cases} \tag{C.3}$$

where we define

$$\tilde{\nu} \equiv 1 - \tau^*(\nu) + \nu R(\tau^*(\nu)). \tag{C.4}$$

There are three differences with respect to the baseline model. First, $G$ is now provided for all $b \geq \tilde{\nu}$ rather than for $b \geq \nu$. Second, $T$ is always provided (funded by the same tax rate $\tau^*(\nu)$ as before), whereas before it was equal to zero for $b < \nu$. Third, agents' lower incomes due to the religious restrictions $\tilde{\tau} > 0$ imposed when $b \geq \tilde{\nu}$ reduce the tax base, so that for any given value of $\tau$, $T$ is also lower. Proposition 1 thus becomes:

**Proposition 10** *The fiscal and legal policies implemented in the second period are:*
*(1) If* $b < \tilde{\nu}$*, then* $(\tau, \tilde{\tau}, T, G) = (\tau^*(\nu), 0, R(\tau^*(\nu)), 0)$; $\tau^*(\nu))$*, so that* $\tau$ *and* $T$ *increase in* $\nu$*.*
*(2) If* $b \geq \tilde{\nu}$*, then* $(\tau, \tilde{\tau}, T, G) = (\tau^*(\nu), \tilde{\tau}^*(b), (1 - \tilde{\tau}^*(b))R(\tau^*(\nu)), \tilde{R}(\tilde{\tau}^*(b)))$*, so that so that* $\tilde{\tau}$ *and* $G$ *increase in* $b$*.*

For any $b$ and $\nu$, we denote again the second-period equilibrium level of $G$ as

$$G(b, \nu) \equiv \begin{cases} 0 & \text{if } b < \tilde{\nu} \\ \tilde{R}(\tilde{\tau}^*(b)) & \text{if } b \geq \tilde{\nu}. \end{cases} \tag{C.5}$$

• *Doctrinal repair.* With similar substitutions, the analysis is unchanged from that of Section 5.2. Indeed, the value of repairing, $\tilde{\pi}(b, \nu)$, has the same single-peaked shape as $\pi(b, \nu)$, due to the fact that $\tilde{R}$ has similar properties to those of $R$ (see Lemma 10 in Online Appendix D). The analogue to Assumption 2 is obtained similarly:

**Assumption 10** $\delta \tilde{R}(1) < \eta/q < \tilde{R}(\tilde{\tau}^*(\tilde{\nu}/(1-\delta))) - (1-\delta)\tilde{R}(\tilde{\tau}^*(\tilde{\nu}))$.

We thus obtain a parallel to Proposition 2, with $\nu$ simply replaced by $\tilde{\nu}$.

• *Science policy.* The analysis in Section 5.3 is also essentially unchanged: the blocking loci remain $R^{-1}(\varphi(a)) \leq \Delta^1(b)$ in region 1 ($b > \bar{b} > \tilde{\nu}/(1-\delta)$), and $R^{-1}(\varphi(a)) \leq \Delta^2(b)$ in Region 2 ($\tilde{\nu} \leq b < \underline{b}$), but now with

$$\Delta^1(b) = \lambda p_R \left\{ [1 - \tilde{\tau}^*(b)]\tilde{\nu} + b\tilde{R}(\tilde{\tau}^*(b)) - (1+\gamma)\left[\left(1 - \tilde{\tau}^*(b')\right)\tilde{\nu} + b'\tilde{R}\left(\tilde{\tau}^*(b')\right)\right] \right\} \tag{C.6}$$

$$\Delta^2(b) = \lambda p_R \left\{ [1 - \tilde{\tau}^*(b)]\tilde{\nu} + b\tilde{R}(\tilde{\tau}^*(b)) - (1+\gamma)\tilde{\nu} \right\}. \tag{C.7}$$

Both functions are again increasing wherever they are non-negative (see Online Appendix D.2.3), therefore Proposition 3 still applies.

## C.2 Economy with unequal incomes

### C.2.1 Preferred societal and fiscal policies

As observed earlier, the fiscal preferences of secular agents remain unchanged. For the religious poor, maximizing (C.1) yields $\tau = \tau_L(\nu/\theta_L)$ as in the original specification, while $\tilde{\tau} = \tilde{\tau}_L(b) \equiv$

$\tilde{\tau}^*(b/\tilde{\theta}_L)$, where $\tilde{\tau}^*(\cdot)$ is given by (C.2) and we define

$$\tilde{\theta}_L \equiv [1-\tau_L(\nu)]\theta_L + \nu R(\tau_L(\nu)). \tag{C.8}$$

The problem for the religious rich is similar, except that $\tau_H(\nu) \equiv 0$, hence $\tilde{\theta}_H \equiv \theta_H$ and $\tilde{\tau}_H(b) = \tilde{\tau}^*(b/\theta_H)$. The reason why $\tilde{\theta}_L$ exceeds $\theta_L$, and increases in $\nu$, is that the $RP$ face an additional tradeoff: the tax-base losses generated by religious restrictions imply that the same optimal tax rate $\tau_L(\nu)$ yields a lower level of $T$, leading them to choose positive levels of $G$ and $\tilde{\tau}$ only when $b \geq \tilde{\theta}_L > \theta_L$. For further reference, let us also define

$$\check{b}_j \equiv \tilde{\theta}_j/\tilde{R}'(1), \text{ for } j = L, H. \tag{C.9}$$

Thus $\tilde{\tau}_j(b) = 0$ for $b \leq \tilde{\theta}_j$, solves $b\tilde{R}'(\tilde{\tau}) = \tilde{\theta}_j$ for $\tilde{\theta}_L < b \leq \check{b}_j$, and $\tilde{\tau}_j(b) = 1$ for $b > \check{b}_j$.

**Lemma 9** *(1) The ideal policies of the $SP$ and the $SR$ are the same as in Proposition 1.*
*(2) The ideal policy of the RR coincides with that of the SR (i.e., $T = G = 0$) for $b < \theta_H$, while for $b \geq \theta_H$ it is $(\tau, \tilde{\tau}, T, G) = (0, \tilde{\tau}_H(b), 0, \tilde{R}(\tilde{\tau}_H(b)))$, where $\tilde{\tau}_H(b) \equiv \tilde{\tau}^*(b/\theta_H) > 0$.*
*(3) The ideal policy of the RP is $(\tau, \tilde{\tau}, T, G) = (\tau_L(\nu), \tilde{\tau}_L(b), (1-\tilde{\tau}_L(b))R(\tau_L(\nu)), \tilde{R}(\tilde{\tau}_L(b)))$. They always tax income at the same rate $\tau_L(\nu)$ as the SP, but legislate the religious public good $G$ only when $b \geq \tilde{\theta}_L$, setting $\tau_L(b) \equiv \tilde{\tau}^*(b/\tilde{\theta}_L) > 0$.*

### C.2.2 Political coalitions at $t+1$

In the benchmark model, Lemma 1 showed the existence of a belief threshold $b^*$ above which the religious poor abandoned their "class interests", siding with the religious rich rather than the secular poor. It also showed $b^*(\nu; \theta_H, \theta_L)$ to be increasing in $\nu$ and $\theta_H$, and decreasing in $\theta_L$. The very same intuition and results obtain here provided that $\tilde{R}$ is everywhere less concave than $R'$, or more generally has the following property.

**Assumption 11** *For any $s \leq 1$, $\tilde{R}'(s) \geq R'(s)$. Consequently, $\tau^*(x) \leq \tilde{\tau}^*(x)$, for all $x$.*

The (redefined) $b^*(\nu)$ tells us how the $RP$ rank the $RR$ versus the $SP$, but a CPNE at date $t+1$ involves more than that: all possible coalitions, deviating subcoalitions, etc., must be checked for deviation-proofness. In particular, since the $RP$ now implement redistribution $T > 0$ even when they impose $G > 0$, the $SP$ might prefer such a policy to that of the $RR$ (who set a lower $G$, but $T = 0$). This, in turn, could lead to winning coalitions different from those of the baseline model, with the $RP$ emerging as victor. To rule out this case and ensure that the political outcome remains unchanged, additional assumptions are required.

**Assumption 12**

$$\frac{-\tilde{R}''(1)}{\tilde{R}'(1)} \leq \min\left\{\frac{(1-\hat{\tau})(\theta_H - \theta_L)}{\theta_L + \nu R(\hat{\tau})}\frac{\tilde{R}'(1)}{\tilde{R}(1)},\ \frac{\tilde{\theta}_L}{\theta_L}\left[-\tilde{R}''(0)\right]\right\}.$$

This is of the same nature as Assumption 6, in that it requires the presence of enough income inequality in society, as both terms on the right-hand side are easily seen to increase with $\theta_H$ and decrease with $\theta_L$.

**Assumption 13**

$$\frac{\tilde{R}(1)}{\tilde{R}'(1)} < (1-\tau_L(\nu)) + \frac{\nu R(\tau_L(\nu))}{\theta_H}.$$

A smaller value of $\tilde{R}(1)/\tilde{R}'(1)$ makes Assumptions 12 and 13 both more likely to hold.[48]

The unique CPNE outcome at date $t+1$, paralleling that in Proposition 5, is then characterized below (see Online Appendix D for proofs).

**Proposition 11** *Under Assumptions 11-12, and if $\tilde{\tau}_L(b^*(\nu))$ is relatively high, the equilibrium societal and fiscal policy in the second period is unique and characterized by a religiosity threshold $b^*(\nu;\theta_H,\theta_L) > \theta_H > \nu$, or $b^*(\nu)$ for short, such that:*

*(1) If $b < b^*(\nu)$, the religious poor back the secular poor, who thus come to power and implement their preferred policy, $(\tau,\tilde{\tau},T,G) = (\tau_L(\nu), 0, R(\tau_L(\nu)), 0)$.*

*(2) If $b \geq b^*(\nu)$, the religious poor back the religious rich, who thus come to power and implement their preferred policy, $(\tau,\tilde{\tau},T,G) = (0, \tilde{\tau}^*_H(b), 0, \tilde{R}(\tilde{\tau}^*_H(b)))$.*

*(3) The threshold $b^*$ is strictly increasing in $\nu$ and $\theta_H$, and strictly decreasing in $\theta_L$.*

### C.2.3 Church's Behavior, Blocking Equilibrium, and Comparative Statics

The remaining analysis is essentially unchanged from that of the benchmark model, since:

(i) The policy outcome at $t+1$ hinges in the same manner on whether the $SP$ or the $RR$ are in power, namely on $b$ being below or above (the redefined) $b^*(\nu;\theta_H,\theta_L)$.

(ii) The $SP$ and the $RR$'s policies are the same as in the baseline, except that for the latter $\tau_H(b)$ and $R(\tau_H(b))$ are replaced by the similarly-behaved $\tilde{\tau}^*_H(b)$ and $\tilde{R}(\tilde{\tau}^*_H(b))$.

(iii) The same is therefore true for the Church's repairing decision, with Assumption 8 becoming:

[48] Since the right-hand side of Assumption 13 is bounded below by $1-\hat{\tau}$, sufficient (and simpler) conditions for both assumptions to hold are that $\frac{\tilde{R}(1)}{\tilde{R}'(1)} \leq 1-\hat{\tau}$ and $\frac{-\tilde{R}''(1)}{\tilde{R}'(1)} \leq \min\left\{\frac{\theta_H-\theta_L}{\theta_L+\nu R(\hat{\tau})},\ \frac{\tilde{\theta}_L}{\theta_L}\left[-\tilde{R}''(0)\right]\right\}$.

**Assumption 14** *:* $\delta\tilde{R}(1) < \eta/q < \tilde{R}\left(\tilde{\tau}_H(b^*(\nu)/(1-\delta))\right) - (1-\delta)\tilde{R}\left(\tilde{\tau}_H(b^*(\nu))\right).$

(iv) Continuing the backward induction, the four groups' preferences with respect to blocking (value functions and resulting coalition formation) are also unchanged, up to the same substitutions, resulting in the same monotonicities and comparative statics. ■

# Online Appendix D: Proofs for Appendix C

## D.1 Economy without Income Differences

The only result not proved in Appendix C concerns the behavior of the religious sector.

**Lemma 10** *The function* $\pi(b,\nu)$ *equals* 0 *for* $b < \tilde{\nu}$*, then jumps up to* $\pi(\tilde{\nu},\nu) = \tilde{R}(\tilde{\tau}^*(\tilde{\nu}))$*. It is continuous and increasing on* $[\tilde{\nu}, \tilde{\nu}/(1-\delta))$*, then jumps down to* $\pi(\tilde{\nu}/(1-\delta),\nu) = \tilde{R}(\tilde{\tau}^*(\tilde{\nu}/(1-\delta))) - (1-\delta)\tilde{R}(\tilde{\tau}^*(\tilde{\nu}))$*. Finally, it is continuous and strictly decreasing on* $[\tilde{\nu}/(1-\delta), +\infty)$*, with* $\lim_{b\to+\infty}\pi(b,\nu) = \delta\tilde{R}(1) > 0$*.*

**Proof.** The proof is identical to that of Lemma 2, as $\tilde{R}$ has similar properties to those of $R$. Together with Assumption 10, this yields the optimal-repairing interval. ■

Let us now turn to the State's blocking loci. In Region 1, differentiating (C.6) and using the envelope theorem gives

$$\frac{\partial\Delta^1(b)}{\partial b} = \lambda p_R\left[\tilde{R}(\tilde{\tau}^*(b)) - (1+\gamma)(1-\delta)\tilde{R}\left(\tilde{\tau}^*\left(b'\right)\right)\right]. \tag{D.1}$$

Blocking $BR$ innovations requires that $\Delta^1(b) \geq 0$, which by (C.6) takes the form

$$\tilde{R}(\tilde{\tau}^*(b)) - (1+\gamma)(1-\delta)\tilde{R}\left(\tilde{\tau}^*\left(b'\right)\right) \geq (\tilde{\nu}/b)\left[(1+\gamma)\left(1-\tilde{\tau}^*\left(b'\right)\right) - (1-\tilde{\tau}^*(b))\right]. \tag{D.2}$$

Since $\tilde{\tau}^*(b)$ is nondecreasing and $b' \equiv (1-\delta)b$, the right-hand side of (D.2) is strictly positive. Therefore, $\Delta^1(b) \geq 0$ implies that $\partial\Delta^1(b)/\partial b > 0$ in (D.1). Similarly, from (C.7) we obtain $\partial\Delta^2(b)/\partial b = \lambda p_R\tilde{R}(\tilde{\tau}^*(b))$, which is always positive. Finally, we omit the proof that there is no blocking when $b \in [\underline{b}, \bar{b}]$ as it closely follows the one in Appendix B.2.

## D.2 Economy with Unequal Incomes

To prove Proposition 11, we again solve the game backwards from $t+1$.

### D.2.1 Political preferences at $t+1$

Recall the definitions of $\tilde{\tau}_L(b)$ and $\tilde{\tau}_H(b)$ from Appendix C.2.1. The proofs establishing the existence and uniqueness of $b^*(\nu)$ in Lemma 4 of Appendix B go through unchanged, by simply replacing everywhere $\tau_H(b)$ and $R(\tau_H(b))$ with $\tilde{\tau}_H(b)$ and $\tilde{R}(\tilde{\tau}_H(b))$. In particular, the $RP$'s indifference condition (between $SP$ and $RR$) defining $b^*(\nu)$ is now

$$[1-\tilde{\tau}_H(b^*(\nu))]\,\theta_L + b^*(\nu)\,\tilde{R}(\tilde{\tau}_H(b^*(\nu))) = [1-\tau_L(\nu)]\theta_L + \nu R(\tau_L(\nu)). \tag{D.3}$$

For any $b \geq \check{b}_H > \check{b}_L$ defined by (C.9), we have $\tilde{\tau}_H(b) = \tilde{\tau}_L(b) = 1$ : the $RR$ and $RP$'s ideal policies coincide ($\tilde{\tau} = 1$, making $\tau$ irrelevant), so the $RP$ must prefer the $RR$ to the $SP$. By definition of $b^*$ this means that $b^*(\nu) < \check{b}_H$, therefore

$$\forall\ b \leq b^*(\nu),\ \tilde{\tau}_H(b) < 1 \text{ and } b\tilde{R}'(\tilde{\tau}_H(b)) = \theta_H. \tag{D.4}$$

The proofs for the comparative statics of $b^*(\nu)$ with respect to $\nu$ and $\theta_H$ also remain unchanged. For monotonicity in $\theta_L$, however, under the benchmark specification we made use of the fact that $\tau_L(\nu) > \tau_H(b^*(\nu))$; see Lemma 5 in Appendix B. In the present case, we show a similar inequality, which in turns makes the same proof of monotonicity go through.

**Lemma 11** *Under Assumption 11,* $\tau_L(\nu) > \tilde{\tau}_H(b^*(\nu))$.

**Proof.** Suppose, by contradiction, that $\tau_L(\nu) \leq \tilde{\tau}_H(b^*(\nu))$. Let us rewrite (D.3) as

$$\begin{aligned}\tilde{\tau}_H(b^*(\nu)) - \tau_L(\nu) &= \frac{b^*(\nu)\tilde{R}(\tilde{\tau}_H(b^*(\nu)))}{\theta_L} - \frac{\nu R(\tau_L(\nu))}{\theta_L} \\ &= \frac{b^*(\nu)}{\theta_L}\left[\tilde{R}(\tilde{\tau}_H(b^*(\nu))) - \tilde{R}(\tau_L(\nu))\right] \\ &\quad + \frac{b^*(\nu)}{\theta_L}\left[\tilde{R}(\tau_L(\nu)) - R(\tau_L(\nu))\right] + \frac{b^*(\nu)-\nu}{\theta_L}R(\tau_L(\nu)).\end{aligned} \tag{D.5}$$

Since $R(0) = \tilde{R}(0) = 0$ and $\tilde{R}'(x) \geq R'(x)$ for all $x$, $\tilde{R}$ lies everywhere above $R$. Together with $b^*(\nu) > \nu$, this implies that the last line in (D.5) is strictly positive. Turning to the second line, the Mean-Value Theorem implies that

$$\tilde{R}(\tilde{\tau}_H(b^*(\nu)) - \tilde{R}(\tau_L(\nu)) = [\tilde{\tau}_H(b^*(\nu)) - \tau_L(\nu)] \cdot \tilde{R}'(c),$$

for some $c \in [\tau_L(\nu),\ \tilde{\tau}_H(b^*(\nu))]$. We can then rewrite (D.5) as

$$\begin{aligned}&[\tilde{\tau}_H(b^*(\nu)) - \tau_L(\nu)]\left[1 - \frac{b^*(\nu)}{\theta_L}\tilde{R}'(c)\right] \\ = &\frac{b^*(\nu)}{\theta_L}\left[\tilde{R}(\tau_L(\nu)) - R(\tau_L(\nu))\right] + \frac{b^*(\nu)-\nu}{\theta_L}R(\tau_L(\nu)) > 0.\end{aligned} \tag{D.6}$$

This clearly rules out $\tilde{\tau}_H(b^*(\nu)) = \tau_L(\nu)$, but also $\tilde{\tau}_H(b^*(\nu)) > \tau_L(\nu)$, which would imply $b^*(\nu)\tilde{R}'(c) < \theta_L$, hence $b^*(\nu)\tilde{R}'(\tilde{\tau}_H(b^*(\nu))) < \theta_L$, by concavity of $\tilde{R}'$. Recall, however, that by

(D.4) we have $b\tilde{R}'(\tilde{\tau}_H(b)) = \theta_L$, implying a contradiction for $b = b^*(\nu)$. ■

### D.2.2 Coalition formation and CPNE at $t+1$

**A - Region** $b < b^*(\nu)$

**Case 1:** $b < \tilde{\theta}_L \equiv (1-\tau_L(\nu))\theta_L + \nu R(\tau_L(\nu))$. The *RP*'s ideal policy coincides with that of the *SP*, which is therefore always implemented.

**Case 2:** $\tilde{\theta}_L \leq b < \theta_H$. In this case the *RP* desire $G > 0$, but the *RR* do not. Table D.1 reports the corresponding preference structure.

| | $SP$ | $RP$ | $RR$ | $SR$ |
|---|---|---|---|---|
| $SP$ | 1 | $y$ | $x$ | $x$ |
| $RP$ | 2 | 1 | 3 | 3 |
| $RR$ | 3 | 4 | 1 | 2 |
| $SR$ | 3 | 4 | 2 | 1 |

where $(x, y) = (2, 3)$ [subcase (a)], or $(3, 2)$ [subcase (b)].

Table D.1. Fiscal preferences of each group when $(1-\tau_L(\nu))\theta_L + \nu R(\tau_L(\nu)) \leq b < \theta_H$.

The *RR* have the same ideal policy as the *SR* ($G = T = 0$), so the *SP* and *RP* are indifferent between them (as in Region A, Case 2 of the baseline model, where $\nu < b < \theta_H$; see Table B.2). The *RR* and *SR* prefer the *SP* to the *RP*, because both these groups redistribute income at the rate $\tau_L(\nu)$ but latter also impose positive levels of $G$.

The *RP* rank the *SP* in $2^{nd}$ place, by Lemma 4.(1) and the fact that $b < b^*(\nu)$. The *SP*, in turn, rank the *RP* as $2^{nd}$ for values of $b$ close to $\theta_L$, as the latter then impose only a low level of $G$ (subcase (b)). As $b$ increases (and eventually approaches $\theta_H$), it is possible that the *SP* switch to preferring the ideal policy of the *SR* (and *RR*) to that the *RP*, because the losses generated by $\tilde{\tau}_L(b)$ more than compensate their gains from redistribution. The *RP* will then be ranked last (subcase (a)).

In either subcase, the *SP* winning is the unique CPNE, as they are preferred to the *RR* by both the *SP* and the *RP*. Formally, subcase (a) in Table D.1 is identical to that in Table B.2; that the equilibrium is also unchanged in subcase (b) is immediate to verify.[49]

**Case 3:** $\theta_H \leq b < b^*(\nu)$. Table D.2 reports the preference structure for this case.

[49] First note that the *RP* winning is not a CPNE. Indeed, assume that $RP = E$ is a NE. A profitable deviation is ($RR = N$, $SP = E$) since it brings the *SP* to power and $(3, 1) < (4, z)$ as $z \in \{2, 3\}$. The deviation is also self-enforcing: if the *RR* deviate and enter, they go to round 2 with the *RP* and lose. Similarly, it is immediate to show that the *SP* winning is a CPNE.

| | $SP$ | $RP$ | $RR$ | $SR$ |
|---|---|---|---|---|
| $SP$ | 1 | $y$ | $x$ | $z$ |
| $RP$ | 2 | 1 | 3 | 4 |
| $RR$ | 3 | 4 | 1 | 2 |
| $SR$ | $x'$ | 4 | $y'$ | 1 |

where $(x, y, z) = (3, 4, 2)$ or $(4, 3, 2)$ [subcase (a)], or $(4, 2, 3)$ [subcase (b)]; $(x\prime, y\prime) = (2, 3)$ or $(3, 2)$.

Table D.2. Fiscal preferences of each group when $\theta_H \leq b < b^*(\nu)$.

This case differs from the previous one, since the $RR$ now choose $G > 0$. The $SP$, however, may still prefer the $RP$ to the $SR$ because of the income redistribution which the former provide, but not the latter. In this case the $SP$ rank the $RR$ last, as they are a just as source of losses, by imposing $G > 0$ (subcase (b)). Alternatively, the $SP$ may rank the $SR$ as $2^{nd}$; they could then prefer the $RR$ to the $RP$, or vice versa (subcase (a)).[50] By definition of $b^*(\nu)$, the $RP$ still continue to prefer the $SP$ to the $RR$, and always rank the $SR$ last. The preferences of the $SR$ are the same as in Region A, Case 1 of the baseline framework (see Table B.1).

Consider, finally, the $RR$. A priori, they could now prefer (when $b$ is high relative to $\theta_H$) prefer the $RP$'s policy to that of the $SP$, and this in turn may prevent the $SP$ from winning. The reason is that, in this case, the $SP$ may rank $2^{nd}$ the $RP$'s ideal policy (this was not the case in the baseline framework). And if both the $SP$ and the $RR$ rank the $RP$ in second place, they will be the winner. The first part of Assumption 12 serves to rule out this scenario and ensure that the preferences of the $RR$ remain the same as in subcase (a) of Table B.1. Indeed, the $RR$ prefer the $SP$ to the $RP$ if:[51]

$$[1 - \tau_L(\nu)]\,\theta_H + \nu R(\tau_L(\nu)) > [1 - \tilde{\tau}_L(b)]\,[(1 - \tau_L(\nu))\theta_H + \nu R(\tau_L(\nu))] + b\tilde{R}(\tilde{\tau}_L(b)).$$

This expression simplifies to

$$\Gamma(b) \equiv -\tilde{\tau}_L(b)\,[(1 - \tau_L(\nu))\theta_H + \nu R(\tau_L(\nu))] + b\tilde{R}(\tilde{\tau}_L(b)) < 0. \tag{D.7}$$

This condition always holds for $b$ equal or close to $\theta_H$, since in this case the $RR$'s preferred societal policy is $\tilde{\tau}_H(\theta_H) \approx 0$, whereas the $RP$ impose on them not only the same redistribution $\tau_L(\nu)$ as the $SP$, but also a strictly positive $\tilde{\tau}_L(B)$. Hence, (D.7) is always satisfied if $\partial\Gamma/\partial b \leq 0$ for all $\theta_H \leq b < b^*(\nu)$. Differentiating (D.7), we obtain

[50] The religious component of the $RR$'s policy package imposes lower losses (a lower $\tilde{\tau}$) on the $SP$ than that of the $RP$. However, the $RP$ provide some income redistribution that may compensate for such losses.

[51] Both $SP$ and $RP$ tax and redistribute income at the same rate $\tau_L(\nu)$, but transfers $T$ under the $SP$ are higher, as there are no income losses from a positive $\tilde{\tau}$.

$$\frac{\partial\Gamma}{\partial b} = -\frac{\partial\tilde{\tau}_L(b)}{\partial b}\left[(1-\tau_L(\nu))\theta_H + \nu R(\tau_L(\nu))\right] + b\tilde{R}'(\tilde{\tau}_L(b))\frac{\partial\tilde{\tau}_L(b)}{\partial b} + \tilde{R}(\tilde{\tau}_L(b)). \tag{D.8}$$

• *Interior solution for* $\tilde{\tau}_L(b)$. Suppose first that $b^*(\nu) \leq \check{b}_L$, so that for all $b \leq b^*(\nu)$, $\tilde{\tau}_L(b)$ is defined by the first-order condition $b\tilde{R}'(\tilde{\tau}_L(b)) = \tilde{\theta}_L$. This also implies that $\partial\tilde{\tau}_L(b)/\partial b = \tilde{\theta}_L/[-b^2\tilde{R}''(\tilde{\tau}_L(b))] > 0$, therefore $\partial\Gamma/\partial b \leq 0$ if and only if

$$\begin{aligned}
\frac{(\tilde{\theta}_L)^2}{-b^2\tilde{R}''(\tilde{\tau}_L(b))} + \tilde{R}(\tilde{\tau}_L(b)) \quad &\leq \quad \frac{\tilde{\theta}_L}{-b^2\tilde{R}''(\tilde{\tau}_L(b))}\left[\tilde{\theta}_L + (1-\tau_L(\nu))(\theta_H-\theta_L)\right] \iff \\
-\frac{\tilde{R}''(\tilde{\tau}_L(b))}{[\tilde{R}'(\tilde{\tau}_L(b))]^2}\tilde{R}(\tilde{\tau}_L(b)) \quad &\leq \quad \frac{(1-\tau_L(\nu))(\theta_H-\theta_L)}{(1-\tau_L(\nu))\theta_L + \nu R(\tau_L(\nu))}.
\end{aligned} \tag{D.9}$$

The left-hand-side is increasing in $\tilde{\tau}_L(b)$, and therefore reaches its maximum at $-\tilde{R}''(1)\tilde{R}(1)/[\tilde{R}'(1)]^2$.[52] On the right-hand side, the numerator is minimized when $\tau_L(\nu) = \hat{\tau}$, while the denominator is always less than $\theta_L + \nu R(\hat{\tau})$. Therefore, (D.9) will hold provided that

$$-\frac{\tilde{R}''(1)\tilde{R}(1)}{[\tilde{R}'(1)]^2} \leq \frac{(1-\hat{\tau})(\theta_H-\theta_L)}{\theta_L + \nu R(\hat{\tau})}.$$

Rearranging terms, this is exactly the first part of Assumption 12. Thus $\Gamma(b) < 0$, meaning that the $RR$ prefer the $SP$ to the $RP$, holds for all $b \leq \check{b}_L$.

• *Corner solution for* $\tilde{\tau}_L(b)$. Suppose now that $b^*(\nu) > \check{b}_L$ meaning that $\tilde{\tau}_L(b) = 1$ for all $b \in [\check{b}_L, b^*(\nu)]$; for $\tilde{\tau}_H(b)$, in contrast, we have (D.4). Over that range, (D.8) now yields $\partial\Gamma/\partial b = \tilde{R}(1) > 0$, so (D.7) will hold if it is satisfied at $b = b^*(\nu)$, i.e.

$$b^*(\nu)\tilde{R}(1) < (1-\tau_L(\nu))\theta_H + \nu R(\tau_L(\nu)). \tag{D.10}$$

Since $\tilde{\tau}_L(b) = 1$, it follows from $b^*(\nu) < \check{b}_H$ and the definition of $\check{b}_H \equiv \theta_H/\tilde{R}'(1)$ in (C.9) that $b^*(\nu) < \theta_H/\tilde{R}'(1)$. Therefore, a sufficient condition is

$$\frac{\tilde{R}(1)}{\tilde{R}'(1)} \leq \frac{(1-\tau_L(\nu))\theta_H + \nu R(\tau_L(\nu))}{\theta_H}, \tag{D.11}$$

which is Assumption 13. Thus $\Gamma(b) < 0$ for $b \in [\check{b}_L, b^*(\nu)]$ as well, and again the $RR$ prefer the $SP$ to the $RP$.

Clearly, the $RR$ also always prefer the $SR$ to the $SP$ (who tax). The rest of the proof that the $SP$ winning is the unique CPNE is then similar to that of the baseline model.

[52] Indeed, $S(x) \equiv -\tilde{R}''(x)\tilde{R}(x)/[\tilde{R}'(x)]^2$ is increasing in $x$ (hence maximized at $x = 1$), since $S'(x)\left[\tilde{R}'(x)\right]^2 = -[\tilde{R}'''(x)\tilde{R}(x) + \tilde{R}''(x)\tilde{R}'(x)]\tilde{R}'(x) - [\tilde{R}''(x)]^2\tilde{R}(x) > 0$.

**B - Region** $b^*(\nu) < b$.

The $RP$ now prefer the $RR$ to the $SP$. If the $SP$ prefer the $RR$ to the $RP$, the entire structure of preferences is the same as in the baseline's Table B.3, leading to the $RR$ winning as the unique CPNE. The $SP$ indeed prefer the $RR$'s policy package to that of the $RP$ if

$$[1-\tilde{\tau}_H(b)]\theta_L > [1-\tilde{\tau}_L(b)]\left[(1-\tau_L(\nu))\theta_L + \nu R(\tau_L(\nu))\right] \equiv [1-\tilde{\tau}_L(b)]\tilde{\theta}_L. \tag{D.12}$$

As $b$ increases, $\tilde{\tau}_L(b)$ and $\tilde{\tau}_H(b)$ reach 1 at finite levels $\check{b}_L$ and $\check{b}_H$ defined in (C.9); since there is no income to left redistribute, the fiscal component of the $RP$'s policy becomes irrelevant. When $b \in [\check{b}_L, \check{b}_H)$, the $SP$ prefer the $RR$ to the $RP$, and when $b \geq \check{b}_H$ they are indifferent between them. We now need to check that (D.12) is satisfied for all $b \in [b^*(\nu), \check{b}_L)$, when this interval is nonempty. At $b = b^*(\nu)$, by definition,

$$[1-\tau_L(\nu)]\,\theta_L + \nu R(\tau_L(\nu)) = [1-\tilde{\tau}_H(b^*(\nu))]\,\theta_L + b^*(\nu)\tilde{R}(\tilde{\tau}_H(b^*(\nu))). \tag{D.13}$$

Substituting (D.13) into (D.12) evaluated at $b^*(\nu)$, the latter can be rewritten as

$$\tilde{\tau}_L(b^*(\nu))[1-\tilde{\tau}_H(b^*(\nu))]\theta_L - [1-\tilde{\tau}_L(b^*(\nu))]b^*(\nu)\tilde{R}(\tilde{\tau}_H(b^*(\nu))) > 0. \tag{D.14}$$

**Lemma 12** *Condition (D.14) is satisfied when $\tilde{\tau}_L(b^*(\nu))$ is high enough, namely*

$$\tilde{\tau}_L(b^*(\nu)) > \frac{\Phi\theta_L + \nu R(\tau_L(\nu))}{[1-\tau_L(\nu)]\,\theta_L + \nu R(\tau_L(\nu))}, \tag{D.15}$$

*where* $\Phi \equiv (\theta_H - \theta_L)^{-1}\left\{\theta_H\left[\tilde{R}(\tau_L(\nu)) - R(\tau_L(\nu))\right] + (\theta_H - \nu)\,R(\tau_L(\nu))\right\}$.

**Proof.** The proof proceeds in three steps.

*Step 1.* From the definition of $b^*(\nu)$ in (D.13), we obtain

$$b^*(\nu)\,\tilde{R}(\tilde{\tau}_H(b^*(\nu))) = [\tilde{\tau}_H(b^*(\nu)) - \tau_L(\nu)]\,\theta_L + \nu R(\tau_L(\nu)). \tag{D.16}$$

Substituting (D.16) into equation (D.14) yields

$$0 < \tilde{\tau}_L(b^*(\nu))\,[1-\tilde{\tau}_H(b^*(\nu))]\,\theta_L - [1-\tilde{\tau}_L(b^*(\nu))]\,\{[\tilde{\tau}_H(b^*(\nu)) - \tau_L(\nu)]\,\theta_L + \nu R(\tau_L(\nu))\}$$

or, after some simple manipulations,

$$\tilde{\tau}_L(b^*(\nu))\theta_L - \{[\tilde{\tau}_H(b^*(\nu)) - \tau_L(\nu)]\,\theta_L + \nu R(\tau_L(\nu))\} + \tilde{\tau}_L(b^*(\nu))\,[-\tau_L(\nu)\theta_L + \nu R(\tau_L(\nu))] > 0.$$

Isolating the terms in $\tilde{\tau}_L(b^*(\nu))$, this is equivalent to

$$\tilde{\tau}_L(b^*(\nu))\left\{[1-\tau_L(\nu)]\,\theta_L+\nu R(\tau_L(\nu))\right\} > [\tilde{\tau}_H(b^*(\nu))-\tau_L(\nu)]\,\theta_L+\nu R(\tau_L(\nu)).$$

Since the term in curly brackets is strictly positive, (D.14) becomes

$$\tilde{\tau}_L(b^*(\nu)) > \frac{[\tilde{\tau}_H(b^*(\nu))-\tau_L(\nu)]\,\theta_L+\nu R(\tau_L(\nu))}{[1-\tau_L(\nu)]\,\theta_L+\nu R(\tau_L(\nu))}. \tag{D.17}$$

*Step 2.* In the remaining part of the proof, we look for a lower bound on $\tilde{\tau}_H(b^*(\nu))-\tau_L(\nu)$ that does not depend on $b^*(\nu)$. Recalling the definition of $b^*(\nu)$ as rewritten in (D.6), we have

$$\tilde{\tau}_H(b^*(\nu))-\tau_L(\nu) = -\frac{\frac{b^*(\nu)}{\theta_L}\left[\tilde{R}(\tau_L(\nu))-R(\tau_L(\nu))\right]+\frac{b^*(\nu)-\nu}{\theta_L}R(\tau_L(\nu))}{\frac{b^*(\nu)}{\theta_L}\tilde{R}'(c)-1},$$

for some $c\in(\tilde{\tau}_H(b^*(\nu)),\tau_L(\nu))$. Since $R'$ is decreasing, this implies

$$\tilde{\tau}_H(b^*(\nu))-\tau_L(\nu) < -\frac{\frac{b^*(\nu)}{\theta_L}\left[\tilde{R}(\tau_L(\nu))-R(\tau_L(\nu))\right]+\frac{b^*(\nu)-\nu}{\theta_L}R(\tau_L(\nu))}{\frac{b^*(\nu)}{\theta_L}\tilde{R}'(\tilde{\tau}_H(b^*(\nu)))-1}. \tag{D.18}$$

Recalling next that $b^*(\nu)\tilde{R}'(\tilde{\tau}_H(b^*(\nu)))\equiv\theta_H<b^*(\nu)$, (D.18) in turn implies

$$\tilde{\tau}_H(b^*(\nu))-\tau_L(\nu) < -\frac{\theta_H\left[\tilde{R}(\tau_L(\nu))-R(\tau_L(\nu))\right]+(\theta_H-\nu)\,R(\tau_L(\nu))}{\theta_H-\theta_L}\equiv\Phi. \tag{D.19}$$

*Step 3.* Condition (D.17) provides an upper bound, $\Phi$, which does not depend on $b^*(\nu)$, for the term $\tilde{\tau}_H(b^*(\nu))-\tau_L(\nu)$. Together with (D.17), this implies *a fortiori:*

$$\tilde{\tau}_L(b^*(\nu)) > \frac{\Phi\theta_L+\nu R(\tau_L(\nu))}{[1-\tau_L(\nu)]\,\theta_L+\nu R(\tau_L(\nu))},$$

which is exactly (D.15). Finally, since the right-hand-side does not depend on $b^*(\nu)$, it provides a lower bound for $\tilde{\tau}_L(b^*(\nu))$ above which (D.14) holds. ■

From here on we shall assume that $\tilde{\tau}_L(b^*(\nu))$ satisfies (D.15), so that (D.12) holds at $b=b^*(\nu)$. To show that it also holds for $b>b^*(\nu)$, we rewrite it as

$$[1-\tilde{\tau}_H(b)]\,\theta_L-[1-\tilde{\tau}_L(b)]\,\tilde{\theta}_L>0. \tag{D.20}$$

Under (D.14), a sufficient condition for (D.12) to hold for $b>b^*(\nu)$ is that the left-hand side of (D.20) be nondecreasing in $b$. From the first order conditions of the $RR$'s and $RP$'s, we have

$$\frac{\partial\tilde{\tau}_H(b)}{\partial b}=-\frac{\tilde{R}'(\tilde{\tau}_H(b))}{b\tilde{R}''(\tilde{\tau}_H(b))},\quad \frac{\partial\tilde{\tau}_L(b)}{\partial b}=-\frac{\tilde{R}'(\tilde{\tau}_L(b))}{b\tilde{R}''(\tilde{\tau}_L(b))}.$$

Using these expressions, $[1-\tilde{\tau}_H(b)]\,\theta_L - [1-\tilde{\tau}_L(b)]\,\tilde{\theta}_L$ weakly increases in $b$ if

$$\frac{\tilde{\theta}_L}{\theta_L} \geq \frac{\tilde{R}'\left(\tilde{\tau}_H(b)\right)}{-\tilde{R}''\left(\tilde{\tau}_H(b)\right)} \cdot \frac{-\tilde{R}''\left(\tilde{\tau}_L(b)\right)}{\tilde{R}'\left(\tilde{\tau}_L(b)\right)}, \tag{D.21}$$

By Assumption 9, we have: (i) $\tilde{R}'\left(\tilde{\tau}_H\right) < 1$, since $\tilde{R}'\left(0\right) = 1 \geq \tilde{R}'\left(x\right)$ for any $x$ as $\tilde{R}''\left(x\right) < 0$; (ii) $-\tilde{R}''\left(\tilde{\tau}_L(b)\right)/\tilde{R}'\left(\tilde{\tau}_L(b)\right) \leq -\tilde{R}''\left(1\right)/\tilde{R}'\left(1\right)$, since $-\tilde{R}''\left(x\right)/\tilde{R}'\left(x\right)$ is increasing in $x$ and $\tilde{R}'\left(1\right) > 0$; (iii) $-\tilde{R}''\left(\tilde{\tau}_H(b)\right) \geq -\tilde{R}''\left(0\right)$, since $\tilde{R}'''\left(x\right) \leq 0$ and $\tilde{R}''\left(x\right) < 0$. These three facts imply that

$$\frac{1}{-\tilde{R}''\left(0\right)}\frac{-\tilde{R}''\left(1\right)}{\tilde{R}'\left(1\right)} \geq \frac{\tilde{R}'\left(\tilde{\tau}_H(b)\right)}{-\tilde{R}''\left(\tilde{\tau}_H(b)\right)}\frac{-\tilde{R}''\left(\tilde{\tau}_L(b)\right)}{\tilde{R}'\left(\tilde{\tau}_L(b)\right)},$$

so that (D.21) is always satisfied under Assumption 12, the second part of which is $\tilde{\theta}_L/\theta_L \geq \tilde{R}''\left(1\right)/[\tilde{R}''\left(0\right)\tilde{R}'\left(1\right)]$. This completes the proof that (D.12) is satisfied for all $b \in [b^*(\nu), \check{b}_L)$ and, therefore, that the $SP$ prefer the ideal policy of the $RR$ to that of the $RP$ in this range.

Table D.3 reports the preference structure for this case.

| | $SP$ | $RP$ | $RR$ | $SR$ |
|---|---|---|---|---|
| $SP$ | 1 | 4 | 3 | 2 |
| $RP$ | 3 | 1 | 2 | 4 |
| $RR$ | $x$ | $y$ | 1 | $z$ |
| $SR$ | $x'$ | 4 | $y'$ | 1 |

where $(x, y, z) = (3, 4, 2)$ [subcase(a)], or $(4, 2, 3)$ or $(4, 3, 2)$ [subcase b]; $(x\prime, y\prime) = (2, 3)$ or $(3, 2)$.

Table D.3. Fiscal preferences of each group when $b^*(\nu) < b$.

It is the same as in the baseline's Table B.3, so the $RR$ winning is the unique CPNE.

### D.2.3 Behavior of the Religious Sector and Science Policy

Replacing $\tau_H(b)$ and $R(\tau_H(b))$ by $\tilde{\tau}^*_H(b)$ and $\tilde{R}(\tilde{\tau}^*_H(b))$ in Lemma 6 and Assumption 8 (which then becomes Assumption 14), the same proofs lead to the same characterization and comparative statics of the Church's repairing policy.

As stated at the end of Appendix C, with these same substitutions the four groups' blocking preferences (value functions at $t$) inherit, from the later stages of the game, the same properties as in the core model, and therefore does the equilibrium coalition formation (PCPNE) and its comparative statics. ■

# Online Appendix E: Further Variants and Extensions

## E.1 Parents and Children

Instead of their own religious beliefs and scientific-technical knowledge, adults may want to shape those of their offspring, through similar channels of tolerance versus blocking of new ideas, or doctrinal adaptation. We outline here a reinterpretation of the basic model corresponding to this timing, in which adults internalize the young's material and spiritual utility.

As before, all variables are normalized by current TFP. Agents are now young adults in odd periods $(t-1, t+1)$, and old in even ones $(t, t+2)$. When young, they derive utility from consumption and possibly religion,

$$U_{t+1}^i = c_{t+1}^i + \beta^i b_{t+1} G_{t+1} = 1 - \tau_{t+1} + \nu T_{t+1} + \beta^i b_{t+1} G_{t+1}, \tag{E.1}$$

where $(a_{t+1}, b_{t+1})$ are determined by the science-religion tradeoffs made at time $t$ by their parents, $(\tau_{t+1}, G_{t+1}, T_{t+1})$ by their own generation's choices over public goods and their financing, and $\beta^i$ indicates whether an agent belongs to a religious or secular "dynasty". Young adults either do not yet have the opportunity (time, knowledge, political power) to invest in blocking or, equivalently, youth is myopic: they do not anticipate how, once older, they will start worrying about the religious values and welfare of their children.[53] That is what their own parents did in as older adults, however, maximizing

$$\begin{aligned} U_t^i &= c_t^i + \mathbb{E}_t[U_{t+1}^i\,(a_{t+1}/a_t)] = 1 - \tau_t + \mathbb{E}_t[(c_{t+1}^i + \beta^i b_{t+1} G_{t+1})\,(a_{t+1}/a_t) \mid (a_t, b_t)] \\ &= 1 - \chi_t R(\varphi(a_t)) + \mathbb{E}_t[(1 - \tau_{t+1} + \nu T_{t+1} + \beta^i b_{t+1} G_{t+1})\,(a_{t+1}/a_t) \mid (a_t, b_t)] \end{aligned} \tag{E.2}$$

over the blocking-investment decision $\chi_t = 0, 1$, which can protect the transmission of their beliefs $b_t$ to their children (and the latter's resulting maximized utility $U_{t+1}^i$), but may also deprive them of productive new knowledge. Keeping the objective function of the Church and the fact that it acts between period $t$ and $t+1$ unchanged, the above formulation is *isomorphic* to the one in the paper, leading to identical results.

*Remarks.*

1. Old parents internalize the utility of their children in youth $U_{t+1}^i$, but not in the children's old age: since $U_{t+2}^i$ includes concerns about the grandchildren's generation $(U_{t+3}^i)$, this would transform the model into one with infinite-horizon dynasties.

2. We can equivalently think of *individuals living three periods:* (i) as a child as date $t$, whose parents are currently old; (ii) as a young adult without children nor living parents

[53] This can be see as a form of "projection bias", which is well documented in many realms. In particular, the young do not anticipate how they typically will become more "conservative" once they age, have families, etc.

date $t+1$; (iii) as an older adult with a young child at $t+2$. As above, blocking-investment decisions made by parents' generation at date $t$ apply to the innovations (if any) that arrive between then and $t+1$. Thus, instead of inheriting their parents' $(a_t, b_t)$, children's beliefs and productivity will be $(a_{t+1}, b_{t+1})$ once they become young adults, and remain the same with age: $(a_{t+2}, b_{t+2}) = (a_{t+1}, b_{t+1})$. If $BR$ innovations are not blocked by $\chi_t = 1$, they will thus erode *the next generation's religiosity* to $b_{t+1} = (1-\delta)b_t$, unless these beliefs are "repaired" by the Church at the start of $t+1$, by adapting the doctrine to the new knowledge.

3. In the extended (ergodic) version of the model of Section 6, the exogenous shocks to religiosity (natural disasters, etc.) still occur between periods $t+1$ and $t+2$, but this now corresponds to them "hitting" agents between youth and old age.

4. The above model is (intentionally) restrictive in some ways, in that young and old *adults* do not "overlap": (i) when the former make decisions, their parents are dead, or more generally economically and politically inactive; (ii) when the latter make decisions, the latter are still passive children. Together with the assumption that young adults do not "think though" the (different) preferences they will have when they become parents, or if they do cannot yet act upon it, these assumptions "break" the additional interactions that would arise in a standard OLG model, on top of the ones already present. In such a model, young and old adults would vote simultaneously, therefore on blocking and public-goods policies at the same time, leading to a single government budget constraint (hence, crowding out between the costs of blocking and those of public goods). Moreover, the political-competition game determining who gets to set $(\chi, G, T)$ would feature *not just four but eight* social groups, each with different preferences: *(old/young, religious/secular, rich/poor).* Such a model would be intractable, leading to opacity rather than additional insights.

### E.2 Integration of State and Church

We analyze here the case where there is no State-Church separation. Clearly, this requires that religious agents be in power. We therefore take this as given, or more simply focus on the case of homogenous incomes, which delivers this outcome. In the baseline model, religious citizens and the Church had the same value $bG$ for religious public goods (or laws); their payoffs differed because citizens also have an income endowment from which they consume and pay taxes, while only the Church paid the cost $\eta b$ for doctrinal repairing. A natural unitary objective function merges (1) and (3), so that the unified State-Church body now maximizes

$$U_t^i = \mathbb{E}_t[c_t^i - \rho_t \eta b_t + c_{t+1}^i + b_{t+1}G_{t+1}]. \tag{E.3}$$

Up to a renormalization, this is equivalent to summing (1) and (3), which corresponds to the case where Church and State are nominally distinct but can make compensating lump-sum transfers to each other. The political game is the same as before, except that now the unified State-Church player decides sequentially: (i) whether to block belief-eroding innovations ex ante; (ii) if it hasn't, whether to repair the doctrine ex post when one occurs, or do nothing; (iii) its preferred provision of both secular and religious public good; this last aspect is unchanged, and still described by Proposition 1.

Naturally, when Church-State is an integrated actor it will choose, between blocking and repair, the one instrument that is the most efficient, weighing all the (direct and opportunity) costs and benefits of each option according to (E.3). Intuition suggests, and we shall verify, that the outcome will depend in the same straightforward way as before on the cost $\eta$ and effectiveness $q$ of repair, and on the setup cost for blocking, $\varphi(a)$. How the decision varies with the level of religiosity $b$, on the other hand, now leads to a richer set of possibilities. We shall both: (i) provide intuitive conditions for the blocking locus to remain upward-sloping everywhere, demonstrating the robustness to State-Church merging of the whole dynamical system, and in particular of the feature that increased religiosity makes blocking more likely, generating an absorbing basin of attraction; (b) show that, absent such conditions, parts of the blocking locus may now be downward-sloping, reversing this last feature; a sufficiently strong and coordinated religious state will then find reform more efficient than blocking.

### E.2.1 State-Church's Belief-Repairing Strategy

The State-Church entity will now invest in doctrinal adaptation if

$$q\left[1-\tau^*(b)+bR(\tau^*(b))\right]+(1-q)\left[1-\tau^*\left(b'\right)+b'R(\tau^*\left(b'\right))\right]-\eta b \geq 1-\tau^*\left(b'\right)+b'R(\tau^*\left(b'\right)), \tag{E.4}$$

with $b'=(1-\delta)\,b$ when $b \geq \nu/(1-\delta)$. When $b \in (\nu, \nu/(1-\delta))$ the condition is unchanged except that $b'$ is replaced by $\nu$.

**1.** For $b \geq \nu/(1-\delta)$, we can rewrite (E.4) as:

$$\pi(b,\nu) \equiv \frac{-\tau^*(b)+bR(\tau^*(b))+\tau^*(b')-b'R(\tau^*(b'))}{b} \geq \frac{\eta}{q}. \tag{E.5}$$

Using the first-order conditions (5) defining $\tau^*(b)$ and $\tau^*(b')$, we have

$$\frac{\partial \pi(b,\nu)}{\partial b} \equiv \frac{\tau^*(b)-\tau^*(b')}{b^2} > 0,$$

since $b' < b$ and $\tau^*(b)$ is increasing in $b$.

**2.** For $b \in (\nu, \nu/(1-\delta))$, the repairing condition can be rewritten as

$$\pi(b,\nu) \equiv \frac{-\tau^*(b)+bR(\tau^*(b))+\tau^*(\nu)-\nu R(\tau^*(\nu))}{b} \geq \frac{\eta}{q}. \tag{E.6}$$

Using again the first order condition for $\tau^*(b)$, we have in this range

$$\frac{\partial \pi(b,\nu)}{\partial b} \equiv \frac{\tau^*(b) - \tau^*(\nu) + \nu R(\tau^*(\nu))}{b^2} \geq 0,$$

since the optimality of fiscal decisions requires that $\tau^*(\nu) \leq \nu R(\tau^*(\nu))$. Thus, $\pi(b,\nu)$ is increasing in $b$ over $\mathbb{R}_+$ (whereas in the baseline case it was hill-shaped), up to the point where it reaches its maximal value of $\delta R(\hat{\tau})$; $\pi(b,\nu)$ is also continuous everywhere, and it is equal zero to for $b \leq \nu$; see Figure E.1.

**Proposition 12** *When $\eta/q < \delta R(\hat{\tau})$, there exists a unique threshold $\hat{b} > \nu$, defined as $\pi(\hat{b},\nu) = \eta/q$, such that the State-Church entity attempts doctrinal repair following unblocked belief-eroding innovations if and only if $b \geq \hat{b}$. If $\eta/q > \delta R(\hat{\tau})$, repairing is never optimal.*

### E.2.2 State-Church Policy Toward Science

The analysis of blocking when there is no repairing (i.e., $b < \hat{b}$) is exactly the same as in the baseline framework. In particular, there is no blocking when $b < \nu$, and for $\nu \leq b < \hat{b}$ Proposition 3 applies. The State-Church entity thus blocks $BR$ discoveries if and only if $(a,b)$ lies above the *upward-sloping locus* $b = B^1(a)$ in the first case, or $b = B^2(a)$ in the second.

• **Characterization of the blocking region for** $b \geq \hat{b}$. It remains to examine the choice of the State-Church entity between blocking and repairing when $b \geq \hat{b}$. Its value from blocking $BR$ discoveries is the same as in (9), i.e.

$$V^B(a,b) = 1 - R^{-1}(\varphi(a)) + [1 - \lambda + \lambda p_R + \lambda(1-p_R)(1+\gamma)]\, V(b), \tag{E.7}$$

where $V(b) = 1 - \tau^*(b) + bR(\tau^*(b))$ is its second-period utility, defined by (8) in Section 5.3. As to the value of repairing, it is

$$\begin{aligned} V^R(a,b) \quad = \quad & 1 + [1 - \lambda + \lambda(1-p_R)(1+\gamma) + \lambda p_R q(1+\gamma)]\, V(b) \\ & + \lambda p_R(1-q)(1+\gamma)\, V(b') - \lambda p_R \eta b, \end{aligned} \tag{E.8}$$

where $V(b')$ is defined as follows:

*(1) High religiosity:* when $b \geq \max\{\hat{b},\ \nu/(1-\delta)\}$, we have $V(b') = 1 - \tau^*(b') + b'R(\tau^*(b'))$, with $b' \equiv (1-\delta)b$.

*(2) Intermediate religiosity:* when $\hat{b} \leq b < \nu/(1-\delta)$, we have $V(b') = V(\nu) = 1 - \tau^*(\nu) + \nu R(\tau^*(\nu))$.

Using (9) and (E.8) and rearranging terms, it follows that blocking is preferred to repairing, $V^B(a,b) \geq V^R(a,b)$, when

$$R^{-1}\left(\varphi\left(a\right)\right) \leq \lambda p_R \left\{\eta b - \left[q\left(1+\gamma\right)-1\right] V\left(b\right) - \left(1-q\right)\left(1+\gamma\right) V\left(b'\right)\right\} \equiv \Delta^1(b). \tag{E.9}$$

As the term on the left is positive (and increasing in TFP $a$), the occurrence of blocking requires that $\Delta^1(b) > 0$. From (E.9), note that Assumption 7, which in the baseline framework ensures that there is never blocking ($\Delta^1(b) \leq 0$) when the Church is willing to attempt repair, no longer guarantees this recursivity. This is because the single State-Church entity now making both choices internalizes the cost of repairing $\eta b$, which, other things equal, makes blocking relatively more attractive than under State-Church separation.

We also observe, intuitively, that the possibility of blocking ($\Delta^1(b) > 0$) is greater, the higher is the cost of repairing $\eta$, and the lower its probability of success $q$ or/and the TFP gains $\gamma$ forsaken by blocking.

We next provide explicit conditions for blocking to occur over a nonempty region, while Assumption 7 continues to hold. If $\eta/q < \delta R(\hat{\tau})$, then by Proposition 12 $\hat{b} < +\infty$ and for all $b \geq \hat{b}$, repairing is preferred to doing nothing. Since blocking is preferred to repairing for some positive range of $a$'s if and only if $\Delta^1(b) > 0$, it will actually occur for all $(a, b)$ with $a$ in that range and $b \geq \hat{b}$ if and only if

$$\left[q\left(1+\gamma\right)-1\right] V\left(b\right) + \left(1-q\right)\left(1+\gamma\right) V\left(b'\right) < \eta b \leq q\delta b R(\hat{\tau}). \tag{E.10}$$

As the leftmost term is increasing in $b$, this condition becomes, for $b$ large enough (so that $\tau^*(b) = \hat{\tau}$ and hence $V\left(b\right) = 1 - \hat{\tau} + bR\left(\hat{\tau}\right)$ and $V\left(b'\right) = 1 - \hat{\tau} + \left(1-\delta\right) bR\left(\hat{\tau}\right))$ :

$$[\gamma - \delta\left(1-q\right)\left(1+\gamma\right)]R(\hat{\tau}) < \eta < q\delta R(\hat{\tau}),$$

which defines a non-empty interval for $\eta$ if and only if $\gamma - \delta\left(1-q\right)\left(1+\gamma\right) < q\delta$, or equivalently:

$$\delta > \frac{\gamma}{1+\gamma\left(1-q\right)}. \tag{E.11}$$

This requires that $q\gamma < 1$, but the latter is compatible with $q\left(1+\gamma\right) \geq 1$. Suppose, finally, that $\eta/q \geq \delta R(\hat{\tau})$, so that $\hat{b} = +\infty$, i.e. repairing is never optimal. Blocking will occur when $V^B(a, b) > 0$, which by (E.7) defines for any $b$ a nonempty interval for $a$, and conversely for any $a$ will hold for all $b$ large enough, as $V(b) \approx bR(\hat{\tau}))$ also becomes arbitrarily large.

• **Shape of the blocking locus** $B^1(a)$. If this boundary is increasing, as in the benchmark model, then once again as a country becomes more religious, blocking becomes more likely (in particular, relative to repairing). If it is decreasing, or non-monotonic, on the other hand, the reverse may happen. In what follows, we provide conditions, and intuitions, for both cases.

Since the left-hand side of (E.9) is increasing in $a$ (a more scientifically advanced country is still always less likely to block), the blocking boundary will be upward-sloping if and only if

$\Delta^1(b)$ is increasing in $b$. The same two cases as in (E.8) must be distinguished.

*(1) High religiosity:* $b \geq \max\{\hat{b}, \nu/(1-\delta)\}$. We have

$$\frac{\partial \Delta^1(b)}{\partial b} = \lambda p_R \left\{\eta - [q(1+\gamma)-1] R(\tau^*(b)) - (1-q)(1+\gamma)(1-\delta) R\left(\tau^*\left(b'\right)\right)\right\}, \quad \text{(E.12)}$$

as the first order conditions for $\tau^*(b)$ and $\tau^*(b')$ imply respectively that $\partial V(b)/\partial b = R(\tau^*(b))$ and $\partial V(b')/\partial b = (1-\delta) R(\tau^*(b'))$. From (E.12) it is immediate that $\partial^2 \Delta^1(b)/\partial b^2 \leq 0$ for all $b$, so $\partial \Delta^1(b)/\partial b$ is monotonically decreasing in $b$. Its minimum value is thus achieved at all $b$ above the threshold $\breve{b}$ defined by $\tau^*(\breve{b}/(1-\delta)) = \hat{\tau}$, and equal to

$$\min_b \left\{\frac{\partial \Delta^1(b)}{\partial b}\right\} = \left.\frac{\partial \Delta^1(b)}{\partial b}\right|_{b \geq \breve{b}} = \lambda p_R \left\{\eta - [q(1+\gamma)-1] R(\hat{\tau}) - (1-q)(1+\gamma)(1-\delta) R(\hat{\tau})\right\}, \quad \text{(E.13)}$$

which is positive when[54]

$$\eta > [\gamma - \delta(1-q)(1+\gamma)] R(\hat{\tau}). \quad \text{(E.14)}$$

In particular, if

$$\delta(1-q) > \frac{\gamma}{1+\gamma}, \quad \text{(E.15)}$$

condition (E.14) is automatically satisfied, and it is easy to see that (E.11) is also implied.

When (E.14) holds, so that the minimum value of $\partial \Delta^1(b)/\partial b$ in (E.13) is positive, equation (E.9) with the equality sign defines an *upward-sloping* blocking locus, $b = B^1(a)$; see Figure E.2a. Blocking will take place when $(a, b)$ is above (equivalently, to the left of) this schedule, and repairing (or, for $b$ low enough, neither) when it is below. Moreover, as $a$ becomes large, $\varphi(a)$ tends to $\overline{\varphi} < R(\hat{\tau})$, implying that $B^1(a)$ tends to the horizontal asymptote $\Delta^1(b) = R(\bar{\varphi})$, as illustrated in Figure E.2a.

Note, finally, that the condition (E.13) for an upward-sloping locus (or the stronger E.15) is quite intuitive: as $b$ rises, the cost of repairing $\eta b$ must increase faster than the *opportunity cost* of blocking (i.e., leaving aside the fixed cost $\varphi(a)$), which is the difference between religious consumption $bG \precapprox bR(\hat{\tau})$ lost due to foregone TFP growth $\gamma$ and that lost due to eroded faith following a failed repair attempt.

When (E.13) is reversed, conversely, the blocking locus $B^1(a)$ will not be positively sloped everywhere: since $\partial \Delta^1(b)/\partial b$ is monotonically decreasing in $b$, its sign may become negative when religiosity exceeds a certain threshold; formally, if $\partial \Delta^1(b)/\partial b\big|_{b=\hat{b}} > 0$ but $\partial \Delta^1(b)/\partial b\big|_{b=\breve{b}} < 0$, the blocking locus $B^1(a)$ has first a positive and then a negative slope as $b$ rises, as illustrated in Figure E.2b. If instead $\Delta^1(b) > 0$ but $\partial \Delta^1(b)/\partial b\big|_{b=\hat{b}} < 0$, we have $\partial \Delta^1(b)/\partial b < 0$

[54] Recall also that the maximal value of $\pi(b, \nu)$ is $\delta R(\hat{\tau})$, so the only restriction on $\eta$ follows from $\delta R(\hat{\tau}) \geq \eta/q$. Therefore, substituting $\eta = q\delta R(\hat{\tau})$ into (E.14), the parameter space satisfying (E.14) is non-empty as long as $\delta > \gamma/[1+\gamma(1-q)]$, which is again condition (E.11).

for all $b \geq \hat{b}$, so the blocking locus $B^1(a)$ will be decreasing everywhere, as in Figure E.2c. In particular, we can provide a sufficient condition for $B^1(a)$ to be negatively sloped (at least over some range): combining equation (E.11), which ensures a non-empty blocking region above $\hat{b}$, with the opposite of (E.15), which ensures that, for some nonempty range of $\eta$, (E.14) is reversed, so that $\min_b\{\partial\Delta^1/\partial b\} < 0$, yields:

$$\frac{\gamma}{1+(1-q)\gamma} < \delta < \frac{\gamma}{(1-q)(1+\gamma)}. \tag{E.16}$$

*(2) Intermediate religiosity: $\hat{b} \leq b < \nu/(1-\delta)$.* In this range, the blocking locus is defined by equation (E.9) with the equality sign and $V(b') \equiv V(\nu)$.[55] Its slope, (E.12) now becomes

$$\frac{\partial\Delta^1(b)}{\partial b} = \lambda p_R \left\{\eta - \left[q(1+\gamma)-1\right] R(\tau^*(b))\right\}. \tag{E.17}$$

From Assumption 7, i.e. $q(1+\gamma) > 1$, and $R(\tau^*(b)) \leq R(\hat{\tau})$, it follows that

$$\eta > \left[q(1+\gamma)-1\right] R(\hat{\tau}) = \left[\gamma-(1-q)(1+\gamma)\right] R(\hat{\tau}) \tag{E.18}$$

ensures that $\partial\Delta^1(b)/\partial b$ is always positive, and therefore the $b = B^1(a)$ locus is upward-sloping in this range; see again Figure E.2a. The interpretation is similar to the previous case, except that now if repair fails the entire value of religious consumption is lost, as the secular public good will be preferred.

As before, absent (E.18) $B^1(a)$ could be nonmonotonic (first increasing, then decreasing), or monotonically decreasing in $b$, in this region as well. This occurs, for some nonempty range of $\eta$, when the right-hand-side of (E.18) is positive (which, in turn, ensures that (E.11) holds), that is:

$$\delta > \frac{\gamma}{(1-q)(1+\gamma)}. \tag{E.19}$$

Finally, comparing (E.12) and (E.17) shows that $\partial\Delta^1(b)/\partial b$ is larger in absolute value in case (1) than in case (2), which implies that the blocking locus is steeper when $\hat{b} \leq b < \nu/(1-\delta)$ than when $\nu/(1-\delta) \leq \hat{b} \leq b$; see again Figure E.2c.

### E.2.3 Dynamics of Scientific Progress and Religiosity: Summary

As established above and illustrated by Figures E.2a and E.2c, we see that, in countries where there is no separation between State and Church (presumably requiring a relatively high level of religiosity to start with):

[55] The earlier analysis on the non-emptiness of the parameter space for blocking remains unchanged in this region, now simply setting $V(b') = V(\nu)$.

(a) As before, it remains the case that belief-eroding innovations are likely to be blocked when the economy is not well developed in terms of scientific and technical knowledge, whereas religious doctrines becomes more likely to adapt as the economy grows.

(b) It also remains the case that, when religiosity is higher than a certain threshold $\hat{b}$, there is always either blocking of BR innovations or repairing of beliefs –both ways of preserving valuable religious capital.

(c) Under a simple and intuitive condition, it remains the case that higher religiosity makes blocking relatively more likely than repairing, leading again to stagnating theocracies, and more generally leaving all results from the benchmark model qualitatively unchanged. Under alternative parameter configurations, which we also provide, this particular ranking of policies can be reversed in part of the phase diagram, making it easier for even slow knowledge growth (e.g., due only to neutral innovations) to ultimately move the economy outside of the stagnation region.

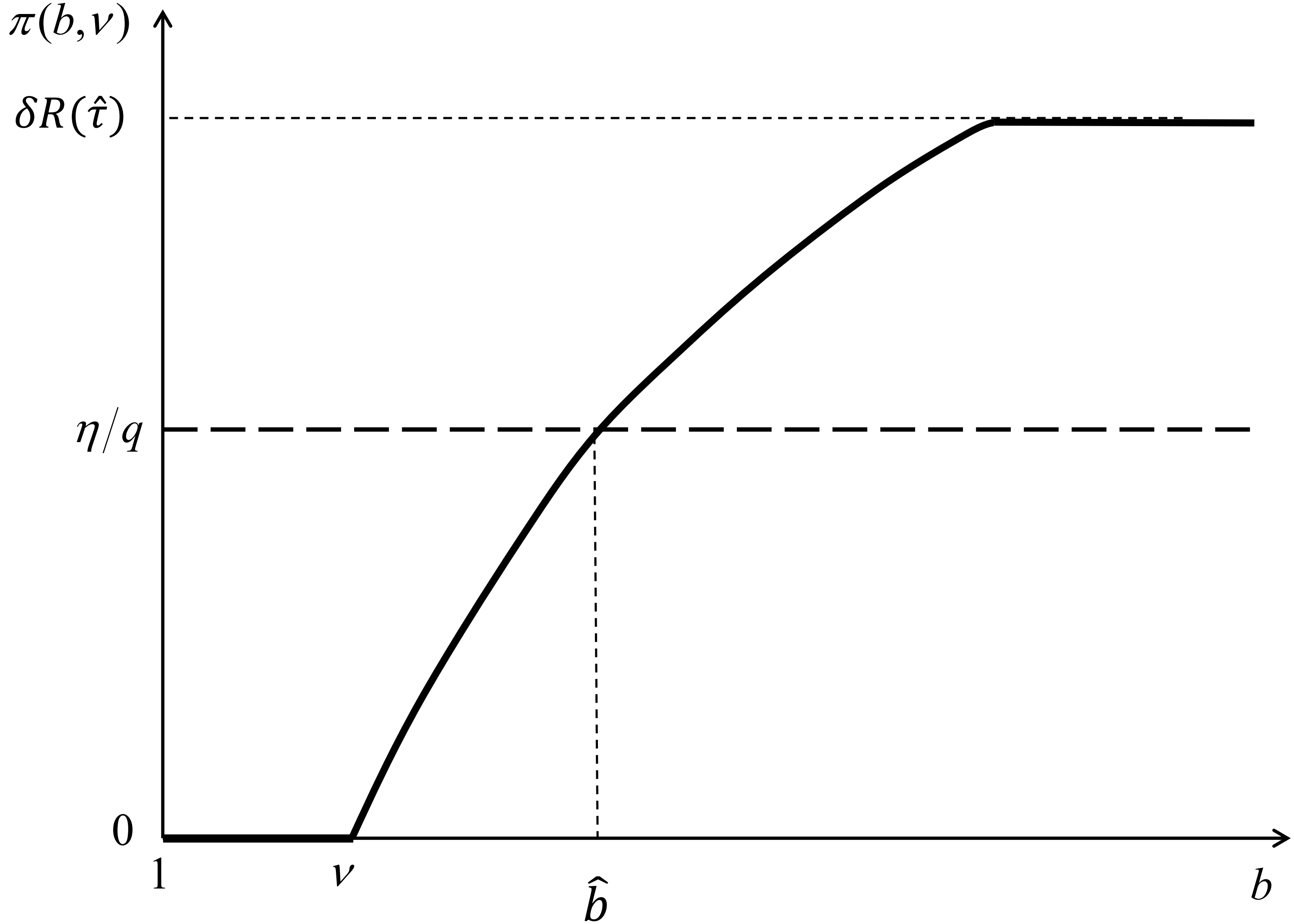


**Figure E.1: Return to doctrinal repair for an integrated State-Church entity**

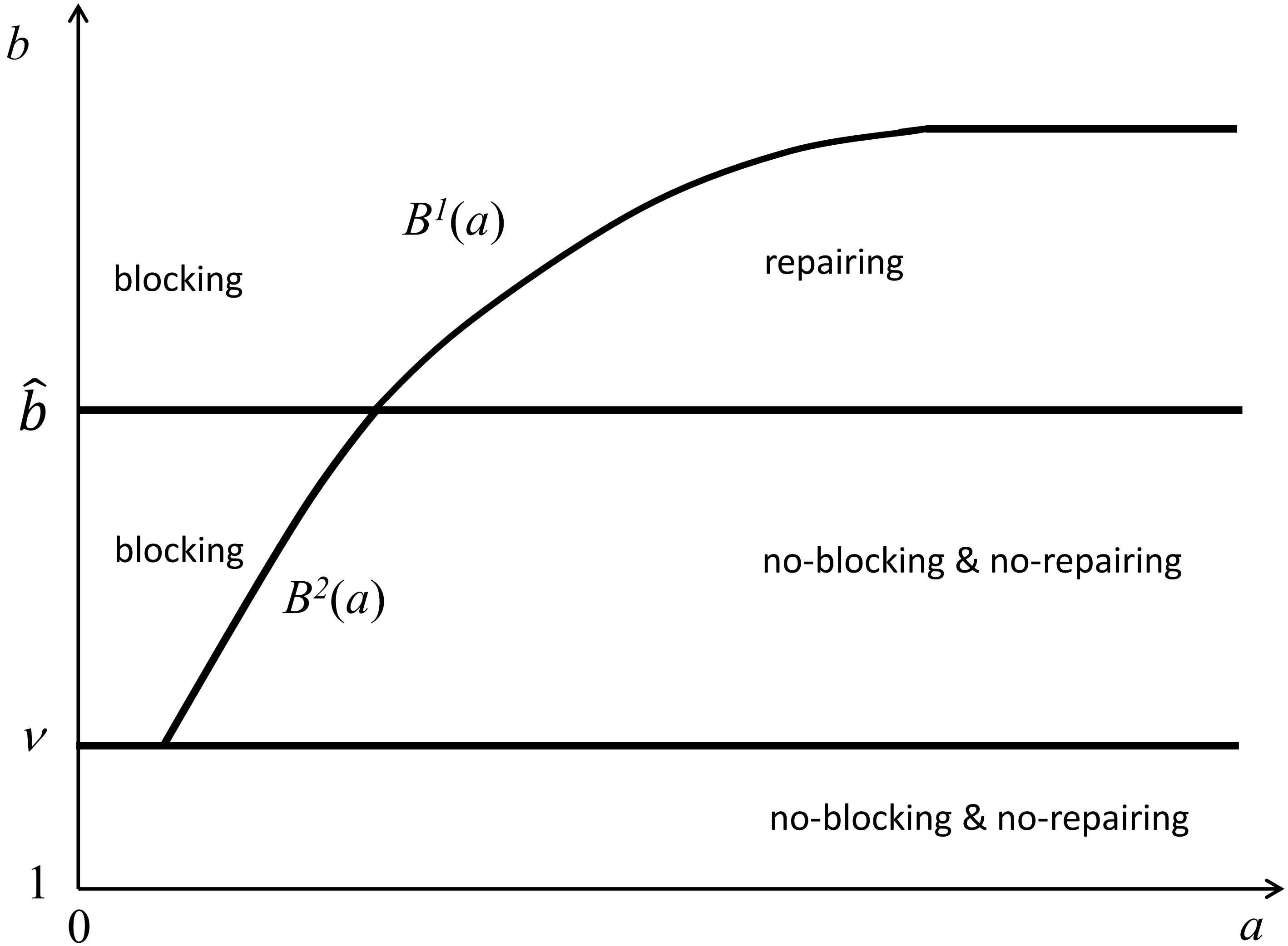


**Figure E.2a: Repairing and blocking regions, with increasing locus *B(a)***

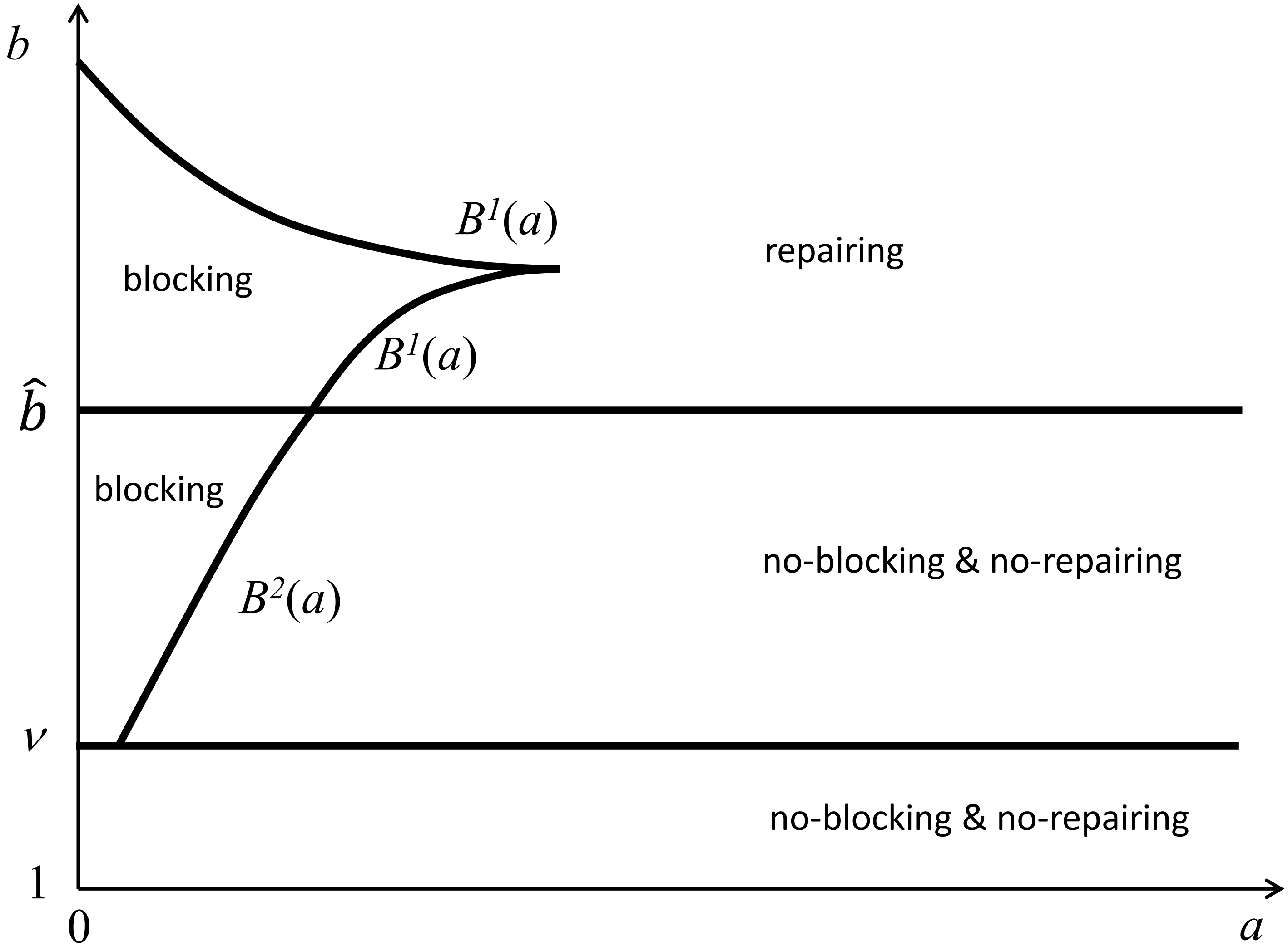


**Figure E.2b: Repairing and blocking regions, with nonmonotonic locus $B^1(a)$**

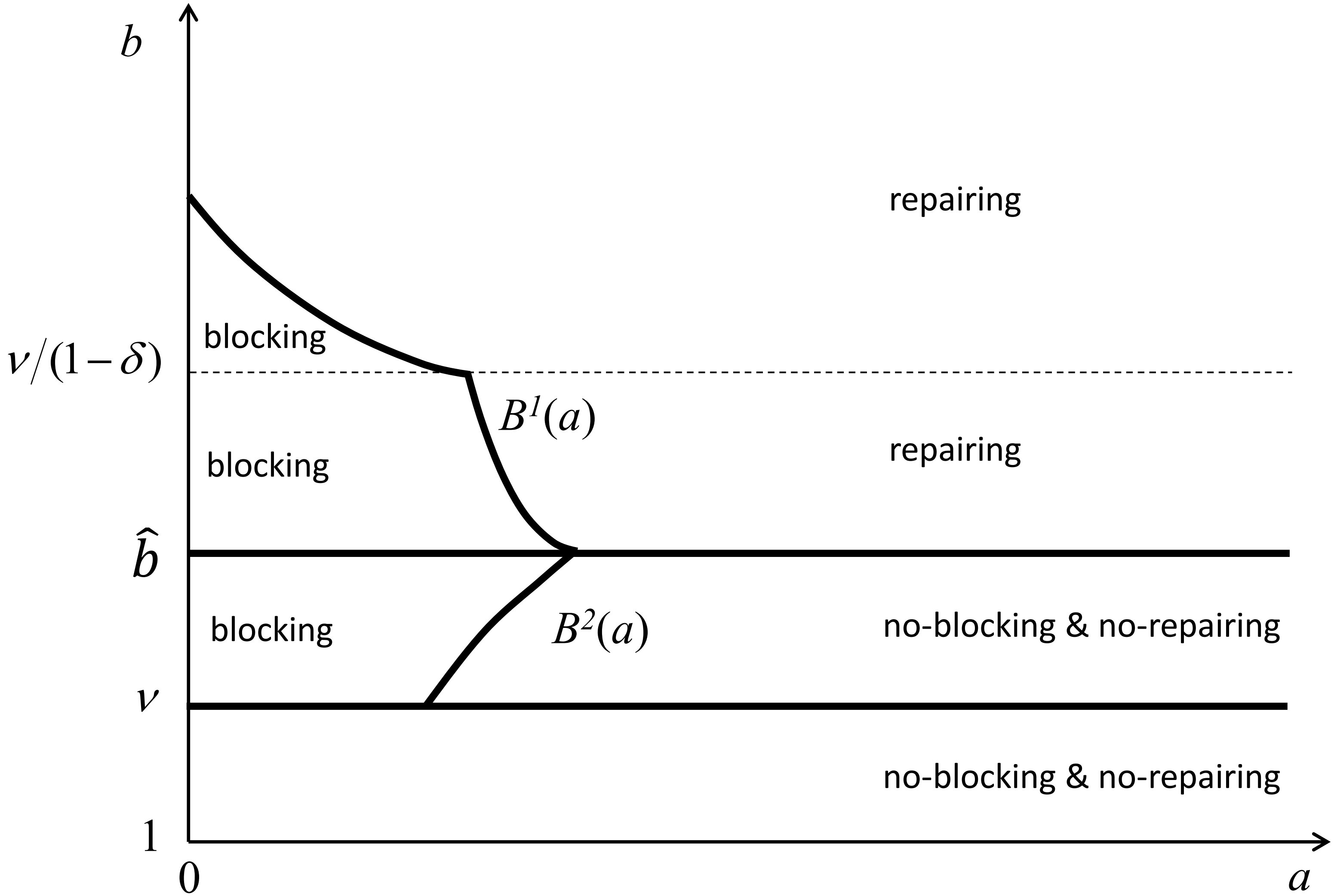


**Figure E.2c: Repairing and blocking regions, with decreasing locus $B^1(a)$; shown here for $\hat{b} < \nu/(1-\delta)$**

# APPENDIX F: Innovation and Religiosity Across Countries and States – Robustness Checks

Section F.1 presents the robustness checks for the international cross-country analysis, and Section F.2 those for the U.S. cross-state analysis.

## F.1 Cross-Country Patterns: Robustness Checks

Subsection F.1.1 contains the estimates and scatterplots for the relationship between religiosity and innovation with all five measures of religiosity not shown in the main text (Table F.1, Figures F.1-F.4).

Subsection F.1.2 reports the material for the robustness checks when:

- using total patents per capita, namely those filed in a country by both residents and foreigners, in place of patents per capita by residents (Table F.2);
- the control set includes dummies for current and formerly Communist countries, as well their interactions with religiosity measures (Table F.3, Figures F.5a-5b);
- using controls for the population shares of major religions, rather than which one is dominant (Table F.4).

### F.1.1 Robustness checks with other measures of religiosity

We first reproduce Table 2 (also included in the main text), which contains the estimates for the three main measures of religiosity—*Religious person*, *Belief in God*, *Church attendance.* Table F.1 next provides the estimates for all specifications using the other two indexes—*Importance of religion*, *God very important*. We then show the scatterplots displaying the unconditional and conditional relationships between all five measures of religiosity and the level of innovation (Figures 1a-1b, contained also in the main text, followed by Figures F.1-F.4).

For each of the five religiosity variables, we list below the corresponding figures showing the unconditional and the conditional relationships (baseline specification), as well as the table and column containing the corresponding estimate:

(i) *Religious person*: Figures 1a, 1b (Table 2: Columns 1, 4).
(ii) *Belief in God*: Figures F.1a, F.1b (Table 2: Columns 2, 5).
(iii) *Church attendance*: Figures F.2a, F.2b (Table 2: Columns 3, 6).
(iv) *Importance of religion*: Figures F.3a, F.3b (Table F.1: Columns 1, 3).
(v) *God very important*: Figures F.4a, F.4b (Table F.1: Columns 2, 4).

TABLE 2: Religiosity and Innovation: Cross−Country Estimates

| Dep. var.: *Residents' patents per capita (log)* | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Religiosity* | –4.668*** | | | –2.377*** | | | –2.280*** | | | –1.871*** | | |
| | (1.103) | | | (0.573) | | | (0.597) | | | (0.656) | | |
| *Belief in God* | | –5.309*** | | | –2.493*** | | | –2.319*** | | | –1.826*** | |
| | | (1.307) | | | (0.728) | | | (0.742) | | | (0.679) | |
| *Church attendance* | | | –5.468*** | | | –2.305*** | | | –1.917*** | | | –1.129 |
| | | | (0.962) | | | (0.717) | | | (0.684) | | | (0.798) |
| *Religious freedom* | | | | 0.005 | 0.015* | 0.015 | –0.005 | 0.005 | 0.004 | –0.003 | 0.008 | –0.001 |
| | | | | (0.009) | (0.009) | (0.010) | (0.009) | (0.009) | (0.009) | (0.012) | (0.011) | (0.013) |
| *GDP per capita (log)* | | | | 1.082*** | 1.143*** | 1.056*** | 0.754*** | 0.853*** | 0.771*** | 0.875*** | 0.986*** | 0.867*** |
| | | | | (0.171) | (0.177) | (0.160) | (0.182) | (0.184) | (0.154) | (0.187) | (0.180) | (0.180) |
| *Population (log)* | | | | 0.128 | 0.107 | 0.188** | 0.068 | 0.052 | 0.129 | 0.103 | 0.081 | 0.121 |
| | | | | (0.077) | (0.077) | (0.086) | (0.076) | (0.075) | (0.083) | (0.081) | (0.069) | (0.083) |
| *Protection intellectual property* | | | | 0.105 | 0.034 | 0.044 | 0.608*** | 0.474*** | 0.535*** | 0.536*** | 0.406*** | 0.541*** |
| | | | | (0.120) | (0.124) | (0.123) | (0.173) | (0.159) | (0.151) | (0.177) | (0.150) | (0.161) |
| *Tertiary education (years)* | | | | 0.930** | 0.813* | 0.806* | 1.309*** | 1.171*** | 1.187*** | 0.850* | 0.581 | 0.844* |
| | | | | (0.457) | (0.436) | (0.427) | (0.435) | (0.409) | (0.447) | (0.455) | (0.382) | (0.491) |
| *Foreign direct investment* | | | | –0.019* | –0.020* | –0.014 | –0.010 | –0.011 | –0.005 | 0.009 | –0.011 | –0.006 |
| | | | | (0.010) | (0.012) | (0.012) | (0.009) | (0.010) | (0.011) | (0.010) | (0.012) | (0.011) |
| *Protestant (pred.)* | | | | | | | | | | –0.068 | –0.089 | –0.275 |
| | | | | | | | | | | (0.286) | (0.322) | (0.314) |
| *Catholic (pred.)* | | | | | | | | | | –0.451 | –0.515* | –0.689** |
| | | | | | | | | | | (0.282) | (0.271) | (0.295) |
| *Muslim (pred.)* | | | | | | | | | | –0.414 | –0.495 | –0.642 |
| | | | | | | | | | | (0.536) | (0.542) | (0.588) |
| *Orthodox (pred.)* | | | | | | | | | | 0.589 | 0.730 | 0.179 |
| | | | | | | | | | | (0.546) | (0.545) | (0.545) |
| *Year fixed effects* | | | | | | | YES | YES | YES | YES | YES | YES |
| *Constant* | –6.916*** | –5.611*** | –8.599*** | –21.956*** | –22.191*** | –24.198*** | –17.769*** | –18.479*** | –20.335*** | –19.391*** | –20.291*** | –21.591*** |
| | (0.786) | (1.095) | (0.273) | (2.231) | (2.410) | (2.253) | (2.414) | (2.496) | (2.235) | (2.734) | (2.678) | (2.585) |
| Observations | 278 | 220 | 281 | 221 | 172 | 224 | 221 | 172 | 224 | 220 | 171 | 222 |
| Adjusted $R$−squared | 0.198 | 0.234 | 0.324 | 0.698 | 0.720 | 0.690 | 0.743 | 0.757 | 0.728 | 0.756 | 0.777 | 0.739 |

*Notes*: OLS estimates. Standard errors (in parentheses) are clustered by country. *Significant at 10%; **significant at 5%; ***significant at 1%.

TABLE F.1

Religiosity and Innovation: Cross−Country Estimates. *Robustness with other measures of religiosity*

| Dep. var.: *Residents' patents per capita (log)* | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| *Importance of religion* | –5.140*** | | –2.368*** | | –2.018*** | | –1.833*** | |
| | (0.809) | | (0.434) | | (0.425) | | (0.518) | |
| *God very important* | | –5.017*** | | –2.517*** | | –2.198*** | | –2.236*** |
| | | (0.513) | | (0.432) | | (0.427) | | (0.544) |
| *Religious freedom* | | | 0.003 | 0.004 | –0.004 | –0.002 | 0.001 | 0.008 |
| | | | (0.009) | (0.009) | (0.010) | (0.009) | (0.012) | (0.012) |
| *GDP per capita (log)* | | | 0.906*** | 0.952*** | 0.732*** | 0.752*** | 0.844*** | 0.852*** |
| | | | (0.160) | (0.151) | (0.164) | (0.163) | (0.179) | (0.178) |
| *Population (log)* | | | 0.152** | 0.154** | 0.115 | 0.111 | 0.136 | 0.126 |
| | | | (0.069) | (0.076) | (0.072) | (0.079) | (0.083) | (0.081) |
| *Protection intellectual property* | | | 0.196 | 0.062 | 0.581** | 0.424** | 0.530*** | 0.380** |
| | | | (0.119) | (0.112) | (0.164) | (0.166) | (0.169) | (0.170) |
| *Tertiary education (years)* | | | 1.093** | 0.889** | 1.297*** | 1.185*** | 0.874* | 0.851* |
| | | | (0.432) | (0.384) | (0.438) | (0.386) | (0.482) | (0.446) |
| *Foreign direct investment* | | | –0.013 | –0.014 | –0.007 | –0.008 | –0.006 | –0.008 |
| | | | (0.011) | (0.011) | (0.010) | (0.010) | (0.011) | (0.011) |
| *Protestant (pred.)* | | | | | | | –0.101 | –0.030 |
| | | | | | | | (0.321) | (0.285) |
| *Catholic (pred.)* | | | | | | | –0.509 | –0.355 |
| | | | | | | | (0.307) | (0.279) |
| *Muslim (pred.)* | | | | | | | –0.125 | 0.412 |
| | | | | | | | (0.564) | (0.591) |
| *Orthodox (pred.)* | | | | | | | 0.513 | 0.522 |
| | | | | | | | (0.548) | (0.548) |
| *Year fixed effects* | | | | | YES | YES | YES | YES |
| *Constant* | –6.941*** | –8.131*** | –21.135*** | –21.560*** | –19.163*** | –18.975*** | –20.625*** | –20.668*** |
| | (0.563) | (0.261) | (2.171) | (2.145) | (2.283) | (2.389) | (2.751) | (2.733) |
| Observations | 262 | 281 | 207 | 224 | 207 | 224 | 205 | 222 |
| Adjusted $R$−squared | 0.376 | 0.471 | 0.731 | 0.757 | 0.752 | 0.777 | 0.764 | 0.786 |

*Notes*: OLS estimates. Standard errors (in parentheses) are clustered by country. *Significant at 10%; **significant at 5%; ***significant at 1%.

(i) *Religious person*: Figures 1a, 1b (Table 2: Columns 1, 4).

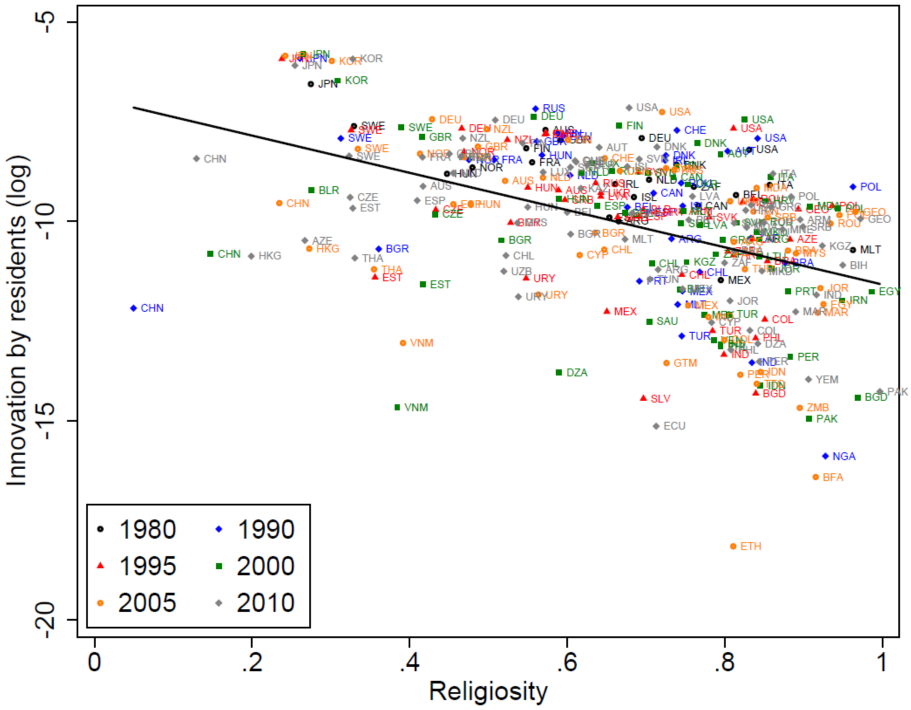


FIGURE 1a: Unconditional relationship

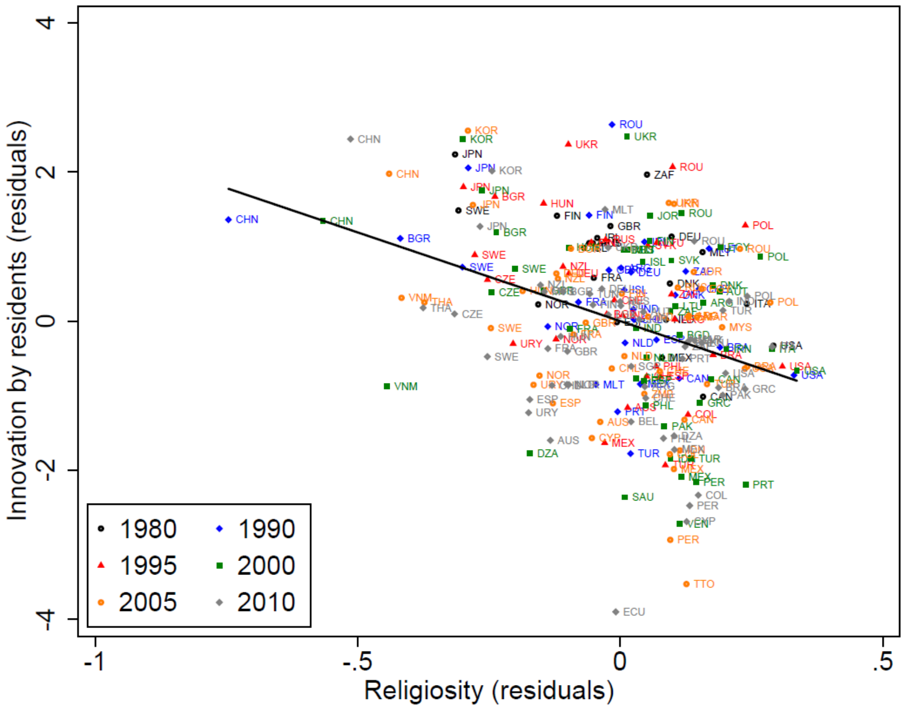


FIGURE 1b: Conditional relationship

(ii) *Belief in God*: Figures F.1a, F.1b (Table 2: Columns 2, 5).

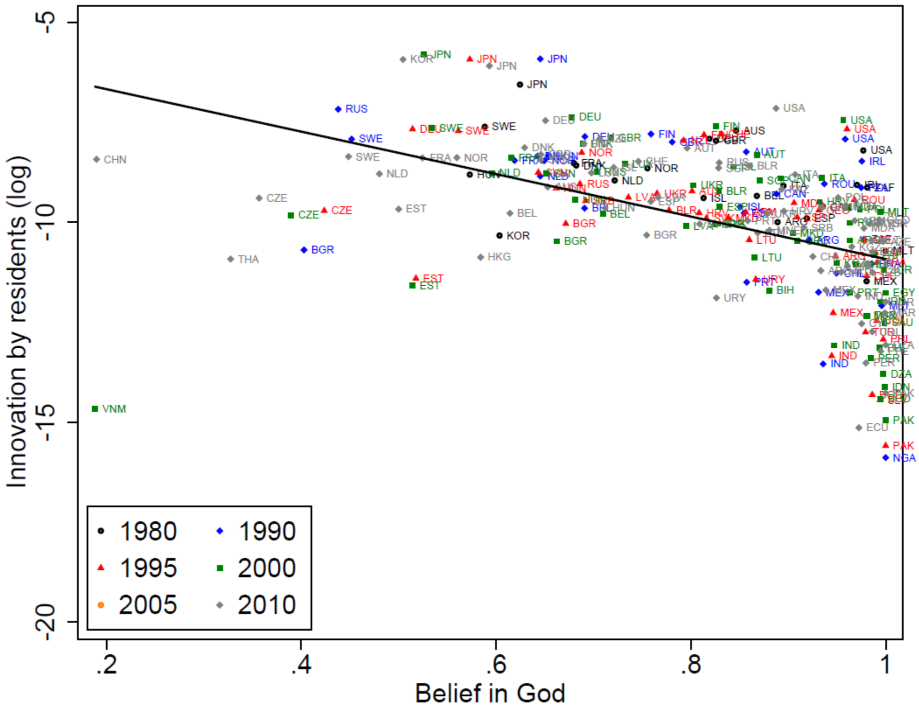


FIGURE F.1a: Unconditional relationship

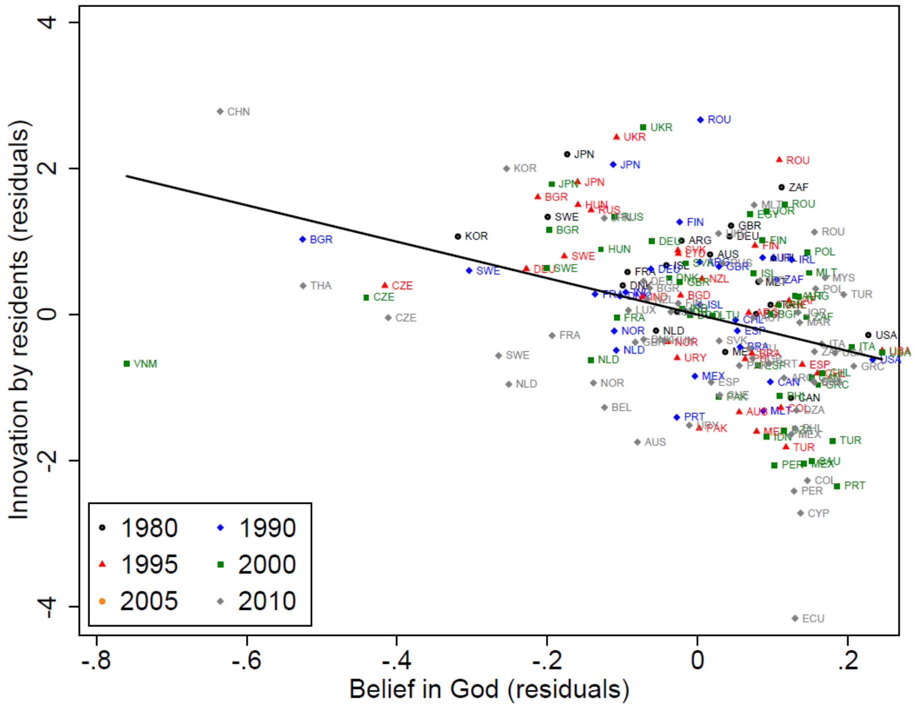


FIGURE F.1b: Conditional relationship

(iii) *Church attendance*: Figures F.2a, F.2b (Table 2: Columns 3, 6).

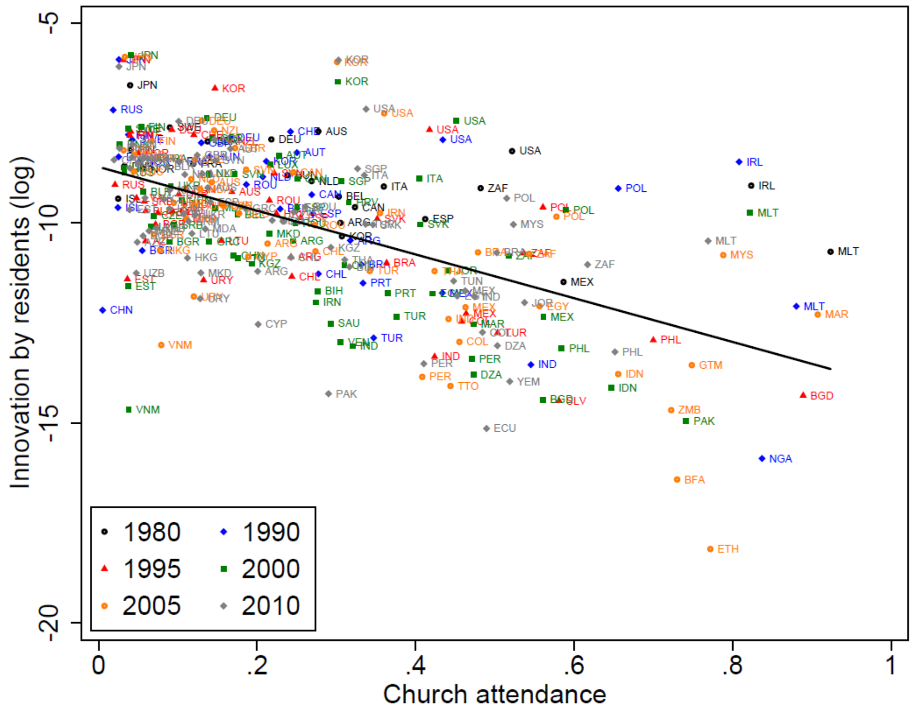


FIGURE F.2a: Unconditional relationship

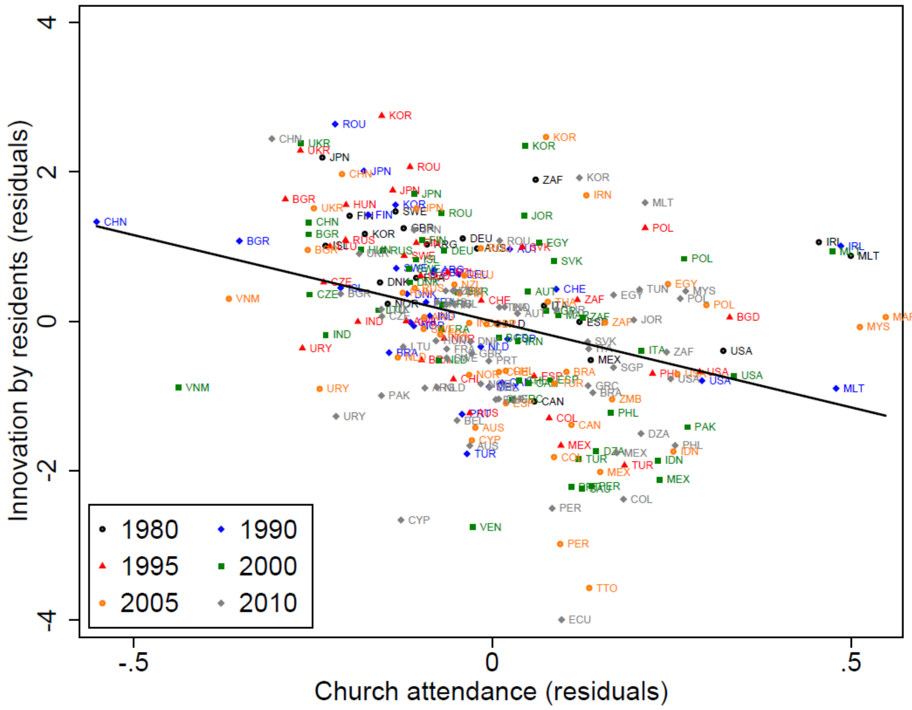


FIGURE F.2b: Conditional relationship

(iv) *Importance of religion*: Figures F.3a, F.3b (Table F.1: Columns 1, 3).

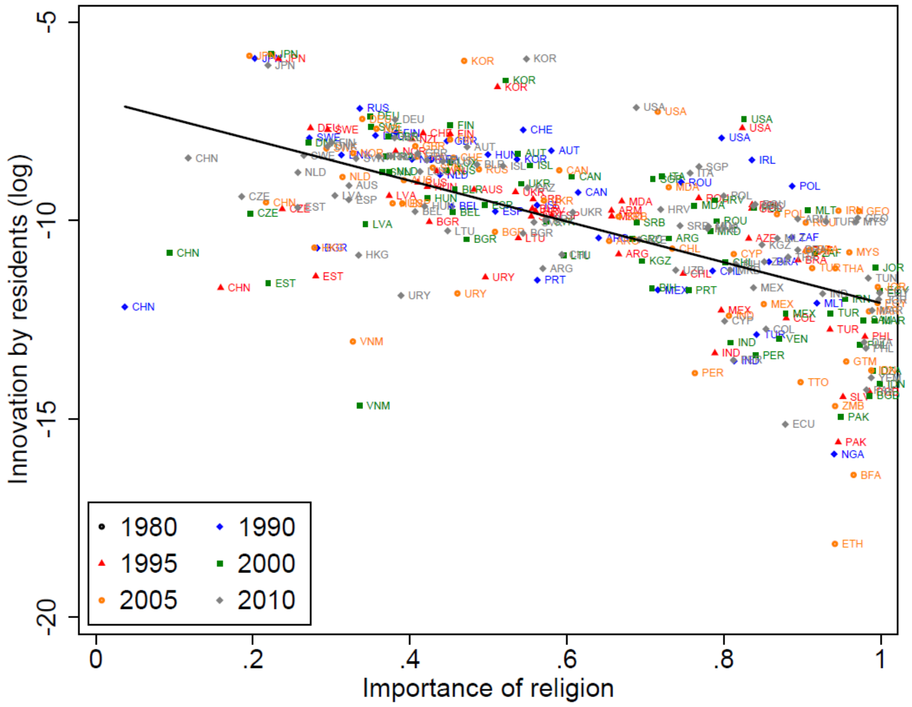


FIGURE F.3a: Unconditional relationship

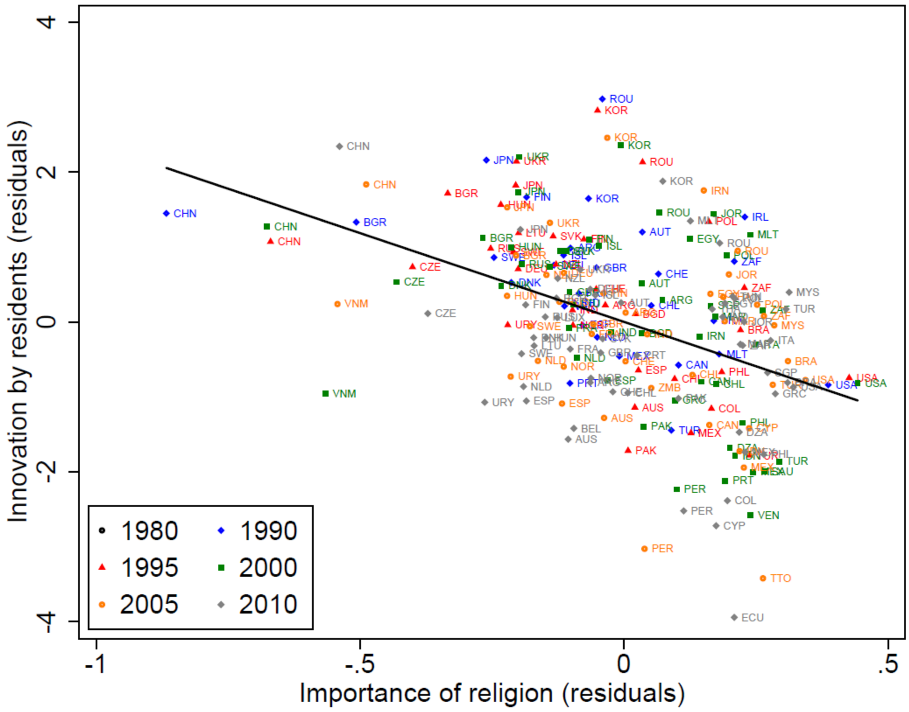


FIGURE F.3b: Conditional relationship

(v) *God very important*: Figures F.4a, F.4b (Table F.1: Columns 2, 4).

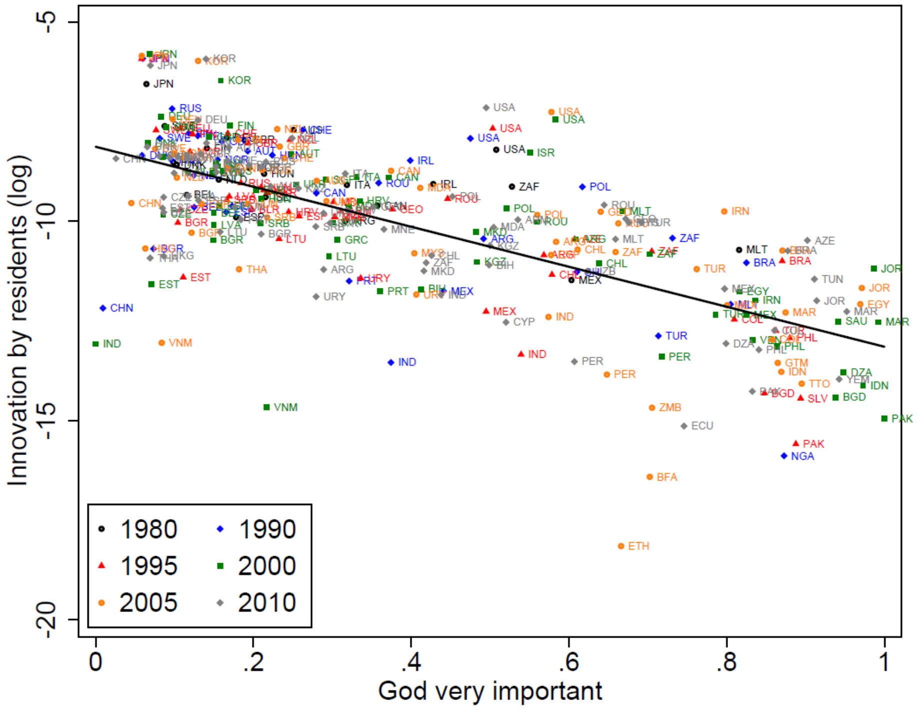


FIGURE F.4a: Unconditional relationship

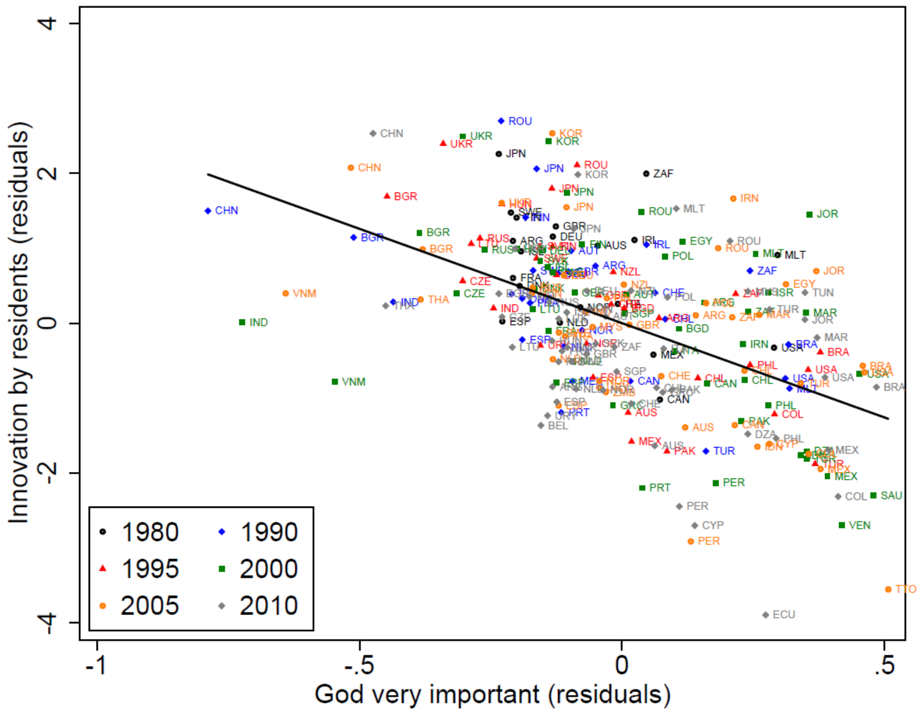


FIGURE F.4b: Conditional relationship

### F.1.2 Robustness checks with total patents per capita, controlling for Communist countries, and for the population shares of major religions

In this subsection, we report the robustness checks for the international cross-country analysis when:

- using total patents per capita, namely those filed in a country by both residents and foreigners (Table F.2);
- using dummies for current and formerly Communist countries, as well their interactions with religiosity measures (Table F.3 and Figures F.5a-5b);
- controlling for the population shares of major religions, rather than which one is dominant (Table F.4).

TABLE F.2: Religiosity and Innovation: Cross−Country Estimates. *Robustness with Total patents per capita*

| Dep. var.: *Total patents per capita (log)* | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Religiosity* | –3.909$^{***}$ | | | –1.678$^{***}$ | | | –1.681$^{***}$ | | | –1.385$^{***}$ | | |
| | (0.901) | | | (0.367) | | | (0.364) | | | (0.449) | | |
| *Belief in God* | | –3.785$^{***}$ | | | –1.344$^{***}$ | | | –1.296$^{**}$ | | | –0.814 | |
| | | (0.890) | | | (0.472) | | | (0.490) | | | (0.530) | |
| *Church attendance* | | | –3.380$^{***}$ | | | –0.866$^{**}$ | | | –0.698 | | | –0.285 |
| | | | (0.792) | | | (0.419) | | | (0.444) | | | (0.546) |
| *Religious freedom* | | | | 0.023$^{***}$ | 0.028$^{***}$ | 0.027$^{***}$ | 0.018$^{***}$ | 0.023$^{***}$ | 0.021$^{***}$ | 0.017$^{**}$ | 0.020$^{**}$ | 0.014$^{*}$ |
| | | | | (0.006) | (0.006) | (0.007) | (0.006) | (0.006) | (0.007) | (0.007) | (0.008) | (0.008) |
| *GDP per capita (log)* | | | | 0.795$^{***}$ | 0.882$^{***}$ | 0.846$^{***}$ | 0.623$^{***}$ | 0.712$^{***}$ | 0.692$^{***}$ | 0.594$^{***}$ | 0.684$^{***}$ | 0.643$^{***}$ |
| | | | | (0.086) | (0.098) | (0.098) | (0.079) | (0.090) | (0.090) | (0.100) | (0.106) | (0.112) |
| *Population (log)* | | | | 0.006 | 0.009 | 0.048 | –0.029 | –0.025 | 0.014 | –0.049 | –0.055 | –0.034 |
| | | | | (0.054) | (0.069) | (0.067) | (0.050) | (0.065) | (0.064) | (0.048) | (0.060) | (0.057) |
| *Protection intellectual property* | | | | –0.091 | –0.158 | –0.108 | 0.163 | 0.097 | 0.152 | 0.177 | 0.129 | 0.189 |
| | | | | (0.097) | (0.116) | (0.111) | (0.100) | (0.116) | (0.121) | (0.109) | (0.118) | (0.118) |
| *Tertiary education (years)* | | | | 0.704$^{***}$ | 0.656$^{**}$ | 0.689$^{**}$ | 0.957$^{***}$ | 0.939$^{***}$ | 0.950$^{***}$ | 0.970$^{***}$ | 0.770$^{**}$ | 0.957$^{***}$ |
| | | | | (0.248) | (0.288) | (0.269) | (0.228) | (0.270) | (0.288) | (0.275) | (0.290) | (0.308) |
| *Foreign direct investment* | | | | –0.028$^{***}$ | –0.026$^{**}$ | –0.025$^{**}$ | –0.023$^{**}$ | –0.021$^{**}$ | –0.020$^{**}$ | –0.022$^{**}$ | –0.020$^{**}$ | –0.020$^{**}$ |
| | | | | (0.009) | (0.010) | (0.011) | (0.009) | (0.010) | (0.010) | (0.009) | (0.010) | (0.009) |
| *Protestant (pred.)* | | | | | | | | | | –0.086 | –0.226 | –0.278 |
| | | | | | | | | | | (0.221) | (0.262) | (0.237) |
| *Catholic (pred.)* | | | | | | | | | | –0.370$^{*}$ | –0.625$^{**}$ | –0.643$^{***}$ |
| | | | | | | | | | | (0.207) | (0.242) | (0.229) |
| *Muslim (pred.)* | | | | | | | | | | –0.186 | –0.481 | –0.681 |
| | | | | | | | | | | (0.434) | (0.492) | (0.471) |
| *Orthodox (pred.)* | | | | | | | | | | –0.420 | –0.448 | –0.717$^{*}$ |
| | | | | | | | | | | (0.395) | (0.417) | (0.394) |
| *Year fixed effects* | | | | | | | YES | YES | YES | YES | YES | YES |
| *Constant* | –6.296$^{***}$ | –5.762$^{***}$ | –8.024$^{***}$ | –16.965$^{***}$ | –18.048$^{***}$ | –19.334$^{***}$ | –14.509$^{***}$ | –15.779$^{***}$ | –17.080$^{***}$ | –13.878$^{***}$ | –14.863$^{***}$ | –15.091$^{***}$ |
| | (0.647) | (0.742) | (0.234) | (1.375) | (1.648) | (1.663) | (1.294) | (1.541) | (1.599) | (1.459) | (1.578) | (1.577) |
| Observations | 278 | 220 | 281 | 221 | 172 | 224 | 221 | 172 | 224 | 220 | 171 | 222 |
| Adjusted $R$−squared | 0.215 | 0.191 | 0.185 | 0.704 | 0.679 | 0.674 | 0.739 | 0.716 | 0.703 | 0.742 | 0.726 | 0.721 |

*Notes*: OLS estimates. Standard errors (in parentheses) are clustered by country. *Significant at 10%; **significant at 5%; ***significant at 1%

Table F.3 reports the estimates of the relationship between religiosity and innovation for all five measures of religiosity when we include a dummy for *current and former Communist countries* and its interaction term with the religiosity variable. This allows us to estimate the impact of religiosity on innovation in communist and non-communist countries.

The unconditional estimated marginal effects of religiosity on innovation in Communist and non-Communist countries are shown in Figure F.5a; they are obtained from the estimates reported in Columns 1-5 of Table F.3. The figure shows that the estimated effect of religiosity on innovation is always significantly negative in never-Communist countries, while it is always insignificant in countries that are or that experienced a Communist regime.

Figure F.5b reports the estimated marginal effects of religiosity on innovation when we include the full set of controls, corresponding to the estimates in Columns 6-10 of Table F.3. The results of the unconditional estimates are confirmed; the only exception is the estimated coefficient of Church attendance in never-Communist countries that is still negative, but no longer statistically significant at standard levels.

TABLE F.3: Religiosity and Innovation: Cross−Country Estimates. *Robustness with current and former Communist countries*

| Dep. var.: *Residents' patents per capita (log)* | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Religiosity* | –7.772*** | | | | | –2.324*** | | | | |
| | (1.081) | | | | | (0.835) | | | | |
| *Belief in God* | | –8.978*** | | | | | –2.069** | | | |
| | | (1.402) | | | | | (0.788) | | | |
| *Church attendance* | | | –6.721*** | | | | | –0.667 | | |
| | | | (1.110) | | | | | (0.958) | | |
| *Importance of religion* | | | | –7.085*** | | | | | –1.734** | |
| | | | | (0.650) | | | | | (0.785) | |
| *God very important* | | | | | –5.726*** | | | | | –1.997*** |
| | | | | | (0.535) | | | | | (0.656) |
| *Communist* | –5.274*** | –7.280*** | –1.567*** | –4.000*** | –1.651*** | –0.705 | –1.290 | 1.017** | –0.310 | 0.298 |
| | (0.934) | (1.608) | (0.533) | (0.790) | (0.509) | (0.731) | (1.056) | (0.484) | (0.691) | (0.461) |
| *Religiosity* x *Communist* | 7.979*** | | | | | 3.016*** | | | | |
| | (1.326) | | | | | (0.992) | | | | |
| *Belief in God* x *Communist* | | 8.912*** | | | | | 3.348** | | | |
| | | (1.925) | | | | | (1.268) | | | |
| *Church attendance* x *Communist* | | | 4.016 | | | | | 1.453 | | |
| | | | (2.861) | | | | | (1.248) | | |
| *Importance of religion* x *Communist* | | | | 6.246*** | | | | | 2.722*** | |
| | | | | (1.255) | | | | | (0.953) | |
| *God very important* x *Communist* | | | | | 3.485** | | | | | 2.655*** |
| | | | | | (1.360) | | | | | (0.996) |
| *Religious freedom* | | | | | | 0.002 | 0.010 | 0.005 | 0.005 | 0.011 |
| | | | | | | (0.011) | (0.010) | (0.012) | (0.012) | (0.012) |
| *GDP per capita (log)* | | | | | | 1.033*** | 1.118*** | 1.090*** | 0.985*** | 0.986*** |
| | | | | | | (0.173) | (0.144) | (0.183) | (0.190) | (0.184) |
| *Population (log)* | | | | | | 0.172** | 0.150** | 0.167** | 0.187** | 0.161* |
| | | | | | | (0.081) | (0.070) | (0.079) | (0.084) | (0.081) |
| *Protection intellectual property* | | | | | | 0.379** | 0.297** | 0.403*** | 0.406** | 0.286* |
| | | | | | | (0.159) | (0.137) | (0.143) | (0.156) | (0.162) |
| *Tertiary education (years)* | | | | | | 0.704* | 0.433 | 0.856* | 0.897** | 0.902** |
| | | | | | | (0.367) | (0.297) | (0.465) | (0.429) | (0.406) |
| *Foreign direct investment* | | | | | | –0.003 | –0.004 | –0.004 | –0.002 | –0.005 |
| | | | | | | (0.008) | (0.009) | (0.010) | (0.010) | (0.010) |
| *Protestant (pred.)* | | | | | | 0.024 | –0.062 | –0.134 | –0.046 | 0.026 |
| | | | | | | (0.282) | (0.303) | (0.326) | (0.337) | (0.283) |
| *Catholic (pred.)* | | | | | | –0.627** | –0.717*** | –0.853*** | –0.724** | –0.504* |
| | | | | | | (0.254) | (0.241) | (0.277) | (0.289) | (0.268) |
| *Muslim (pred.)* | | | | | | –0.065 | –0.310 | –0.265 | 0.068 | 0.572 |
| | | | | | | (0.538) | (0.490) | (0.571) | (0.562) | (0.585) |
| *Orthodox (pred.)* | | | | | | –0.190 | –0.170 | –0.343 | –0.339 | –0.145 |
| | | | | | | (0.411) | (0.412) | (0.466) | (0.427) | (0.418) |
| *Year fixed effects* | | | | | | YES | YES | YES | YES | YES |
| *Constant* | –4.877*** | –2.501** | –7.990*** | –5.566*** | –7.675*** | –21.722*** | –22.301*** | –23.782*** | –22.810*** | –22.628*** |
| | (0.718) | (1.141) | (0.345) | (0.442) | (0.302) | (2.735) | (2.188) | (2.645) | (3.064) | (2.854) |
| Observations | 278 | 220 | 281 | 262 | 281 | 220 | 171 | 222 | 205 | 222 |
| Adjusted $R$−squared | 0.334 | 0.387 | 0.373 | 0.490 | 0.510 | 0.799 | 0.818 | 0.774 | 0.796 | 0.807 |

*Notes*: OLS estimates. Standard errors (in parentheses) are clustered by country. *Significant at 10%; **significant at 5%; ***significant at 1%.

Estimated marginal effects of religiosity on innovation in Communist and non-Communist countries:

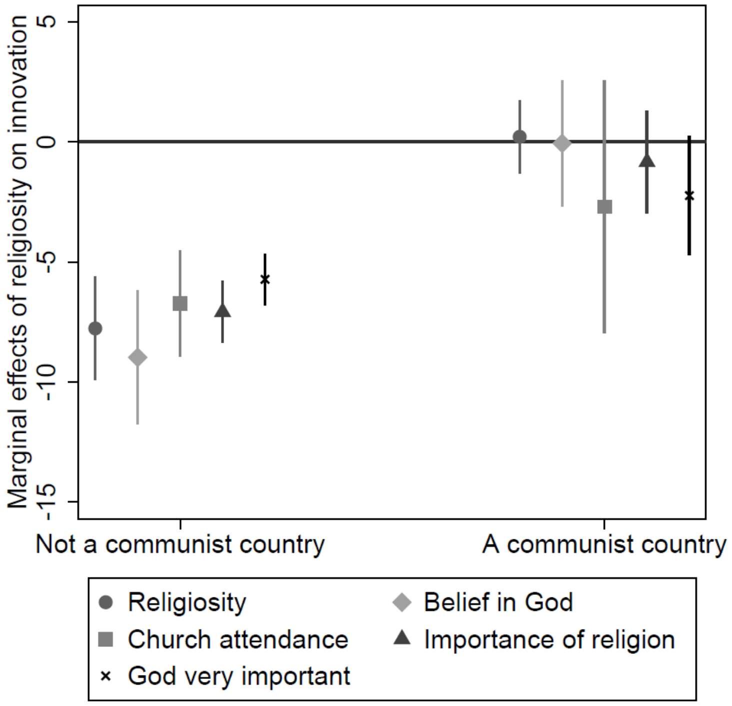


FIGURE F.5a: Unconditional estimates

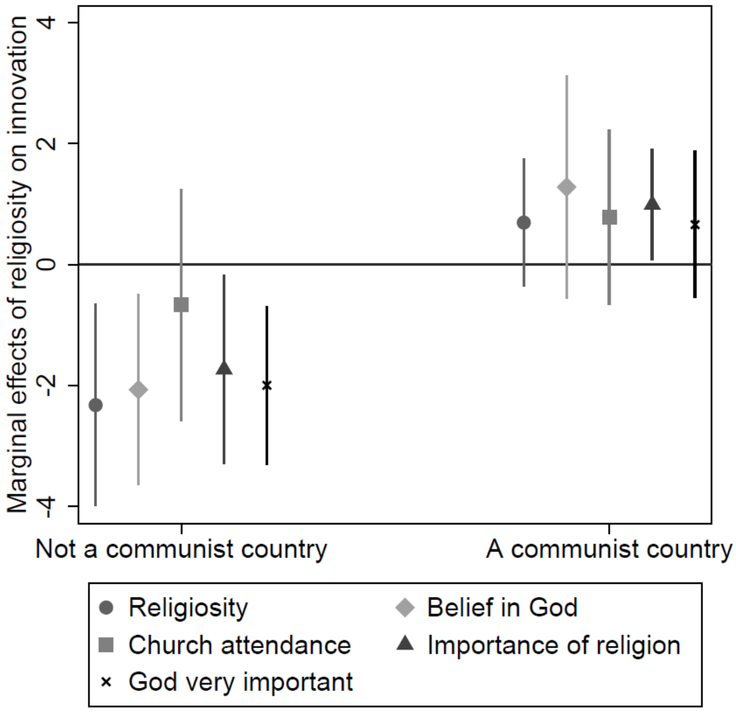


FIGURE F.5b: Conditional estimates

Table F.4 reports the estimates of the relationship between the level of innovation and all five measures of religiosity, when controlling for the population shares of major religions, rather than which one is dominant (as reported in Columns 10-12 of Table 2 and Columns 7-8 of Table F.1).

TABLE F.4: Religiosity and Innovation: Cross−Country Estimates. *Robustness with the shares of religions*

| Dep. var.: *Residents' patents per capita (log)* | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| *Religiosity* | –1.712*** | | | | |
| | (0.626) | | | | |
| *Belief in God* | | –1.689** | | | |
| | | (0.652) | | | |
| *Church attendance* | | | –0.864 | | |
| | | | (0.725) | | |
| *Importance of religion* | | | | –1.718*** | |
| | | | | (0.482) | |
| *God very important* | | | | | –2.094*** |
| | | | | | (0.534) |
| *Religious freedom* | –0.003 | 0.008 | –0.002 | 0.001 | 0.007 |
| | (0.012) | (0.011) | (0.013) | (0.013) | (0.012) |
| *GDP per capita (log)* | 0.906*** | 1.021*** | 0.937*** | 0.883*** | 0.889*** |
| | (0.194) | (0.188) | (0.187) | (0.179) | (0.180) |
| *Population (log)* | 0.086 | 0.058 | 0.072 | 0.108 | 0.102 |
| | (0.084) | (0.069) | (0.082) | (0.084) | (0.082) |
| *Protection intellectual property* | 0.548*** | 0.424*** | 0.578*** | 0.546*** | 0.405** |
| | (0.178) | (0.153) | (0.162) | (0.170) | (0.171) |
| *Tertiary education (years)* | 0.869* | 0.583 | 0.856* | 0.877* | 0.831* |
| | (0.455) | (0.380) | (0.477) | (0.474) | (0.438) |
| *Foreign direct investment* | –0.009 | –0.011 | –0.008 | –0.007 | –0.009 |
| | (0.010) | (0.012) | (0.011) | (0.011) | (0.011) |
| *Protestant (share)* | –0.392 | –0.529 | –1.061* | –0.547 | –0.455 |
| | (0.612) | (0.659) | (0.583) | (0.570) | (0.602) |
| *Catholic (share)* | –0.757 | –0.946* | –1.389*** | –0.943* | –0.772 |
| | (0.545) | (0.533) | (0.513) | (0.527) | (0.529) |
| *Muslim (share)* | –0.650 | –0.845 | –1.223* | –0.429 | 0.124 |
| | (0.648) | (0.665) | (0.648) | (0.610) | (0.707) |
| *Orthodox (share)* | 0.595 | 0.684 | –0.182 | 0.392 | 0.415 |
| | (0.708) | (0.755) | (0.742) | (0.743) | (0.778) |
| *Year fixed effects* | YES | YES | YES | YES | YES |
| *Constant* | –19.315*** | –20.050*** | –19.845*** | –20.301*** | –20.306*** |
| | (2.670) | (2.648) | (2.542) | (2.666) | (2.652) |
| Observations | 220 | 171 | 222 | 205 | 222 |
| Adjusted $R$−squared | 0.755 | 0.781 | 0.745 | 0.766 | 0.788 |

*Notes*: OLS estimates. Standard errors (in parentheses) are clustered by country. *Significant at 10%; **significant at 5%; ***significant at 1%.

## F.2. The United States: Robustness checks

We first reproduce Table 3 and Figures 2a-2b, which are also reported in the main text. We next include the corresponding scatterplots when religiosity is measured by the variables *Belief in God* and *Church attendance*, respectively.

For each of the three religiosity variables used in the U.S. cross-state analysis, we list below the scatterplots for the unconditional and conditional (baseline) relationships, as well as the table and column containing the corresponding estimate:
(i) *Importance of religion*: Figures 2a, 2b (Table 3: Columns 1, 7).
(ii) *Belief in God*: Figures F.6a, F.6b (Table 3: Columns 2, 8).
(iii) *Church attendance*: Figures F.7a, F.7b (Table 3: Columns 3, 9).

TABLE 3: Religiosity and Innovation in the US: Cross-State Estimates

| Dep. var.: *Patents per capita (log)* | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| *Importance of religion* | −3.226*** | | | −3.015*** | | | −3.913*** | | |
| | (1.057) | | | (0.787) | | | (0.625) | | |
| *Belief in God* | | −12.977*** | | | −8.688** | | | −10.290*** | |
| | | (3.287) | | | (3.536) | | | (3.385) | |
| *Church attendance* | | | −2.737** | | | −2.373** | | | −3.181*** |
| | | | (1.289) | | | (1.111) | | | (1.067) |
| *GSP per capita (log)* | | | | −1.125* | −1.061 | −1.222* | −0.477 | −0.569 | −0.709 |
| | | | | (0.588) | (0.663) | (0.617) | (0.489) | (0.673) | (0.618) |
| *Population (log)* | | | | 0.260*** | 0.199** | 0.237*** | 0.218*** | 0.154 | 0.200** |
| | | | | (0.078) | (0.090) | (0.085) | (0.079) | (0.094) | (0.089) |
| *Tertiary education* | | | | 0.074*** | 0.078** | 0.086*** | 0.035* | 0.050 | 0.054** |
| | | | | (0.025) | (0.032) | (0.026) | (0.021) | (0.032) | (0.024) |
| *Foreign direct investment* | | | | | | | −3.017*** | −2.232*** | −2.545*** |
| | | | | | | | (0.574) | (0.733) | (0.619) |
| *Constant* | −6.681*** | 3.718 | −7.422*** | −0.551 | 6.065 | −0.227 | −5.075 | 3.886 | −3.803 |
| | (0.647) | (3.128) | (0.550) | (5.907) | (7.258) | (6.420) | (5.267) | (7.887) | (6.559) |
| Observations | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |
| Adjusted $R$-squared | 0.198 | 0.206 | 0.101 | 0.463 | 0.396 | 0.386 | 0.567 | 0.451 | 0.456 |

*Notes*: OLS estimates. Robust standard errors in parentheses. *Significant at 10%; **significant at 5%; ***significant at 1%.

(i) *Importance of religion*: Figures 2a, 2b (Table 3: Columns 1, 7).

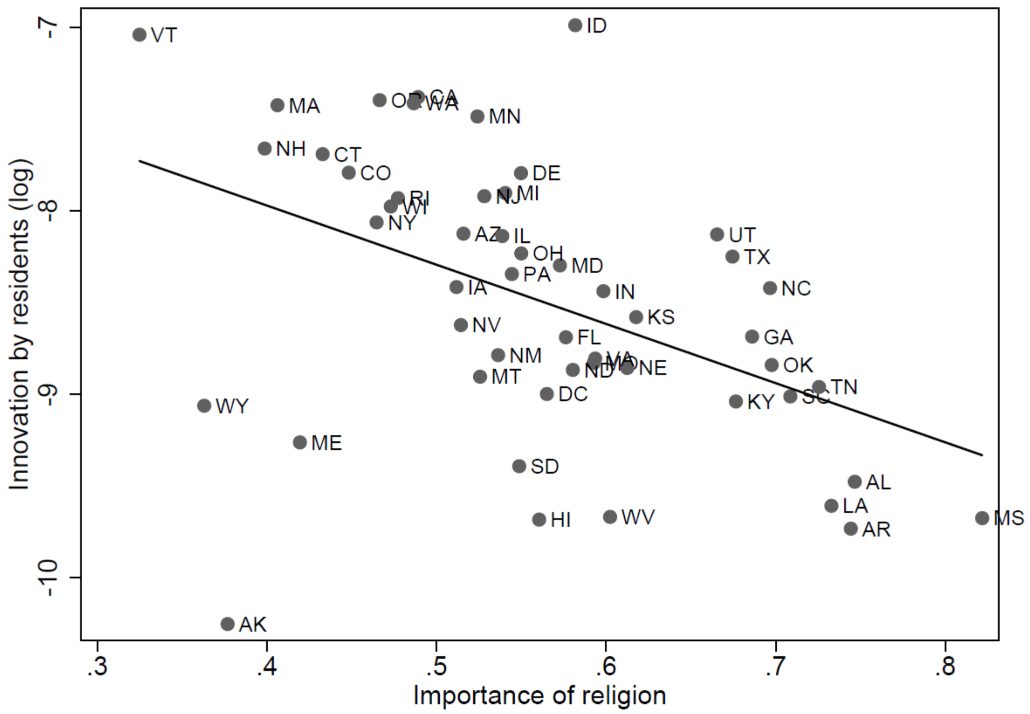


FIGURE 2a: Unconditional relationship

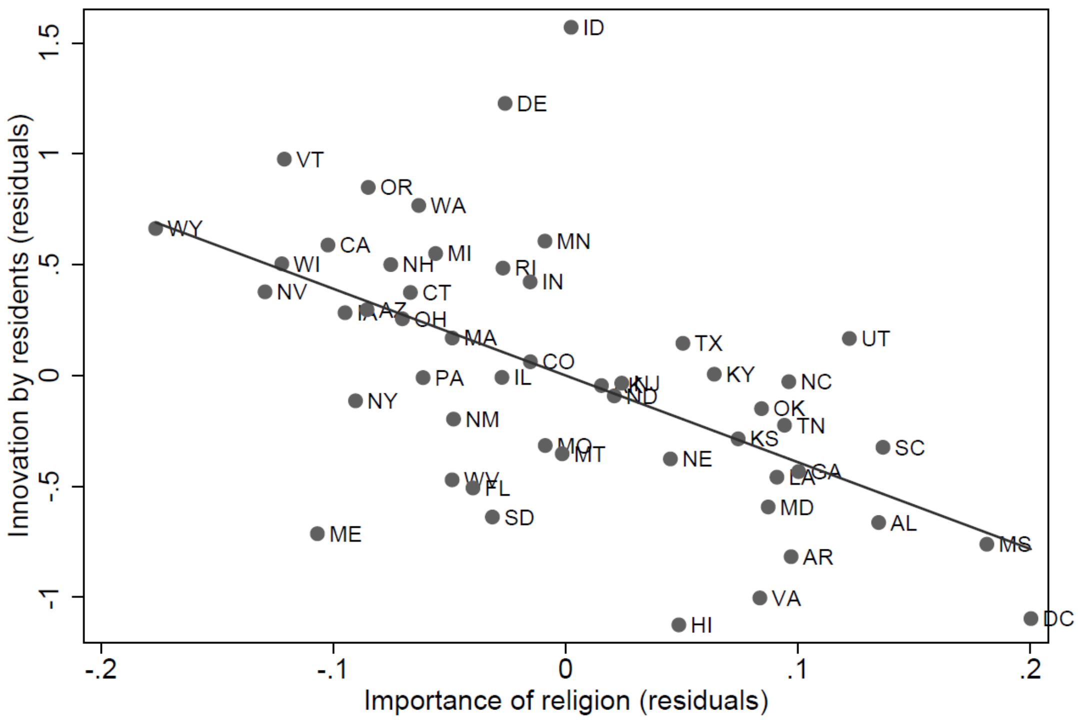


FIGURE 2b: Conditional relationship

(ii) *Belief in God*: Figures F.6a, F.6b (Table 3: Columns 2, 8).

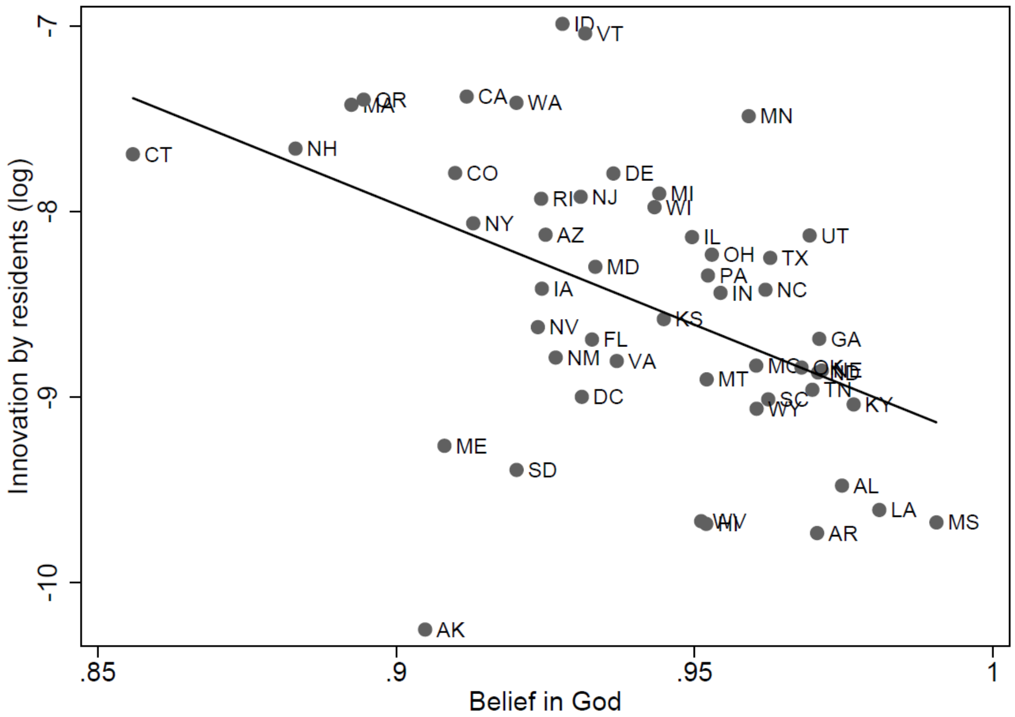


FIGURE F.6a: Unconditional relationship

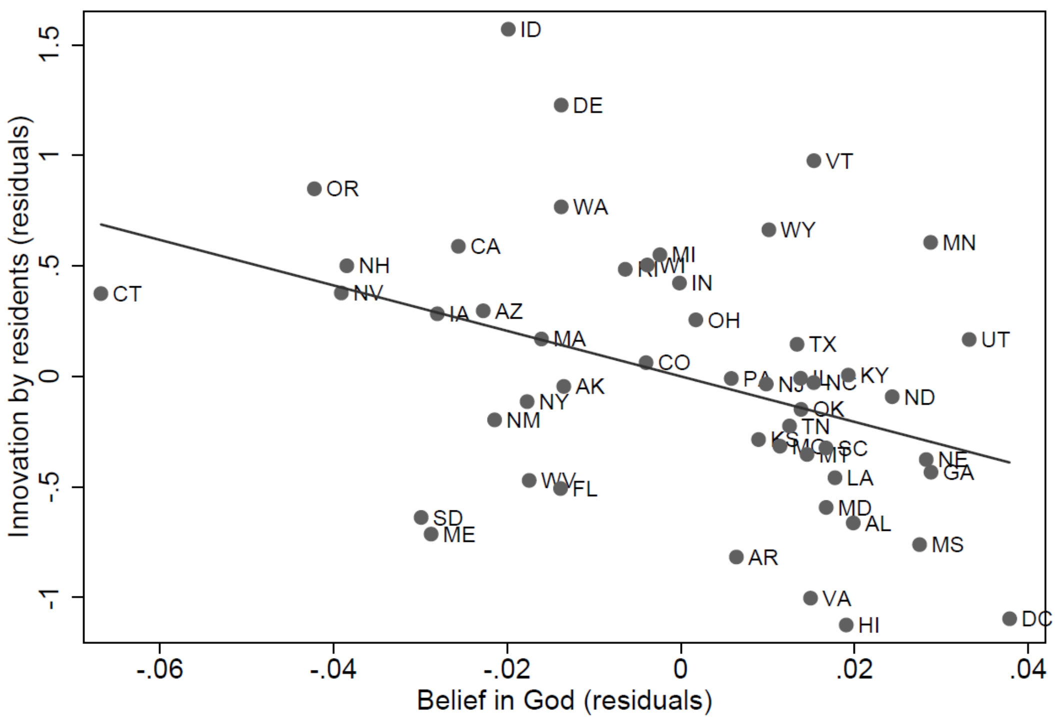


FIGURE F.6b: Conditional relationship

(iii) *Church attendance*: Figures F.7a, F.7b (Table 3: Columns 3, 9).

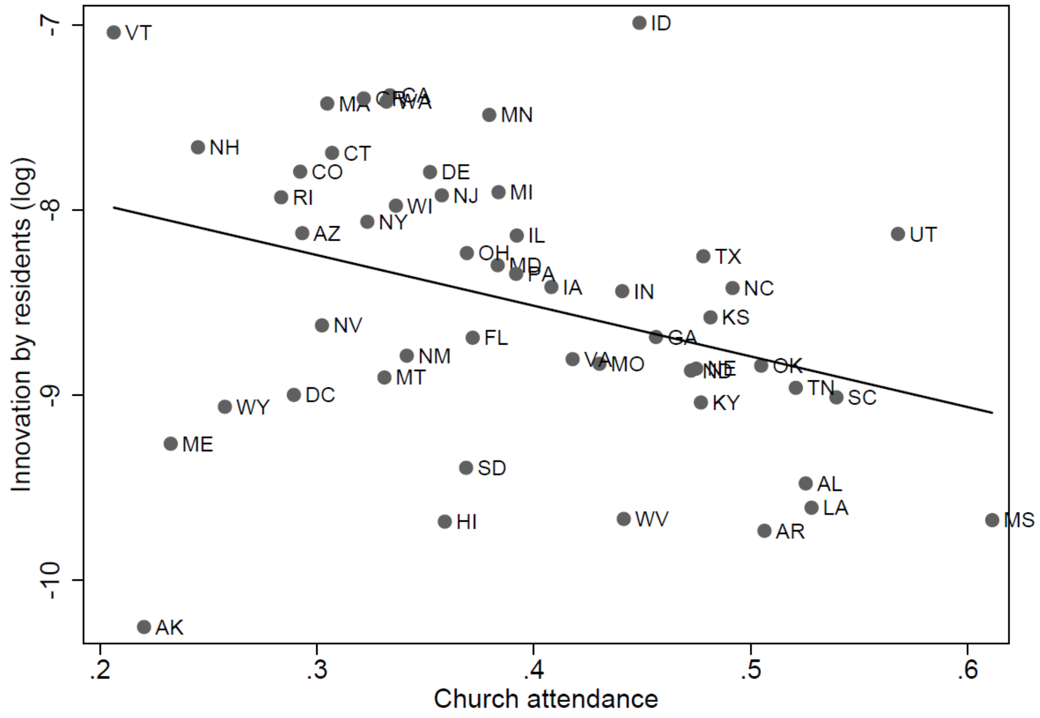


FIGURE F.7a: Unconditional relationship

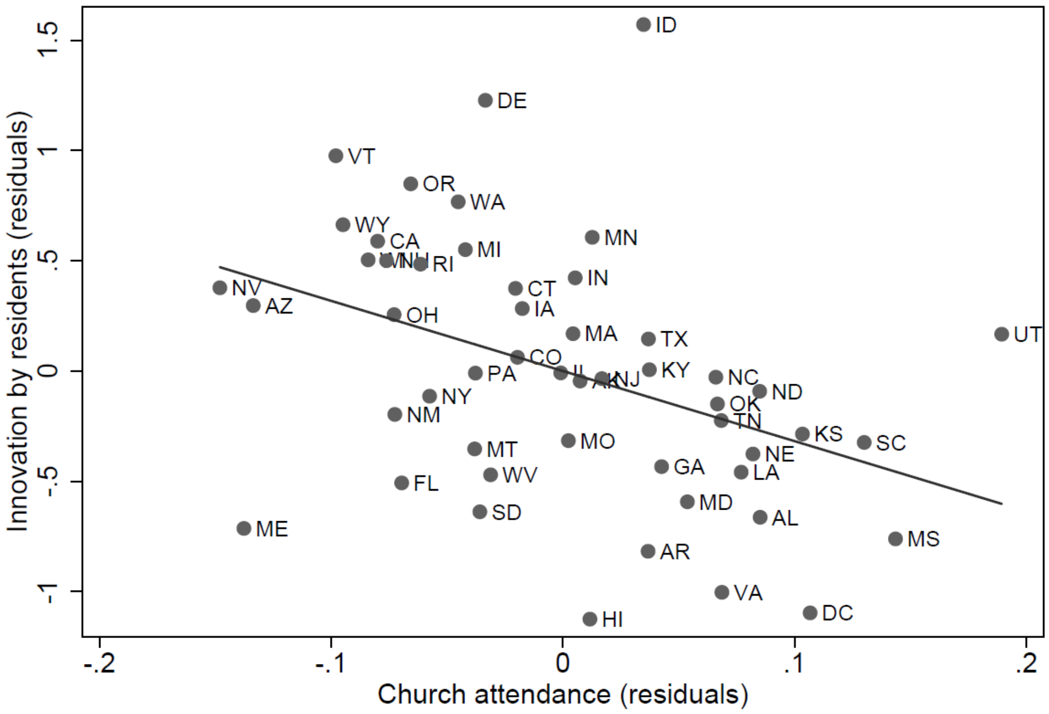


FIGURE F.7b: Conditional relationship

# APPENDIX G: Data Appendix

This Data Appendix reports detailed information on each variable employed in the empirical analysis, i.e. the data source and how it is obtained, for the international cross-state analysis as well as for the one with the US data. A summary list with the datasets used is reported at the end of this appendix.

## G.1. Data Appendix: *Religiosity and Innovation – International Cross-State Estimates*

The variables in this appendix are listed in the following order.
- Country code: WDI
- Country name: WVS and EVS
- Year
- Religiosity and Religion variables: WVS and EVS (1980 – 2010)
- Religious freedom: Norris (2009)
- Population, GDP per capita, Foreign Direct Investment: WDI
- Innovation variables, i.e. Patents per capita by residents and total: WIPO
- Protection of intellectual property index: Park (2008)
- Tertiary education: Barro and Lee (2013)
- Communist dummy: Wikipedia

**Country Code**
Variable name in our dataset: code2
The variable "code2" is a three-letter code that identifies the country and is taken from the World Development Indicators. The code is used for combining the various datasets as country names may contain minor differences and, therefore, are a less reliable variable for merging the datasets.
The dataset "codes.dta" in the source subfolder "Data/Source/ICC" contains a list with the name of each country and the variable "code2": the dataset comes from our elaboration.

**Country name**
Variable name in our dataset: country_wv
The name of the country is taken from the WVS/EVS (variable name: S003) and is reported also in the source dataset "codes.dta".

**Year**
Variable name in our dataset: year
The variable "year" identifies the reference year of the WVS/EVS wave as specified below and corresponds to the following six dates: 1980, 1990, 1995, 2000, 2005, 2010.

***Preliminary notes on the religiosity and religion variables obtained from WVS and EVS***

The (five) measures of religiosity and the (four) variables for predominant religions (as well as the shares of religions) all come from the World Values Survey (WVS) and the European Values Study (EVS), i.e., respectively:

Inglehart, R., C. Haerpfer, A. Moreno, C. Welzel, K. Kizilova, J. Diez-Medrano, M. Lagos, P. Norris, E. Ponarin & B. Puranen et al. (eds.). 2014. World Values Survey: All Rounds - Country-Pooled Datafile Version: http://www.worldvaluessurvey.org/WVSDocumentationWVL.jsp. Madrid: JD Systems Institute. (accessed January 27, 2020).
Datafile: "WVS_Longitudinal_1981_2016_stata_v20180912.dta" (not provided)
"WVS_Longitudinal_1981_2016_stata_v20180912_extract.dta" (the extracted datafile is provided)
Folder: "/Data/Source/ICC"

EVS (2020). European Values Study Longitudinal Data File 1981-2008 (EVS 1981-2008). GESIS Data Archive, Cologne. ZA4804 Data file Version 3.1.0, https://doi.org/10.4232/1.13486. (accessed July 16, 2021).
Datafile: "ZA4804_v3-1-0.dta" (not provided)
"ZA4804_v3-1-0_extract.dta" (the extracted datafile is provided)
Folder: "/Data/Source/ICC"

The six waves (1980–2010) of the World Values Survey are the following:
Wave 1: 1981-1984 – denoted as year 1980
Wave 2: 1990-1994 – denoted as year 1990
Wave 3: 1995-1998 – denoted as year 1995
Wave 4: 1999-2004 – denoted as year 2000
Wave 5: 2005-2009 – denoted as year 2005
Wave 6: 2010-2014 – denoted as year 2010

The four waves (1981-2008) of the European Values Study are the following:
Wave 1: 1981 – integrated with WVS Wave 1 – 1980
Wave 2: 1990 – integrated with WVS Wave 2 – 1990
Wave 3: 1999 – integrated with WVS Wave 4 – 2000
Wave 3: 2008 – integrated with WVS Wave 6 – 2010

Note 1: In computing the aggregate (five) variables of religiosity, the (four) variables for the shares of religions and the four dummies for the predominant religions (listed below) from the WVS/EVS datasets, individual data have been weighted with the variable Weight – S017 (Question text: Weight by gender and age). At the same time, in computing such aggregate variables, the denominator of each variable (i.e., the total number of respondents) does not include the individuals whose answer to the question considered is missing.
In the WVS/EVS the missing answers are denoted with negative values:
–5 Missing; Unknown; –4 Not asked in survey; –3 Not applicable; –2 No answer; –1 Don't know.

Note 2: There is generally no overlap between the data of the WVS and the EVS. However, we have used the rule of integrating the WVS with the EVS data. This implies that in case the data is contained in *both* datasets the WVS data prevails.

**Religiosity**
Variable name in our dataset: relig
Variable name in the WVS/EVS: F034 Religious person

Our variable *Religiosity* (also named *Religious person*) is the share of the individuals in each country that have replied they are "A religious person" to the following question:
F034 – Independently of whether you go to church or not, would you say you are?
1 A religious person
2 Not a religious person
3 A convinced atheist

The *total number of respondents* is the sum of those that responded 1, 2, or 3. Hence, the variable *Religiosity* is the ratio between the number of those that responded they are "A religious person" and the total number of respondents:
relig = #(1) / #(1, 2, 3)

**Belief in God**
Variable name in our dataset: god
Variable name in the WVS/EVS: F050 Believe in: God

Our variable *Belief in God* is the share of the individuals in each country that believe in God, i.e. that have replied “Yes” to the following question:
F050 – Which, if any, of the following do you believe in? God:
0 No
1 Yes

The *total number of respondents* is the sum of those that responded 0 or 1. Hence, the variable *Belief in God* is the ratio between the number of those that responded “Yes” and the total number of respondents:
god = #(1) / #(0, 1)

**Church attendance**
Variable name in our dataset: atleastweek
Variable name in the WVS/EVS: F028 How often do you attend religious services

Our variable *Church attendance* is the share of the individuals in each country that attend religious services at least once a week, i.e. that have replied they attend religious services “More than once a week” or “Once a week” to the following question:
F028 – Apart from weddings, funerals and christenings, about how often do you attend religious services these days?
1 More than once a week
2 Once a week
3 Once a month
4 Only on special holy days/Christmas/Easter days
5 Other specific holy days
6 Once a year
7 Less often
8 Never practically never

The *total number of respondents* is the sum of those that responded 1, 2, 3, 4, 5, 6, 7, or 8. Hence, the variable *Church attendance* is the ratio between the number of those that responded they attend religious services “More than once a week” or “Once a week” and the total number of respondents:
atleastweek = #(1, 2) / #(1, 2, 3, 4, 5, 6, 7, 8)

**Importance of religion**
Variable name in our dataset: imp_religion
Variable name in the WVS/EVS: A006 Important in life: Religion

Our variable *Importance of religion* is the share of the individuals in each country that have replied that religion is important in their life, i.e. that have replied “Very important” or “Rather important” to the following question:
A006 – For each of the following aspects, indicate how important it is in your life. Would you say it is: Religion
1 Very important
2 Rather important
3 Not very important
4 Not at all important

The *total number of respondents* is the sum of those that responded 1, 2, 3, or 4. Hence, the variable *Importance of religion* is the ratio between the number of those that responded that religion is “Very important” or “Rather important” and the total number of respondents:
imp_religion = #(1, 2) / #(1, 2, 3, 4)

**God very important**
Variable name in our dataset: imp_god10
Variable name in the WVS/EVS: F063 How important is God in your life

Our variable *God very important* is the share of the individuals in each country that have replied that God is very important in their life, i.e. that that have replied "10 Very important" to the following question:
F063 – How important is God in your life? Please use this scale to indicate—10 means very important and 1 means not at all important.
1 Not at all important
2 2
3 3
4 4
5 5
6 6
7 7
8 8
9 9
10 Very important

The *total number of respondents* is the sum of those that responded one of the categories between 1 and 10. Hence, the variable *God very important* is the ratio between the number of those that responded that God is "Very important" and the total number of respondents:
imp_god10 = #(10) / #(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

**Religion Shares of:**
**Protestant**
Variable name in our dataset: prot
**Catholic**
Variable name in our dataset: cath
**Muslim**
Variable name in our dataset: musl
**Orthodox**
Variable name in our dataset: orth

These variables are obtained from the variable in the WVS/EVS named:
F025 Religious denomination – "Do you belong to a religious denomination? In case you do, answer which one."
Categories
0 No religious denomination
1 – 91, 12001, 360001, 528001, 528002, 710001, 710002 – "Various denominations"

Notes:
(a) The EVS contains only the main denominations denoted with the following numbers: 12, 28, 31, 42, 49, 52, 53, 62, 64.
(b) The share of each religion i is the ratio between the number of individuals belonging to the denominations that refer to that religion and the number of individuals that answered the question F025 on religious denomination, i.e. individuals included in categories "Other answer" are not considered (as explained above). Hence:
Share of religion i = #(i) / #(0 – 91, 12001, 360001, 528001, 528002, 710001, 710002)
The details for each of the four religions considered are reported below.

**Religion Share of Protestant**
Variable name in our dataset: prot
It is the share of the individuals in each country that have replied to question F025 by stating that they belong to one of the following categories:

5 Anglican
17 Christian[1]
18 Christian Fellowship
19 Christian Reform
20 Church of Christ / Church of Christ of Latter-day Saints[2]
25 Evangelical
28 Free church / Non denominational church
44 Lutheran
46 Methodists
61 Presbyterian
62 Protestant
78 The Church of Sweden

prot = #(5, 17, 18, 19, 20, 25, 28, 44, 46, 61, 62, 78) / #(0 – 91, 12001, 360001, 528001, 528002, 710001, 710002)

**Religion Share of Catholic**
Variable name in our dataset: cath
It is the share of the individuals in each country that have replied to question F025 by stating that they belong to one of the following categories:
15 Catholic: doesn't follow rules
29 Greek Catholic
64 Roman Catholic

cath = #(15, 29, 64) / #(0 – 91, 12001, 360001, 528001, 528002, 710001, 710002)

**Religion Share of Muslim**
Variable name in our dataset: musl
It is the share of the individuals in each country that have replied to question F025 by stating that they belong to one of the following categories:
2 Al-Hadis
22 Druse[3]
49 Muslim
63 Qadiani
70 Shia
75 Sunni

musl = #(2, 22, 49, 63, 70, 75) / #(0 – 91, 12001, 360001, 528001, 528002, 710001, 710002)

**Religion Share of Orthodox**
Variable name in our dataset: orth
It is the share of the individuals in each country that have replied to question F025 by stating that they belong to one of the following categories:

[1] We included the "Christian" reporting category in the Protestant denomination, because, in the WVS dataset: (i) about half of these respondents are in Nigeria, where Christians are mostly Protestant; (ii) Nigeria is also the only country containing a non-negligible share answering "Christian" to question F025. Excluding this category (0.76% of the sample) from the Protestant denomination would not change the "Predominant Religion" dummies for any country, so all results in Tables 2, F.1, F.2 and F.3 would remain unchanged. It would also only generate minuscule changes in the shares of religions, resulting in quantitatively irrelevant variations in the results of Table F.4. These same two points apply to the treatments, discussed later on, of the Church of Latter-Day Saints and of the Druse.
[2] The Church of Jesus Christ of Latter-Day Saints, also known as the LDS Church, Mormon Church, or simply "Mormons", is often considered part the Protestant religion, although it is not from a legal perspective. The WVS dataset reports very few adherents (0.01%) and their exclusion from the Protestant denomination does not affect any of the estimated coefficients, as discussed in Footnote 1.
[3] Druse do not self-identify as Muslims, but we include them in the Muslim category because this faith originally developed out of Ismailism, which is a branch of Shia Islam. The WVS dataset reports very few adherents (0.01%), and their exclusion from the Muslim denomination does not affects the estimated coefficients (see Footnote 1).

6 Armenian Apostolic Church
30 Gregorian
52 Orthodox

orth = #(6, 30, 52) / #(0 - 91, 12001, 360001, 528001, 528002, 710001, 710002)

**Predominant religion:**
Predominant religion in each country is a dummy variable denoting which religious group represents the absolute majority. Specifically, the dummy variable is equal to 1 if the fraction of members of religious group i is greater than 0.5 and it is 0 otherwise.
The details for each of the four religions considered are reported below.

**Protestant (predominant)**
Variable name in our dataset: pred_prot
pred_prot = 1 if prot > 0.5
pred_prot = 0 if prot <= 0.5
pred_prot = missing if prot is missing

**Catholic (predominant)**
Variable name in our dataset: pred_cath
pred_cath = 1 if cath > 0.5
pred_cath = 0 if cath <= 0.5
pred_cath = missing if cath is missing

**Muslim (predominant)**
Variable name in our dataset: pred_musl
pred_musl = 1 if musl > 0.5
pred_musl = 0 if musl <= 0.5
pred_musl = missing if musl is missing

**Orthodox (predominant)**
Variable name in our dataset: pred_orth
pred_orth = 1 if orth > 0.5
pred_orth = 0 if orth <= 0.5
pred_orth = missing if orth is missing

**Religious freedom**
Variable name in our dataset: Relfree

The Religion Freedom scale is a measure of religious freedom of the country developed by
Norris, Pippa and Ronald Inglehart (2011). *Sacred and Secular: Religion and Politics Worldwide*. Cambridge Studies in Social Theory, Religion and Politics. Cambridge, UK: Cambridge University Press.

The index is based on twenty criteria. Countries were coded from information contained in the U.S. State Department report on International Religious Freedom, 2002. Each criterion was coded 0/1 and the total scale was standardized to 100 points, ranging from low to high religious freedom. See for more details the technical note “Freedom of Religion State” at pp. 293–294 of Norris and Inglehart (2011).

The Religion Freedom index is the same for all of the six years of our sample and taken from the following dataset.

Norris, Pippa (2009). “Democracy Cross-national Data. Release 3.0 Spring 2009.” (accessed March 8, 2013).
Datafile: "Democracy Crossnational Data Spring 2009 StataSE.dta"
Folder: "/Data/Source/ICC"

Data publicly available at the author's webpage:
http://www.pippanorris.com/

**Population**
Variable name in our dataset: pop
Total population of the country correspondent to the year considered.
Source: World Development Indicators. Washington, D.C., The World Bank. (accessed January 27, 2020).
The data are in the public domain and available at:
http://data.worldbank.org/data-catalog/world-development-indicators
Datafile: "WDIData.csv"
Folder: "/Data/Source/ICC"
Variable: Population, total. Series code: SP.POP.TOTL

**Population (log)**
Variable name in our dataset: lpop
lpop = ln(pop)

**Gross Domestic Product per capita**
Variable name in our dataset: gdp
GDP per capita in constant 2010 U.S. dollars of the country correspondent to the year considered.
Source: World Development Indicators. Washington, D.C., The World Bank. (accessed January 27, 2020).
The data are in the public domain and available at:
http://data.worldbank.org/data-catalog/world-development-indicators
Datafile: "WDIData.csv"
Folder: "/Data/Source/ICC"
Variable: GDP per capita (constant 2010 US$). Series code: NY.GDP.PCAP.KD

**Gross Domestic Product per capita (log)**
Variable name in our dataset: lgdp
lgdp = ln(gdp)

**Foreign direct investment**
Variable name in our dataset: fdi
Foreign direct investment, net inflows (% of GDP) of the country correspondent to the year considered.
Source: World Development Indicators. Washington, D.C., The World Bank. (accessed January 27, 2020).
The data are in the public domain and available at:
http://data.worldbank.org/data-catalog/world-development-indicators
Datafile: "WDIData.csv"
Folder: "/Data/Source/ICC"
Variable: Foreign direct investment, net inflows (% of GDP). Series code: BX.KLT.DINV.WD.GD.ZS

**Patents by residents and nonresidents**
Patents are taken from the World Intellectual Policy Organization (WIPO) statistics database. "Intellectual property right: Patent". Last updated: October 2019. (accessed January 27, 2020).
Datafile: "patent_1980_2018.csv"
Folder: "/Data/Source/ICC"
The data are in the public domain and available at:
https://www3.wipo.int/ipstats/index.htm?tab=patent
Indicator 1: Total patent applications (direct and PCT national phase entries)
The data include all people who apply for a patent in a country, resident and non-residents (see below), for the year considered.

Specifically, our dataset contains the following three variables.

Total number of patents submitted by residents' applicants.
Variable name in our dataset: pat_wipores

Total number of patents submitted by non-residents' applicants.
Variable name in our dataset: pat_wipononres

The total number of patents submitted by all, residents and non-residents, applicants.
Variable name in our dataset: pat_wipo_tot
pat_wipo_tot = pat_wipores + pat_wipononres

**Patents per capita by residents**
Variable name in our dataset: innov_res
Patents per capita by residents is the ratio between the total number of patents filed by residents' applicants and total population, i.e.
innov_res = pat_wipores / pop

**Innovation by residents (log)**
Variable name in our dataset: linnov_res
This is the variable used as a main proxy of innovation and it is the logarithm of the patents per capita by residents, i.e.:
linnov_res = log(innov_res)

**Total patents per capita**
Variable name in our dataset: innov_tot
Total patents per capita is the ratio between total number of patents filed by all, residents and nonresidents, applicants and total population, i.e.
innov_tot = pat_wipo_tot / pop

**Total patents per capita (log)**
Variable name in our dataset: linnov_tot
This variable is the logarithm of total patents per capita used for the robustness check presented in the Online Appendix F, i.e.:
linnov_tot = log(innov_tot)

**Protection intellectual property**
Variable name in our dataset: ipr
This variable is an index of patent protection between 0 and 5 that has been initially proposed by:
Ginarte, J.C., Park, W.G. (1997). "Determinants of patent rights: a crossnational study." Research Policy, 26, 283-301.
The index has been updated to 2005 and extended by:
Park, Walter G. (2008) "International patent protection: 1960-2005." Research Policy, 37(4), 761-766. https://doi.org/10.1016/j.respol.2008.01.006. (accessed January 28, 2020).
We have used the latest version of the index that has been recently revised by Park and extended up to the year 2015. The data can be freely downloaded from the Walter Park's webpage:
http://fs2.american.edu/wgp/www/?_ga=2.150063158.1045324815.1586191710-954683830.1586191710
Datafile: "Patent index1960 - 2015.xlsx"
Folder: "/Data/Source/ICC"

**Tertiary education (years)**

Variable name in our dataset: yr_sch_ter
Average years of tertiary schooling attained in the population age 25 and over.
The data come from:
Barro, Robert and Jong-Wha Lee (2013) "A New Data Set of Educational Attainment in the World, 1950-2010." Journal of Development Economics, 104, 184–198. (accessed December 28, 2015).
The data are in the public domain and available at:
http://www.barrolee.com/
Datafile: "BL2013_MF1599_v2.0.dta"
Folder: "/Data/Source/ICC"

**Communist**
Variable name in our dataset: communist
Dummy variable equal to 1 if the country is a communist state or was a communist state, and 0 otherwise.
Information gathered from Wikipedia – History of communist states:
Wikipedia (2020) "Communist state", April 1, 2020. https://en.wikipedia.org/wiki/Communist_state. (accessed April 7, 2020).
Datafile: "14_communism_labels.do"
Folder: "/Programs"
Data for the variable "communist" is imported in the final dataset using the do program file "14_communism_labels.do" contained in the folder "/Programs".

We report below the list of countries from Wikipedia. The countries that are not in our dataset are reported in brackets.
Current communist states: China, (Cuba), (Korea – DPRK), (Laos), Vietnam.
Current non-communist states with communist majority: (Nepal).
Previous communist states: (Afghanistan), (Albania), (Angola), (Benin), Bulgaria, (Congo), Czechoslovakia (see below), Ethiopia, (Germany, GDR), (Grenada), Hungary, (Kampuchea), (Mongolia), (Mozambique), Poland, Romania, (Somalia), Soviet Union (see below), (Tuva), Yemen – PDRY, Yugoslavia (see below).
Countries in our sample from:
Ex-Czechoslovakia: Czezh Republic, Slovakia.
Ex-Yugoslavia: Bosnia Herzegovina, Croatia, Macedonia, Montenegro, Serbia, Slovenia.
Ex-Soviet Union: (Abkhazia), Armenia, (Artsakh), Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, (South Ossetia), (Tajikistan), (Transnistria), (Turkmenistan), Ukraine, Uzbekistan.

List of former and current communist countries in our dataset (other country names in parenthesis) in alphabetical order:

| Country name: | Code2: |
|---|---|
| Armenia | ARM |
| Azerbaijan | AZE |
| Belarus | BLR |
| Bosnia Herzegovina | BIH |
| Bulgaria | BGR |
| China | CHN |
| Croatia | HRV |
| Czech Republic | CZE |
| Estonia | EST |
| Ethiopia | ETH |
| Georgia | GEO |
| Hungary | HUN |
| Kazakhstan | KAZ |
| Kyrgyzstan | KGZ |
| Latvia | LVA |
| Lithuania | LTU |
| Macedonia | MKD |
| Moldova | MDA |
| Montenegro | MNE |
| Poland | POL |

| | |
|---|---|
| Romania | ROU |
| Russia (Russian Federation) | RUS |
| Serbia | SRB |
| Slovakia (Slovak Republic) | SVK |
| Slovenia | SVN |
| Ukraine | UKR |
| Uzbekistan | UZB |
| Vietnam | VNM |
| Yemen | YEM |

## G.2. Data Appendix: *Religiosity and Innovation in the US – Cross-State Estimates*

The variables in this appendix are listed in the following order.
- State
- Code
- Religiosity variables (Importance of religion, Belief in God, Church attendance): Pew Forum on Religion & Public Life, 2007 U.S Religion Landscape Survey.
- Per capita real GDP: U.S. Bureau of Economic Analysis.
- Population: U.S. Census Bureau.
- Tertiary education: U.S. Census Bureau.
- Gross domestic product: U.S. Bureau of Economic Analysis.
- Foreign direct investment: U.S. Bureau of Economic Analysis.
- Patents per capita: U.S. Patent and Trademark Office.

***State***
Variable name in our dataset: state1
Name of the State.

***Code***
Variable name in our dataset: code
Two letters abbreviation denoting the code of the State.

***Preliminary notes on the three religiosity variables obtained from Pew Forum on Religion and Public Life***

The three measures of religiosity (*Importance of religion*, *Belief in God*, *Church attendance*) all refer to the year 2007 and come from:
Pew Forum on Religion and Public Life (2007). "U.S. Religion Landscape Survey". (accessed November 3, 2013).
Datafiles: "Religious Landscape Survey Data - Continental US.dta"
"Religious Landscape Survey Data - Alaska and Hawaii.dta"
Folder: "/Data/Source/USA"
Data can be freely downloaded from the Pew Research Center website at:
https://www.pewforum.org/dataset/u-s-religious-landscape-survey/

Note 1: The two original datasets are in SPSS format (.sav, with the same name reported above) and have been converted in Stata format (.dta) before use.

Note 2: In computing the aggregate variables *Importance of religion*, *Belief in God*, and *Church attendance* respondents have been weighted using the variable "Weight", that is the sample weight for all landline respondents, as this is "Recommended for use in all analyses" by PEW. Moreover, the denominator (i.e. the total number of respondents) does not include those individuals whose answer is: 9 Don't know/refused

***Importance of religion***
Variable name in our dataset: very_imp
Share of individuals (in a 0-1 scale) that have responded "Very important" to question Q.21 – How important is religion in your life – very important, somewhat important, not too important, or not at all important?
1 Very important
2 Somewhat important
3 Not too important
4 Not at all important
9 Don't know/refused

The *total number of respondents* is the sum of those individuals that responded 1, 2, 3, or 4. Hence, the variable *Importance of religion* is the ratio between the number of those that have responded that religion is "1 Very important" and the total number of respondents as follows:
very_imp = #(1) / #(1, 2, 3, 4)

***Belief in God***
Variable name in our dataset: belief_god
Share of individuals (in a 0-1 scale) that believe in God or a universal spirit, i.e. that have responded "Yes" to question Q.30 – Do you believe in God or a universal spirit?
1 Yes
2 No
3 Other
9 Don't know/refused

The *total number of respondents* is the sum of those individuals that responded 1, 2, or 3. Hence, the variable *Belief in God* is the ratio between the number of those that have responded that "1 Yes" and the total number of respondents as follows:
belief_god = #(1) / #(1, 2, 3)

***Church attendance***
Variable name in our dataset: atleastweek
Share of individuals (in a 0-1 scale) that declare to attend church at least once a week, i.e. the share of individuals that have responded "1 More than once a week" or "2 Once a week" to question Q.20 – Aside from weddings and funerals, how often do you attend religious services... more than once a week, once a week, once or twice a month, a few times a year, seldom, or never?
1 More than once a week
2 Once a week
3 Once or twice a month
4 A few times a year
5 Seldom
6 Never
9 Don't know/Refused

The *total number of respondents* is the sum of those individuals that responded 1, 2, 3, 4, 5, or 6. Hence, the variable *Church attendance* is the ratio between the number of those that responded to attend religious services "1 More than once a week" or "2 Once a week" and the total number of respondents as follows:
atleastweek = #(1, 2) / #(1, 2, 3, 4, 5, 6)

***GSP per capita***
Variable name in our dataset: gsp_c_2007
Per capita real GDP by State (Chained 2012 dollars) in 2007.
Source: U.S. Bureau of Economic Analysis, "Gross Domestic Product by State". Last updated: November 7, 2019. https://www.bea.gov/data/gdp/gdp-state. (accessed February 13, 2020).
The data are in the public domain and available at:
https://www.bea.gov/data/gdp/gdp-state
Datafile: "Per capita real GDP by state 2006 2007.xls"
Folder: "/Data/Source/USA"
Variable: (SAGDP10N) Per capita real GDP by State (Chained 2012 dollars) in 2007.

***GSP per capita (log)***
Variable name in our dataset: l_gsp_cap
Logarithm of the (SAGDP10N) Per capita real GDP by State (Chained 2012 dollars) in 2007.

l_gsp_cap = log(gsp_c_2007)

***Population***
Variable name in our dataset: pop2007
Population of the State in 2007.
Source: U.S. Census Bureau, "Table 1. Intercensal Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2010 (ST-EST00INT-01)". Last Revised: November 30, 2016. https://www.census.gov/data/tables/time-series/demo/popest/intercensal-2000-2010-state.html. (accessed February 13, 2020).
The data are in the public domain and available at:
https://www.census.gov/data/tables/time-series/demo/popest/intercensal-2000-2010-state.html
Datafile: "st-est00int-01.xls"
Folder: "/Data/Source/USA"
Variable: Intercensal Estimate of the Resident Population of the State in 2007.

***Population (log)***
Log of the population of the State in 2007.
Variable name in our dataset: l_pop
l_pop = log(pop2007)

***Tertiary education***
Variable name in our dataset: at_least_ba
Share (in percentage term) of the State population with bachelor's degree or more.
Source: U.S. Census Bureau (2009), "Educational Attainment in the United States: 2007". Issued January 2009, P20-560. (accessed February 12, 2020).
Datafiles: "p20-560.pdf"
"ba_US.xls"
Folder: "/Data/Source/USA"
The publication is in the public domain and available at:
https://www.census.gov/library/publications/2009/demo/p20-560.html
The data of the share (in percentage term) of the State population with bachelor's degree or more used for the analysis are contained in "Table 2. Educational Attainment for the Population Aged 25 and Over by Region, State, and Nativity Status: 2007" at page 8 of the file "p20-560.pdf". These data have been reported by the authors in the Excel file "ba_US.xls" that is saved in the folder "/Data/Source/USA".

***Gross domestic product (GDP) by State in 2006***
Variable name in our dataset: gsp2006
Gross domestic product (GDP) by State in 2006.
Source: U.S. Bureau of Economic Analysis, "Gross Domestic Product by State". Last updated: November 7, 2019. https://www.bea.gov/data/gdp/gdp-state. (accessed February 13, 2020).
The data are in the public domain and available at:
https://www.bea.gov/data/gdp/gdp-state
Datafile: "Gross domestic product (GDP) 2006 2007.xls"
Folder: "/Data/Source/USA"
Variable: Gross domestic product (GDP) by State (SAGDP2N) in 2006 (All industry total). In millions of current dollars.
Note: the variable Gross domestic product by State in 2006 is used to compute the Foreign direct investment as a share of GSP (see next).

***Foreign direct investment***
Variable name in our dataset: fdi_st
Foreign Direct Investment as a share of GSP, i.e. it is the ratio between Foreign Direct Investment by State in the United States (FDIUS) in 2006 (variable name in

the dataset = FDI) and the Gross domestic product (GDP) by State (SAGDP2N) in 2006 (variable name in the dataset = gsp2006).
fdi_st = FDI / gsp2006

FDI = Foreign Direct Investment in the United States (FDIUS) in 2006. Table III.D11. Gross Property, Plant, and Equipment of Affiliates, State by Use. In millions of dollars.
Source: U.S. Bureau of Economic Analysis, "Foreign Direct Investment in the United States (FDIUS): 2006 Data Tables". https://www.bea.gov/international/foreign-direct-investment-united-states-fdius-2006-data-tables. (accessed February 13, 2020).
The data are in the public domain and available at:
https://www.bea.gov/international/foreign-direct-investment-united-states-fdius-2006-data-tables
Datafile: "Tab III.D11.xls"
Folder: "/Data/Source/USA"

Note: we have used the Foreign Direct Investment for the year 2006 because the corresponding data for 2007 is missing for some States.

***Patents***
Variable name in our dataset: patents
Total number of patents submitted by residents of the State in 2007.
Source: U.S. Patent and Trademark Office, Electronic Information Products Division, Patent Technology Monitoring Team (PTMT) (2007). "Calendar Year 2007 Patent Counts by Patent Type and by State and Country of Origin (01-Jan-2007 to 31-Dec-2007)". http://www.uspto.gov/web/offices/ac/ido/oeip/taf/st_co_07.htm. (accessed November 4, 2013).
Datafile: "patents_US.csv"
Folder: "/Data/Source/USA"
The data of the total number of patents submitted by residents of the State in 2007 are contained in the report available in the webpage with the URL reported above. The data have been reported by the authors in the csv format file "patents_US.csv" that is saved in the folder "/Data/Source/USA".

***Patents per capita (log)***
Variable name in our dataset: l_innov
Logarithm of the ratio between the total number of patents submitted by residents of the State and the population of the State in 2007.
l_innov = log(patents / pop2007)

**Summary of the Datasets used in the international cross-state analysis**

Barro, Robert and Jong-Wha Lee (2013) "A New Data Set of Educational Attainment in the World, 1950-2010." Journal of Development Economics, 104, 184–198.

EVS (2020). European Values Study Longitudinal Data File 1981-2008 (EVS 1981-2008). GESIS Data Archive, Cologne. ZA4804 Data file Version 3.1.0, https://doi.org/10.4232/1.13486. (accessed July 16, 2021).

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