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Religion, Income Inequality, and the Size of the Government[*]

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Abstract

Recent empirical research has demonstrated that countries with higher levels of religiosity are characterized by greater income inequality. We argue that this is due to the lower level of government services demanded in more religious countries. Religion requires that individuals make financial sacrifices and this leads the religious to prefer making their contributions voluntarily rather than through mandatory means. To the extent that citizen preferences are reflected in policy outcomes, religiosity results in lower taxes, which in turn implies lower levels of spending on both public goods and redistribution. Since measures of income typically do not fully take into account the part of income coming from donations received, this increases measured income inequality. We formalize these ideas in a general equilibrium political economy model and also show that the implications of our model are supported by cross-country data.

Keywords: religion, voluntary donations, taxation, redistribution, income inequality

JEL Classification Numbers: D63, H20, Z12.

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1 Introduction

The economic effects of religion have now been analyzed by researchers for a quite long period of time. Arguably, Weber (1905) was among the first to argue that religion plays a significant role in economic development. The development of the literature on economics of religion using modern economic techniques, however, is fairly recent.[1] Following the seminal work of Azzi and Ehrenberg (1975), economists have explored the potential interactions between religion and a variety of socio-economic variables. For example, Lehrer and Chiswick (1993) investigated religion's effects on marriages, Lehrer (1995), Lehrer (1996), and Lehrer (1999) on labor supply, fertility, and educational attainment, respectively. Barro and McLeary (2002, 2006), on the other hand, analyzed what role religion plays in the evolution of various economic variables, and Barro and McLeary (2003a, 2003b) and Jaffe (2005) of economic development, and Huber (2005) of social policy attitudes.

More recently, research on the relationship between religion and its socio-economic correlates has demonstrated that countries with higher levels of religiosity are characterized by higher levels of income inequality (Palani 2008, Rees 2009). This interesting empirical finding leaves open the question of which leads to which, however, as interactions between religiosity and income inequality potentially involve two directions of causation. One one side, a more unequal society may cause agents to feel less secure, both materially and spiritually, and this may lead them to turn to religion as a source of comfort (Rees 2009). According to this view, more unequal nations would be more religious as a consequence. On the other side, religiosity may help individuals better cope with adverse life events, reducing their incentive to fight serious shortcomings such as income inequality, thereby allowing it to persist (Palani 2008).[2] This line of reasoning would lead us to expect more severe income inequalities in nations with higher levels of religiosity.

In this paper, we offer an alternative theoretical mechanism through which religiosity

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[1]See Iannacone (1998) for a review of the early literature.

[2]Although this mechanism about causality is plausible, Palani provides no theoretical or empirical support for it in her paper.

might lead to greater income inequality. Unlike the abovementioned studies that focus on the role of religion in providing personal security and a coping mechanism with socio-economic hardships, our argument emphasizes religion's role in establishing clear behavioral rules that are to be followed by its adherents. Many of these rules point out the necessity and appropriateness of certain types of actions that require costly sacrifices. Among these costly actions, a very important one is making financial sacrifices, that is, giving up some of what you have for the sake of your belief. These resources might then be used in the provision of collective goods such as financial assistance to the poor and needy (redistribution) and/or in the financing of various types of public goods (and services). Religious teaching often involves an inherent promise of reward for this type of behavior.[3] Recent empirical work by Brooks (2003, 2005) and Thornton and Helms (2010) have shown that religion does indeed motivate individuals to make voluntary donations, suggesting that religious individuals might derive greater enjoyment from giving as compared to secular individuals.

The role of religion in influencing people's giving attitudes has an important politico-economic implication: Keeping all else equal, religious individuals would prefer to make their financial contributions to collective goods privately and voluntarily rather than through mandatory means. As such, when compared with secular individuals, religious individuals on average are likely to prefer lower levels of spending by the state (be it on public goods or redistribution), as this increases their disposable income out of which voluntary donations are to be made. If policy outcomes reflect variation in citizen preferences, then we can also expect countries with higher levels of religiosity to have lower levels of government taxation and spending. Put differently, we can expect the size of the government to be smaller in countries with higher levels of religiosity.[4]

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[3]For more on this, see McCleary (2007), who explores the differences across major world religions in beliefs related to an afterlife, and how these variations in beliefs translate into differences in incentives for economic activity, charitable giving, and so on.

[4]A similar argument appears also in Gill and Lundsgaarde (2004), Clark and Lelkes (2004), and Scheve and Stasavage (2006), who argue that religion and state *welfare* spending are substitute mechanisms for providing social insurance. They do not, however, claim a negative relationship between religiosity and the overall size of the government (understood as including spending on public goods and services in addition to spending on welfare), as we do in this paper.

We next argue that this negative relationship between religiosity and government size is key to understanding the positive relationship between religiosity and income inequality. Religiosity affects the distribution of income potentially in two opposing ways. On the one hand, since governments of countries with higher levels of religiosity are likely to be smaller, they will have fewer resources to devote to redistributive purposes, and this tends to harm the distribution of income (*equality-reducing effect*). On the other hand, religiosity could also work to improve the distribution of income in a country since it increases people's willingness to make voluntary donations to the poor (*equality-increasing effect*). While this latter effect of religion is sound in principle, it is unlikely to be reflected in measures of income inequality, at least not fully. This is because measures of income (on which measures of income inequality are based) typically do not fully take into account the part of income coming from donations received. As a result, the equality-reducing effect of religion dominates its equality-increasing effect, thereby increasing measured income inequality.

We formalize these ideas within the context of a simple general equilibrium political-economy model along the lines of Meltzer and Richard (1981). The government collects taxes and uses the proceeds to finance a public good and redistribution from the rich to the poor. Agents are heterogenous only in their exogenously given initial incomes. Following Azzi and Ehrenberg (1975) and Andreoni (1989) among others, we model religiosity as the intensity of the satisfaction derived from making voluntary donations (a form of warm-glow). As such, religiosity motivates agents to contribute voluntarily to the provision of potentially both public goods and redistribution. We then show that, for a given tax rate, a higher level of religiosity results in larger voluntary contributions in equilibrium, thereby improving the actual -but not necessarily the measured- distribution of income (the equality-increasing effect).

We next embed this model in a previous stage where agents collectively decide on the tax rate in the economy. Differences in initial incomes translate into different preferences over the tax rate. We consider a median voter rule whereby the equilibrium tax rate is the

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one chosen by the agent with median income. The first result of the paper is that, under mild assumptions, a higher level of religiosity results in a lower equilibrium tax rate. The intuition behind this result is simple. Once an optimal amount of the public good has been secured, religiosity means that agents prefer to carry out redistribution voluntarily rather than through mandatory means, as agents derive direct satisfaction from making voluntary donations but not from government-imposed contributions in the form of taxes. Our second result follows immediately from the first one: Since a higher level of religiosity results in a lower equilibrium tax rate, it also leads to lower levels of the public good and public redistribution in equilibrium; that is, a smaller government. The fall in public redistribution, in turn, increases income inequality in the economy (the equality-reducing effect).

We also use our model to explore the implications of religiosity for consumption inequality, only to find that the relationship between the two variables is ambiguous. Therefore, it is theoretically possible for a country with a relatively high income inequality to be characterized by a relatively low consumption inequality.

We test the predictions of our model empirically using cross-country data. Our data on religiosity are drawn from the World Values survey conducted in 2000 which contains various questions that can be used as the basis for an index of religiosity. In this paper, we use the "belief in afterlife" index due to its proximity to our theoretical modeling of religion, but we also check the sensitivity of our results to alternative measures of religiosity. Consistent with Palani (2008) and Rees (2009), we find that there is a significant positive correlation between religiosity and income inequality across a wide spectrum of countries including both advanced and less advanced countries. We next show that there is a negative correlation between religiosity and state welfare spending, thus confirming the findings of Gill and Lundsgaarde (2004) and Scheve and Stasavage (2006). However, we go beyond these studies and show that a negative correlation is also present between religiosity and total government spending as well as between religiosity and government spending excluding spending on welfare. This finding suggests that the religious might have an inherent preference for a smaller state and

that a smaller welfare spending observed in more religious countries documented by these studies is just a manifestation of this more general outlook. All of these empirical findings are consistent with the predictions coming from our theoretical model.

The paper proceeds as follows. Section 2 lays out the theoretical model and presents the main results. Section 3 tests model predictions empirically using cross-country data. Section 4 provides concluding remarks. All proofs are in the Appendix.

2 Model

2.1 The Basic Framework

We consider an endowment economy populated by a large number of agents/individuals each of whom has an exogenously given before-tax before-transfer income of $w \in [0, \infty)$. Individuals are distributed along the continuum according to a continuous and atomless cumulative distribution function $F(w)$, where $F(0) = 0$ and $F(\infty) = 1$.

Individuals derive utility from consumption c, voluntary donations z, and government-provided public goods G according to $U(c, z) = \log(c) + \gamma \log(z) + \log(G)$. While c and z are individual choice variables, G is determined as the outcome of a political process and is taken as given by individuals when making consumption and donation decisions. The term $\gamma (\geq 0)$ in the agent's utility function denotes the relative importance attached to charitable donations and is assumed to be motivated by a belief in the afterlife; i.e. religiosity. We assume that the stronger this belief, the higher the value attached to charitable donations, that is, the higher is the parameter γ. The donations are collected in a pool and then distributed equally among the agents in the economy (equal treatment). Each agent receives a constant amount equal to b.[5]

Tax revenues finance the public good G and lump-sum redistribution of v units of consumption per capita. The tax rate, τ, is a constant fraction of income. Out of all tax revenue collected, a fraction $\alpha \in (0, 1)$ goes to redistribution and the rest to the provision of

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[5]Therefore, we assume that donations are used only for direct redistributive purposes. People donate also to public goods and services. Extending the model in this direction is reasonable and would likely strengthen the main results of our paper, but it would add little additional insight to our analysis.

the public good.

Taking as given the tax rate, τ, the level of redistribution, v, and the amount of donations, b, an individual with income w chooses the level of consumption, $c(w) \geq 0$, and the level of voluntary donations, $z(w) \geq 0$, to solve:

$$\max \log(c(w)) + \gamma \log(z(w)) + \log(G)$$

s.t.

$$c(w) + z(w) \leq (1 - \tau)w + v + b \qquad (1)$$

The right hand-side of (1) is the agent's income after taxes and transfers, including the donations received. For brevity, we call this *after-tax income* in the sequel.

Cobb-Douglas preferences imply that the optimal choices of consumption and voluntary donation are constant fractions of after-tax income:

$$c(w) = \frac{1}{1 + \gamma}((1 - \tau)w + v + b). \qquad (2)$$

$$z(w) = \frac{\gamma}{1 + \gamma}((1 - \tau)w + v + b). \qquad (3)$$

A tax-transfer policy (τ, v) must satisfy the government's budget constraints

$$v = \alpha \tau \bar{w}, \qquad (4)$$

and,

$$G = (1 - \alpha)\tau \bar{w}, \qquad (5)$$

where $\bar{w} \equiv \int_0^\infty w dF(w)$ is average income.

In addition, economywide donations made must equal donations received:

$$b = \int_0^\infty z(w) dF(w). \qquad (6)$$

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Given the tax rate τ, the system of equations (2)-(6) characterizes the equilibrium of the economy.

The tax policy actually chosen depends on the collective choice mechanism by which preferences are aggregated. If all agents have identical preferences over the tax rate, the collective choice problem is trivial: The equilibrium tax rate is the one preferred by all the agents. However, heterogeneity of incomes implies that different individuals prefer different tax rates. To see this, we first eliminate b from the system by expressing it in terms of τ: Inserting (4) in (3) and then inserting (3) in (6), we can write

$$b = \int_0^\infty \frac{\gamma}{1+\gamma}[w(1-\tau) + \alpha\tau\bar{w} + b]dF(w), \tag{7}$$

which can be solved to yield:

$$b = \gamma\bar{w} - (1-\alpha)\gamma\bar{w}\tau. \tag{8}$$

Observe that, for a given tax rate τ, a higher level of religiosity, γ, implies a higher level of voluntary donations, b, in equilibrium.

Next, using (4) and (8), we can write the agent's after-tax income as

$$y(w; \tau) = w + \gamma\bar{w} + ((\alpha - \gamma + \alpha\gamma)\bar{w} - w)\tau. \tag{9}$$

Using equations (2), (3), and (9), the utility maximization problem determining the preferred tax rate of an agent with income w can be expressed as:

$$\max_{\tau \in [0,1]} \log\left(\frac{1}{1+\gamma}y(w;\tau)\right) + \gamma\log\left(\frac{\gamma}{1+\gamma}y(w;\tau)\right) + \log((1-\alpha)\tau\bar{w}),$$

or, equivalently,

$$\max_{\tau \in [0,1]} (1+\gamma)\log(y(w;\tau)) + \log(\tau).$$

In the Appendix, we show that the second order condition for strict concavity of the maximand is satisfied, guaranteeing a unique maximum. Ignoring for now the constraint on τ and exploiting (9), the first order condition can be written as

$$(1+\gamma)\frac{(\alpha-\gamma+\alpha\gamma)\bar{w}-w}{w+\gamma\bar{w}+((\alpha-\gamma+\alpha\gamma)\bar{w}-w)\tau}+\frac{1}{\tau}=0,$$

which after rearrangement yields

$$\tau(w)=\frac{1}{2+\gamma}\frac{w+\gamma\bar{w}}{w-(\alpha-\gamma+\alpha\gamma)\bar{w}}. \tag{10}$$

In order to ensure that $0 \leq \tau(w) \leq 1$ for all $w \geq 0$, we impose the following restriction on parameter values:[6]

Assumption: $\gamma \geq \frac{2\alpha}{1-\alpha}$.

In the Appendix, we show that $\frac{d\tau(w)}{dw} < 0$, that is, an individual's desired tax rate is a decreasing function of his position in the initial income distribution. Note, however, that even the richest individual does not prefer a zero tax rate: Taking the limit of (10) as w goes to infinity and applying the L'Hopital's rule, we get $\tau_{min} = \frac{1}{2+\gamma}$, which is a number greater than zero but less than $1/2$. The intuition behind this result is a simple one: When the tax rate is zero, the public good cannot be provided, which reduces the agent's utility to negative infinity.

Figure 1 below plots the preferred tax rate as a function of the before-tax/transfer income under the above-mentioned assumption.
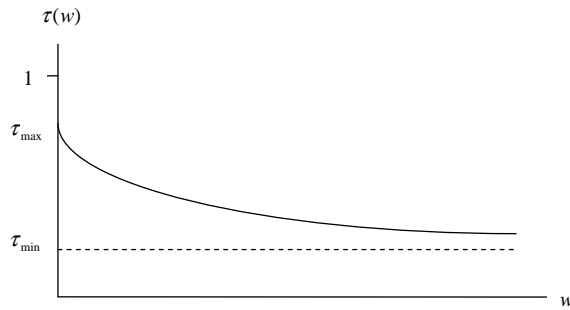
Figure 1: Preferred tax rates

In order to determine the political-economic equilibrium of the economy, we must spec-

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[6]Indeed, the assumption guarantees not only that $0 \leq \tau(w) \leq 1$, but also $0 < \tau(w) < 1$, thereby ensuring an interior solution to the utility maximization problem. See the Appendix for a justification of this claim. This assumption is a sufficient condition that simplifies the theoretical analysis by cutting down on the number of cases to be analyzed, but do not otherwise affect the main conclusions of the paper.

ify the collective choice mechanism. In this paper, we follow Meltzer and Richard (1981) and consider a median voter rule, whereby the individual with median income chooses the economy-wide tax rate. The median voter theorem is applicable in our setup since preferred tax rates are decreasing with before-tax/transfer incomes (i.e. $\frac{d\tau(w)}{dw} < 0$) and the ordering of before-tax/transfer incomes is independent of the tax-transfer policy. Setting $w = w_m$ in equation (10), where w_m denotes the median voter's income, we obtain the equilibrium tax rate $\tau^* = \tau(w_m)$. Therefore, the system of equations (2)-(6) together with (10) evaluated at $w = w_m$ fully characterizes the political-economic equilibrium.

2.2 The Effect of Religiosity on the Equilibrium Tax Rate and Government Size

We are now ready to consider the implications of religiosity for the equilibrium tax rate and the size of the government. The following proposition summarizes the first main result of the paper.

Proposition 1a $\frac{d\tau^*}{d\gamma} < 0$. *That is, an increase in the strength of belief in afterlife, γ, reduces the equilibrium tax rate, τ^*, in the economy.*

The source of this decline is the increased weight attached to voluntary donations. The median voter may or may not be a net beneficiary of government induced transfers, but still votes for a positive tax rate since a portion of tax revenue is used in the provision of the public good. Yet, the median voter has a desire to make voluntary donations, since there is a direct satisfaction induced by donations he makes. Thus, the higher the income left over after taxes and consumption, the more the agent has at his disposal to spend on charity, and therefore the higher is his utility. As γ gets larger, so does the importance of voluntary donations, reducing the tax rate preferred by the median voter.

Notice that Proposition 1a holds regardless of the position of the median voter in the income distribution. That is, both relatively poor and relatively rich individuals prefer a lower tax rate when the strength of belief in the afterlife, γ, is higher. When the median voter is a relatively rich individual, the result of Proposition 1a reflects the preference that, once a "satisfactory" amount of the public good is provided, he would prefer to carry out

redistribution not through mandatory governmental means but voluntarily, as voluntary redistribution provides direct satisfaction. A relatively poor median voter also prefers this because it relaxes the budgets of the relatively well-off individuals, allowing them to make larger donations, which in turn increases both his consumption and voluntary donations.

Our next result is about the size of the government and follows immediately from Proposition 1a.

Proposition 1b $\frac{d(\tau^*\bar{w})}{d\gamma} < 0$. *That is, an increase in the strength of belief in afterlife, γ, reduces the equilibrium size of the government, $\tau^*\bar{w}$, in the economy.*

The proof is straightforward and uses Proposition 1a in conjunction with the fact that average income, $\bar{w}$, is independent of the belief in afterlife, γ. Note that $\tau^*\bar{w} = G^* + v^*$ by equations (4) and (5). Therefore, Proposition 1b says that the sum of the spending on the public good, G^*, and that on governmental redistribution, v^*, goes down with the strength of belief in afterlife, γ.

Our final result here concerns the individual components of spending by the government.

Proposition 1c $\frac{dG^*}{d\gamma} < 0$ and $\frac{dv^*}{d\gamma} < 0$. *That is, an increase in the strength of belief in afterlife, γ, reduces both the equilibrium size of the public good, G^*, and the equilibrium size of governmental redistribution, v^*, in the economy.*

The proof of the result uses Proposition 1a and applies the chain rule of calculus to equations (4) and (5) in equilibrium.

2.3   The Effect of Religiosity on Income Inequality

We next explore the implications of a higher γ for income inequality. Here, it is important to distinguish between *actual* and *measured* income inequality. Measures of inequality are generally based on measured rather than actual incomes. In our model, the measured part of income is given by

$$y(w; \tau^*) = w(1 - \tau^*) + \alpha\tau^*\bar{w}. \tag{11}$$

That is, the part of income that is directly attributable to the strength of belief in afterlife,

$b^* = \gamma\bar{w}(1 - (1-\alpha)\tau^*)$ (private donations received), is not generally taken into account, at least not fully. Put differently, the equality-increasing effect of religion[7] is typically not included in measures of income. This might reflect the tendency of people to underreport the transfers they received, the difficulty of observing donations received on an individual basis by the government, or perhaps simply the unwillingness of authorities to conduct the daunting task of necessary monitoring.[8] Whatever the reason, it would suffice for us to focus on the measured part of income given in equation (11).

In order to see how a higher γ might affect income inequality, consider two agents with (measured) incomes $y(w_1; \tau^*)$ and $y(w_2; \tau^*)$, with $y(w_2; \tau^*) > y(w_1; \tau^*)$. This obtains whenever $w_2 > w_1$. Let $y(w_i; \tau^*) = y_i^*$, $i = 1, 2$, for short. Simple differentiation yields

$$\frac{d(y_2^*/y_1^*)}{d\tau^*} = -\alpha\bar{w}(w_2 - w_1) < 0, \tag{12}$$

which follows since $w_2 > w_1$. That is, an increase in the tax rate τ^* brings y_1^* and y_2^* closer together. Since y_1^* and y_2^* are arbitrary, this result holds for any such pair of individuals, implying a compression of the income distribution. This finding should be intuitive since the tax rate is proportional to and transfers are independent of before-tax/transfer incomes.

We can now apply the chain rule to obtain

$$\frac{d(y_2^*/y_1^*)}{d\gamma} = \frac{d(y_2^*/y_1^*)}{d\tau^*}\frac{d\tau^*}{d\gamma} > 0,$$

which follows since $\frac{d(y_2^*/y_1^*)}{d\tau^*} < 0$ by (12) and $\frac{d\tau^*}{d\gamma} < 0$ by Proposition 1a. Hence, the effect of an increase in the strength of belief in afterlife is the opposite of the effect an increase in the tax rate: It causes a "de-compression" of the income distribution. We, thus, have the following result:

Proposition 2 *An increase in the strength of belief in the afterlife, γ, increases income inequality in the economy.*

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[7]Observe that $\frac{db^*}{d\gamma} = \bar{w}(1 - (1-\alpha)\tau^*) - \gamma\bar{w}(1-\alpha)\frac{d\tau^*}{d\gamma} > 0$ since $\frac{d\tau^*}{d\gamma} < 0$.

[8]Empirical evidence provided by studies such as Cox and Raines (1985) and Gale and Scholz (1994) does indeed suggest that there is substantial underreporting of private transfers, and particularly so for transfers received. As noted by Kessler and Masson (1989, p. 148), this might be attributed to "people's tendency to admit more easily that they have given than that they have received".

This implies that countries with higher levels of religiosity will be characterized by a higher level of income inequality, that is, a higher gap between the income of the rich and that of the poor.

2.4 The Effect of Religiosity on Consumption Inequality

Although the effect of religiosity on measured income inequality is clear, its effect on consumption inequality (equivalently, actual income inequality) is less so. This is because, unlike the previous section, we now take into account both the equality-reducing effect of religion coming from lower governmental transfers, v^*, and the equality-increasing effect due to higher donations received, b^*. In order to see how this changes our analysis, let us pick two arbitrary agents with incomes w_1 and w_2, with $w_2 > w_1$. Let $c(w_i; \tau^*) = c_i^*$ denote optimal consumption levels for $i = 1, 2$. We are interested in the sign of the derivative $\frac{d(c_2^* \diagup c_1^*)}{d\gamma}$. After some algebra, the negative of this derivative can be shown to be proportional to

$$-\frac{d(c_2^* \diagup c_1^*)}{d\gamma} \propto \underbrace{(1 - (1 - \alpha)\tau^*)(1 - \tau^*)}_{>0} + \underbrace{\alpha(1 + \gamma)\frac{d\tau^*}{d\gamma}}_{<0} . \tag{13}$$

If the right hand-side (RHS) of this expression is negative, then $\frac{d(c_2^* \diagup c_1^*)}{d\gamma} > 0$, and hence consumption inequality rises with religiosity. If the RHS of this expression is positive, then the opposite is true. Unfortunately, determining the sign of this term is difficult. Nevertheless, we can still perform some simple thought experiments. Note that when the tax rate τ^* is close to 1, the first term on the RHS is approximately 0, implying that the RHS is likely to be less than zero. When τ^* is close to 0, on the other hand, the first term is approximately equal to 1, and the second term is roughly 0 since the derivative $\frac{d\tau^*}{d\gamma}$ is likely to be small.[9]

We summarize these findings in the following proposition.

Proposition 3 *An increase in the strength of belief in the afterlife, γ, may increase or decrease consumption inequality, or leave it unchanged.*

Propositions 2 and 3, taken together, point to the possibility that an increase in religiosity

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[9]This is because, when the tax rate is already close to 0, a further fall in the tax rate would push the level of the public good towards zero and hence reduce agents' utilities towards negative infinity.

may increase measured income inequality while reducing consumption inequality. Therefore, given two countries identical in every way except the level of their religiosity, it is possible for the country with the higher religiosity to be characterized by a higher level of (measured) income inequality while having a lower level of consumption inequality.

3   Empirical Analysis

In this section, we investigate whether the predictions of our theoretical model regarding the relationship between religion, government fiscal policy (taxes, transfers, and government spending) and inequality hold out in the data. We begin by describing the data and then present results of several econometric estimations.

3.1   Data

Measuring how religious a country is a difficult task. There are several indices of religiosity mostly created by surveys or using expert opinions, which by construction are prone to measurement errors. Since we are mainly interested in accounting for cross-country variation in income inequality, even though measures of religion might be imperfect, we can safely assume that they are not systematically mis-measured across countries.[10] Also, as expected, these different religiosity indices are highly positively correlated with each other.[11] That is why one can safely use one of them without a crucial change in results. In this paper, the results we report use the "belief in afterlife" index reported by the World Values Survey conducted in 2000 as the relevant measure of religiosity due to its proximity to our theoretical modeling of religion in the previous section.[12]

As the measure of inequality, we use the Gini index from the UNDP. The data on tax burden, government spending to GDP ratio, and transfers to GDP ratio come from Government Finance Statistics of the IMF. In addition, we use several control variables. GDP per-capita data is taken from the Total Economy Database of the Groningen Growth and Development

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[10]A list of the 59 countries used in this section's analysis is provided in the Appendix.

[11]See Barro and McCleary (2002) on this point.

[12]The belief in afterlife index is also used by Barro and McCleary (2002) and Sacerdote and Glaeser (2001) among others.

Centre, and informal sector size estimates are from Schneider (2007). Following Alesina, Campante and Tabellini (2008), we define a dummy variable, Democracy, in the following way: We subtract the country's score in an Autocracy index from its score in a Democracy index (resulting in a range from -10 to 10) from the Polity IV Project database. Next, we define our dummy variable Democracy which is equal to 1 if the result of the subtraction is strictly positive and zero otherwise. Finally, data on fractions of different religions in each country comes from La Porta et. al. (1999).

Considering the fact that several of our independent variables (namely, belief in afterlife, GDP per-capita, transfers to GDP ratio, government spending to GDP ratio, and tax burden) might be endogenous and/or be prone to measurement errors, we supplement our OLS analysis with instrumental variables estimations. The instrumental variables we use include latitude as in Hall and Jones (1999), an indicator variable for presidential vs. parliamentary regimes as in Lederman et. al. (2005), and indicator variables for the legal system as in La Porta et al. (1999). Table 1 provides a summary description of the data used in our empirical analysis.

[Insert Table 1 about here]

3.2   Estimation and Results

We run several cross-section regressions using a different set of dependent and independent variables. The first relation we examine is the one between income inequality and religion, specifically, belief in afterlife. The regression equation we estimate for this purpose is of the following form:

$$Gini_i = \beta_0 + \beta_1 Afterlife_i + \sum_{k=2}^{n} \beta_k X_{k_i} + \epsilon_i, \tag{14}$$

where X_{k_i} are explanatory variables other than the belief in afterlife, and ϵ_i is the country-specific error term. The results of this estimation are presented in Table 2. Observe that the coefficient of afterlife is significantly positive in all regressions no matter which control variable is added. These results show that countries with higher levels of belief in afterlife are also those with more unequal populations. Table 2 also shows that GDP per capita

is consistently negative and highly significant in all regressions, indicating that countries with higher per capita incomes tend to have more equal distributions of income. In these regressions, we also check whether the level of democracy and the fraction of population believing in each of the main religions play an important role in shaping the distribution of income. None of these variables produces consistently significant estimates, however.

[Insert Table 2 about here]

Having established the positive correlation between a specific dimension of religion (belief in afterlife) and income inequality, we now want to investigate whether this relationship runs through the mechanism suggested by our model in the previous section. Recall that, in our model, religiosity reduces the level of tax burden (Proposition 1a, 1b) and the level of governmental redistribution and government spending on public goods (Proposition 1c). In order to check this mechanism, we basically run three regressions. First, we look at the relationship between the tax burden and the belief in afterlife index. To do this, we estimate the following equation:

$$Tax_i = \beta_0 + \beta_1 Afterlife_i + \sum_{k=2}^{n} \beta_k X_{k_i} + \epsilon_i, \tag{15}$$

where Tax_i stands for the tax burden, X_{k_i} are explanatory variables other than the belief in afterlife, and ϵ_i is the error term. The results of this estimation are presented in Table 3. Consistent with the prediction of our model in Proposition 1a, countries with higher levels of belief in afterlife tend to have lower levels of tax burden. In these regressions, we also include as control variables GDP per capita, informal sector size (IS), and the fraction of population believing in each of the main religions. However, none of them produces consistently significant estimates.

[Insert Table 3 about here]

We next consider the bilateral relationships between religiosity and the individual components of total government spending, that is, government spending on public goods and on redistribution. As is well known, transfer payments constitute the main means of redistribution and include welfare payments (financial aid), social security expenditures, government

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subsidies, and the like. Government spending on public goods is simply all other spending by the government. In order to test the first result stated in Proposition 1c, we replace tax burden, Tax_i, in equation (15) with government spending (on public goods) to GDP ratio, GS_i, and run the following regression:

$$GS_i = \beta_0 + \beta_1 Afterlife_i + \sum_{k=2}^{n} \beta_k X_{k_i} + \epsilon_i, \tag{16}$$

The results of this estimation are reported in Table 4. The results indicate a clear negative correlation between belief in afterlife and the level of government spending to GDP ratio across countries, thus confirming the first result stated in Proposition 1c. Results also indicate that GDP per capita is statistically significant and negatively correlated with government spending to GDP ratio.

[Insert Table 4 about here]

In order to test the second result stated in Proposition 1c, we run the following regression:

$$TR_i = \beta_0 + \beta_1 Afterlife_i + \sum_{k=2}^{n} \beta_k X_{k_i} + \epsilon_i, \tag{17}$$

where TR_i denotes transfer payments, X_{k_i} are explanatory variables other than the belief in afterlife, and ϵ_i is the error term. The results of this estimation are reported in Table 5. In line with model predictions, countries with higher levels of belief in afterlife have lower levels of transfer payments. Just as in the previous regression, GDP per capita is significant, but this time positively correlated with the dependent variable, transfers to GDP ratio.

[Insert Table 5 about here]

Finally, it will also be of interest to estimate simultaneous system of equations, as this allows us to evaluate the possible feedback effect from income inequality on the level of tax burden, government spending, and/or transfer expenditures through belief in afterlife. Here, we run nine simultaneous equations regressions, three using tax burden, three using government spending to GDP ratio, and another three using transfers to GDP ratio. In each case, we use three different methods to make the estimations: Ordinary least squares,

three-stage least squares, and generalized method of moments. In order to minimize clutter, we only report in Table 6 the results from the simultaneous estimation of equations for taxes.[13] Results suggest that the negative correlation between belief in afterlife and taxes, government spending, and/or transfers seems to be quite robust to different econometric specifications, even after taking into account the pairwise feedback effects between taxes, transfers, and government spending on the one hand, and income inequality, on the other.

[Insert Table 6 about here]

4   Concluding Remarks

The aim of this study was to investigate the role religion plays in determining income inequality within a nation. To this end, we first developed a simple political-economy model in which the more religious the individuals are, the higher is the satisfaction they get from making voluntary donations. In order to be able to spend a higher portion of their incomes on voluntary donations, the religious vote for lower levels of taxes as compared to secular individuals. The political process thus results in a smaller government size in countries with higher levels of religiosity, implying lower levels of spending on public goods and redistribution. Since tax-based redistribution is a major force shaping the distribution of income, our model implies greater income inequality in more religious countries. Our model, therefore, offers a novel mechanism that links religiosity with income inequality that is not based on explanations that emphasize the role of religion in providing personal security and a coping mechanism with socio-economic hardships.

We next showed that the predictions of our theoretical model hold up in cross-national data. In particular, we provided evidence that the positive correlation between religiosity and income inequality runs through the mechanism suggested by our theoretical model. Our empirical results confirm the findings of Palani (2008) and Rees (2009), who find a positive correlation between religiosity and income inequality, and the findings of Gill and Lundsgaarde (2004) and Scheve and Stasavage (2006), who find a negative correlation between

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[13]The results are very similar for transfers and government spending. These estimation results are available upon request.

religiosity and state welfare spending. However, we went beyond these studies and showed that religiosity is also negatively correlated with both total government spending (the size of the government) and government spending excluding welfare payments. This finding suggests that the religious might have an inherent preference for a smaller state, and that a smaller welfare spending observed in more religious countries documented by previous studies might just be a manifestation of this more general outlook.

We believe that future research could extend our findings in different directions. First, the study of the relationship between religion and voluntary donations or religion and income inequality in a microeconomic dataset would further test our claim that religious individuals prefer voluntary donations over taxes. Second, it would be worthwhile to investigate in detail the relationship between consumption inequality and religiosity in order to get a better understanding of the extent religion affects societal well-being.

5 Appendix

5.1 Proofs

1. *Proof that the utility function is strictly concave in τ*

Let $\hat{U}(w; \tau) = (1 + \gamma) \log(y(w; \tau)) + \log(\tau)$, where $y(w; \tau)$ is given by equation (9). It is enough to show that $\frac{d^2\hat{U}}{d\tau^2} < 0$. Differentiating twice we obtain

$$\frac{d^2\hat{U}}{d\tau^2} = -\left((1 + \gamma) \frac{(-w + \bar{w}(\alpha - \gamma + \alpha\gamma))^2}{(w + \gamma\bar{w} + (-w + \bar{w}(\alpha - \gamma + \alpha\gamma))\tau)^2} + \frac{1}{\tau^2}\right),$$

which is always negative since the expression inside the brackets is greater than zero. ∎

2. *Proof that assumption $\gamma \geq \frac{2\alpha}{1-\alpha}$ ensures that $0 < \tau(w) < 1$*

Step 1: $\gamma \geq \frac{2\alpha}{1-\alpha} \Rightarrow \tau(w) > 0$

It is clear from equation (10) that $\tau(w) > 0$ whenever the expression in the denominator, $w - (\alpha - \gamma + \alpha\gamma)\bar{w}$, is greater than zero. But, this is satisfied when $\gamma \geq \frac{2\alpha}{1-\alpha}$.

Step 2: $\gamma \geq \frac{2\alpha}{1-\alpha} \Rightarrow \tau(w) < 1$

Let $\theta \equiv \alpha - \gamma + \alpha\gamma$ and $x \equiv \frac{\bar{w}}{w_m}$. Note that since $F(w)$ is non-degenerate, $\bar{w} > 0$ and $w_m > 0$, and hence $x > 0$. Then, we can write equation (10) as

$$\tau(w) = \frac{1}{2 + \gamma} \frac{1 + \gamma x}{1 - \theta x},$$

which is less than 1 if and only if

$$1 + \gamma x < (2 + \gamma)(1 - \theta x),$$

which after rearrangement yields

$$((2 + \gamma)\theta + \gamma)x < 1 + \gamma. \tag{18}$$

Now, using $\theta = \alpha - \gamma + \alpha\gamma$, we can write

$$(2 + \gamma)\theta + \gamma \;=\; (2 + \gamma)(\alpha - \gamma + \alpha\gamma) + \gamma$$

$$\begin{aligned} &= 2\alpha - 2\gamma + 2\alpha\gamma + \alpha\gamma - \gamma^2 + \alpha\gamma^2 + \gamma \\ &= 2\alpha - \gamma + 3\alpha\gamma - \gamma^2 + \alpha\gamma^2 \\ &= 2\alpha - (1 - 3\alpha)\gamma - (1 - \alpha)\gamma^2 \\ &= (2\alpha - (1 - \alpha)\gamma)(1 + \gamma). \end{aligned}$$

Then, expression (18) can be simplified to

$$(2\alpha - (1 - \alpha)\gamma)x < 1,$$

or, using $x = \frac{\bar{w}}{w_m}$,

$$(2\alpha - (1 - \alpha)\gamma)\bar{w} < w_m. \tag{19}$$

It is easy to see that $2\alpha - (1 - \alpha)\gamma \leq 0$ when $\gamma \geq \frac{2\alpha}{1-\alpha}$. Thus, condition (19) holds since $\bar{w} > 0$ and $w_m > 0$. ∎

3. *Proof that $\frac{d\tau^*(w)}{dw} < 0$*

$$\begin{aligned} \frac{d\tau^*(w)}{dw} &= \frac{1}{2+\gamma} \frac{w - (\alpha - \gamma + \alpha\gamma)\bar{w} - (w + \gamma\bar{w})}{(w - (\alpha - \gamma + \alpha\gamma)\bar{w})^2} \\ &= \frac{1}{2+\gamma} \frac{-(\alpha - \gamma + \alpha\gamma + \gamma)\bar{w}}{(w - (\alpha - \gamma + \alpha\gamma)\bar{w})^2} \\ &= \frac{1}{2+\gamma} \frac{-\alpha(1 + \gamma)\bar{w}}{(w - (\alpha - \gamma + \alpha\gamma)\bar{w})^2}, \end{aligned}$$

which is less than zero since $\alpha > 0$, $\gamma > 0$, and $\bar{w} > 0$. ∎

4. *Proof that $\frac{\partial\tau^*}{\partial\gamma} < 0$*

Let $x \equiv \frac{\bar{w}}{w_m}$ and $M \equiv 1 - x(\alpha - \gamma(1 - \alpha))$. Then, we can write

$$\tau^* = \frac{1 + \gamma x}{2 + \gamma} \frac{1}{M}.$$

Differentiating, we get

$$\frac{\partial \tau^*}{\partial \gamma} = \frac{x}{2+\gamma}\frac{1}{M} - \frac{1+\gamma x}{(2+\gamma)^2}\frac{1}{M} + \frac{1+\gamma x}{2+\gamma}\frac{1}{M^2}x(\alpha - 1),$$

or,

$$\frac{\partial \tau^*}{\partial \gamma} = \frac{1}{M(2+\gamma)}\left(x - \frac{1+\gamma x}{2+\gamma} - \frac{1+\gamma x}{M}x(1-\alpha)\right).$$

Note that since $\gamma \geq \frac{2\alpha}{1-\alpha}$, we have $M > 0$. Hence, it is enough to show that the expression in parentheses is negative. Rewrite this expression as

$$\frac{1+\gamma x}{2+\gamma} + \frac{1+\gamma x}{M}x(1-\alpha) > x,$$

and divide both sides by x to get

$$\frac{1+\gamma x}{(2+\gamma)x} + \frac{1+\gamma x}{M}(1-\alpha) > 1. \tag{20}$$

We are going to show that inequality (20) holds in three steps.

Step 1: Suppose that $x \in [0, \frac{1}{2})$.

If the first term on the left hand side (LHS) in inequality (20) is greater than 1, then we are done for this case, as the second term is always nonnegative. Hence, it suffices to show that $1 + \gamma x > 2x + \gamma x$. But, this condition holds when $x < \frac{1}{2}$.

Step 2: Suppose that $x \in [\frac{1}{2}, 1]$.

Rewrite (20) as

$$\frac{1+\gamma x}{(2+\gamma)x} + \frac{1+\gamma x}{1-x(\alpha - \gamma(1-\alpha))}(1-\alpha) - \frac{1 - x(\alpha - \gamma(1-\alpha))}{1 - x(\alpha - \gamma(1-\alpha))} > 0,$$

or,

$$\frac{1+\gamma x}{(2+\gamma)x} + \frac{1-\alpha + \gamma x - \alpha\gamma x}{1-x(\alpha - \gamma(1-\alpha))} - \frac{1 - x\alpha + \gamma x - x\gamma\alpha}{1 - x(\alpha - \gamma(1-\alpha))} > 0,$$

or,

$$\frac{1+\gamma x}{(2+\gamma)x} > \frac{\alpha(1-x)}{1-x(\alpha-\gamma(1-\alpha))}. \tag{21}$$

Let $x \in [\frac{1}{2}, 1]$. If the following more stringent condition is satisfied, then expression (21) must also be satisfied:

$$\frac{min_x[1+\gamma x]}{max_x[(2+\gamma)x]} > \frac{max_x[\alpha(1-x)]}{min_x[1-x(\alpha-\gamma(1-\alpha))]},$$

where both maximization and minimization are done over the set $[\frac{1}{2}, 1]$. This yields

$$\frac{2+\gamma}{2+\gamma} > \frac{2\alpha}{2-(\alpha-\gamma+\gamma\alpha)}. \tag{22}$$

Note that when $\gamma \geq \frac{2\alpha}{1-\alpha}$, we have $\alpha - \gamma + \gamma\alpha \leq 0$, and hence the denominator on the RHS is greater than zero. Cross-multiplication then gives

$$2 - (\alpha - \gamma + \gamma\alpha) > 2\alpha,$$

which is always true, since $\gamma \geq \frac{2\alpha}{1-\alpha}$ implies that the LHS is at least 2 and $\alpha < 1$ implies that the RHS is strictly less than 2.

Step 3: Suppose that $x \in (1, \infty)$.

We can write inequality (20) as

$$\frac{1+\gamma x}{(2+\gamma)x} + \frac{1-\alpha+\gamma x-\alpha\gamma x}{1-\alpha x+\gamma x-\alpha\gamma x} > 1.$$

Observe that when $x > 1$ the second expression on the LHS is greater than 1. Since the first expression is always nonnegative, the result follows.

Since we have established that $\frac{\partial \tau^*}{\partial \gamma} < 0$ for all $x \geq 0$, we are done. $\blacksquare$

5.2 Tables

	Mean	Std. Dev.	Minimum	Maximum
Gini	39.28	10.01	24.7	60.50
Belief in Afterlife	0.64	0.20	0.16	1
Tax Burden	0.30	0.15	0.01	0.68
GDP per-capita (in thousand GK$)	13.50	9.50	2.28	34.76
Transfers-to-GDP ratio	0.15	0.08	0.02	0.32
Government Spending-to-GDP ratio	0.16	0.06	0.04	0.39
Fraction of Catholics	40.45	40.60	0.00	96.90
Fraction of Protestants	12.45	23.07	2.00	97.80
Fraction of Muslims	14.37	31.07	0.00	99.40
Informal Sector Size	0.30	0.14	0.08	0.68
Indicator for Democracy	0.77	0.42	0.00	1.00
Latitude	36.33	20.20	0.01	83.06
Indicator for French Legal System	0.43	0.50	0.00	1.00
Indicator for British Legal System	0.24	0.43	0.00	1.00
Indicator for German Legal System	0.08	0.27	0.00	1.00
Indicator for Former Socialist Legal System	0.22	0.41	0.00	1.00
Indicator for Presidential Regimes	0.57	0.50	0.00	1.00

Table 2: Income Inequality and Religion[a]

Dependent Variable: Gini Index

	OLS	OLS	OLS	OLS	2SLS
Belief in Afterlife	15.90***	11.39**	13.31**	16.76**	70.81***
	(3.28)	(2.34)	(2.58)	(2.60)	(3.34)
GDP per-capita		-0.32***	-0.36***	-0.40***	-0.60**
		(-3.25)	(-3.04)	(-3.12)	(-2.37)
Indicator for Democracy			4.34	-1.44	-1.08
			(1.32)	(-0.46)	(-0.94)
Fraction of Protestants				0.03	0.07
				(0.90)	(1.22)
Fraction of Catholics				0.08***	-0.02
				(2.88)	(-0.31)
Fraction of Muslims				-0.08	-0.37***
				(-1.42)	(-2.84)
R-squared	0.13	0.23	0.26	0.45	0.40
Observations	57	57	57	57	57
F-Test	7.91	8.20	6.30	6.73	4.50

[a]Heteroskedasticity-consistent t-statistics are in parentheses. ***, **, * denote 1, 5, and 10% confidence levels, respectively. In all regressions, a constant is also included but not reported.

Table 3: Taxes and Religion[b]

Dependent Variable: Tax Burden

	OLS	OLS	OLS	OLS	2SLS
Belief in Afterlife	-0.28***	-0.19**	-0.22**	-0.29**	-0.63**
	(-3.09)	(-2.04)	(-2.56)	(-2.41)	(-2.04)
GDP per-capita		0.069***	0.038**	0.029	0.17
		(3.92)	(2.03)	(1.35)	(0.96)
Informal Sector Size			-0.30**	-0.34**	0.54
			(-2.31)	(-2.17)	(0.52)
Fraction of Protestants				0.03	0.001
				(0.90)	(0.76)
Fraction of Catholics				0.08***	0.001
				(2.88)	(1.23)
Fractio of Muslims				-0.08	0.003**
				(-1.42)	(2.42)
R-squared	0.15	0.35	0.38	0.43	0.37
Observations	57	57	57	57	57
F-Test	10.05	14.42	10.67	9.58	3.75

[b]Heteroskedasticity-consistent t-statistics are in parentheses. ***, **, * denote 1, 5, and 10% confidence levels, respectively. In all regressions, a constant is also included but not reported.

Table 4: Government Spending and Religion[c]

Dependent Variable: Government Spending to GDP ratio

	OLS	OLS	OLS	2SLS
Belief in Afterlife	-0.04**	-0.09**	-0.08**	-0.19**
	(-2.22)	(-2.34)	(-2.17)	(-2.09)
GDP per-capita		-0.003***	-0.004***	-0.004***
		(-4.16)	(-4.86)	(-4.93)
Fraction of Protestants			0.0003	0.0003
			(1.28)	(1.48)
Fraction of Catholics			-0.0003*	-0.0001
			(-1.69)	(-0.33)
Fraction of Muslims			-0.00002	0.0006
			(-0.04)	(0.63)
R-squared	0.02	0.26	0.33	0.27
Observations	57	57	57	57
F-Test	2.54	9.52	4.96	4.76

[c]Heteroskedasticity-consistent t-statistics are in parentheses. ***, **, * denote 1, 5 and 10% confidence levels, respectively. In all regressions, a constant is also included but not reported.

Table 5: Transfers and Religion[d]

Dependent Variable: Transfers to GDP ratio

	OLS	OLS	OLS	2SLS
Belief in Afterlife	-0.24***	-0.17***	-0.18**	-0.48***
	(-4.82)	(-3.34)	(-2.17)	(-3.17)
GDP per-capita		0.037***	0.032**	0.035**
		(4.08)	(2.56)	(2.18)
Fraction of Protestants			0.0004	0.0002
			(0.88)	(0.43)
Fraction of Catholics			0.0001	0.0006
			(0.41)	(1.43)
Fraction of Muslims			0.0001	0.002**
			(0.32)	(2.30)
R-squared	0.30	0.46	0.47	0.42
Observations	57	57	57	57
F-Test	22.54	21.91	9.58	3.75

[d]Heteroskedasticity-consistent t-statistics are in parentheses. ***, **, * denote 1, 5, and 10% confidence levels, respectively. In all regressions, a constant is also included but not reported.

Table 6: Income Inequality, Taxes, and Religion: Systems Estimations[e]

Dependent Variable	3SLS Gini	3SLS Tax	OLS Gini	OLS Tax	GMM Gini	GMM Tax
Belief in Afterlife		-0.21**		-0.20**		-0.22**
		(-2.00)		(-2.38)		(-2.05)
GDP per-capita	-0.16		-0.36***		-0.20	
	(-1.23)		(-3.52)		(-1.58)	
Gini Index		-0.005**		-0.001**		-0.003*
		(-2.38)		(-2.20)		(-1.68)
Tax Burden	-75.49***		-27.81***		-61.62***	
	(-5.67)		(-4.39)		(-3.82)	
Informal Sector Size		-0.40**		-0.50***		-0.48***
		(-2.06)		(-4.36)		(-2.88)
Fraction of Protestants	0.06		0.06		0.08	
	(1.23)		(1.34)		(1.52)	
Fraction of Catholics	0.04		0.10***		0.08**	
	(1.36)		(3.88)		(2.38)	
Fraction of Muslims	-0.05		-0.03		-0.02	
	(-1.00)		(-0.82)		(-0.42)	
R-squared	0.10	0.40	0.52	0.41	0.30	0.40
Observations	79	57	79	57	79	57

[e]Heteroskedasticity-consistent t-statistics are in parentheses. ***, **, * denote 1, 5, and 10% confidence levels, respectively. In all regressions, a constant is also included but not reported.

5.3   Countries

List of Countries Included in Estimations: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Croatia, Denmark, Dominican Republic, Egypt, El Salvador, Estonia, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Italy, Japan, Jordan, Kuwait, Latvia, Lithuania, Mexico, Moldova, Morocco, Netherlands, New Zealand, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Taiwan, Turkey, Ukraine, United Kingdom, USA, Uruguay, Venezuela, Vietnam.

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