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Religious polarization and economic development☆

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Abstract

This paper analyzes the effect of religious diversity on economic development. We argue that the religious polarization index is more appropriate to measure the effect of potential conflict on economic development than the traditional fragmentation index. The empirical exercises support this view.

Keywords: Religious diversity; Polarization; Fragmentation indices; Economic growth

JEL classification: O11; Z12; O55

1. Introduction

Recently several authors have considered the role of religious diversity in the explanation for democracy and economic development (Barro, 1997; Sala-I-Martin, 1997; Tavares and Wacziarg, 2001). However in these papers, religion is included simply as the proportion of each religious group. This implies that what matters for economic development is the identity and size of each religion and not the potential conflictive relationship among them. In contrast, Collier and Hoeffler (2000) construct a measure of religious fragmentation in their study of the causes of civil wars following the criteria used in the construction of ethnolinguistic fragmentation (Mauro, 1995; Easterly and Levine, 1997). More recently, the religious fractionalization index has been used by Alesina et al. (2002) who find that variable to be statistically significant in the explanation of some of the indices of the quality

☆The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the World Bank, its Executive Directors, or the countries they represent.

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of government but not on long-term growth, the latter based on the specification of Easterly and Levine (1997).

In this paper, we argue that the relevant index to measure the impact of religious diversity on economic growth is an index of religious polarization like that proposed by Montalvo and Reynal-Querol (2000). We show, using the specification of Mankiw et al. (1992), that religious polarization is a significant explanatory variable for long-term growth while religious fragmentation is not statistically significant.

2. Religious fragmentation versus religious polarization

The measurement of religious diversity can adopt several forms. One possibility is to use the proportion of people affiliated to each religion in a country[1]. With this variable, we could study, for instance, if Protestant countries have more tendency to democracy and growth than Muslim countries. However the use of separate proportions for each religion cannot deal, for instance, with the effect on economic development of diversity and latent conflict among religious groups inside a country.

In order to assess the importance of religious interactions and potential conflict within a country one could construct two basic measures of religious diversity. The index of religious fragmentation (FRAG) that can be interpreted as the probability that two randomly selected individuals in a country will belong to different religious groups. The form of this indicator is the following

$$\mathrm{FRAG}_i = 1 - \sum_{j=1}^{J} \left(\frac{n_{ij}}{N_i} \right)^2$$

where n_{ij}/N_i is the proportion of people affiliated to religion j in country i[2]. Therefore FRAG increases when the number of groups increases.

An alternative indicator of religious diversity is the index of religious polarization of Montalvo and Reynal-Querol (2000)

$$\mathrm{POL}_i = 1 - \sum_{j=1}^{J} \left(\frac{0.5 - \pi_{ij}}{0.5} \right)^2 \pi_{ij}$$

where π_{ij} is equal to n_{ij}/N_i. The index POL ranges from 0 to 1. Opposite to what happens with the fragmentation index, polarization reaches a maximum when there are two religious groups of equal size. In this type of index, what matters is not only how many groups there are but also if they view other groups as a potential threat for their interests. For a given number of groups, the threat is higher the larger the size of another group relative to the size of the reference group. Therefore the

[1] Reynal-Querol (2002a) has already shown the importance of religious polarization as the main ethnic dimension in the explanation for civil wars. Other authors have used a dummy variable that represents the largest religion of each country.

[2] The ethnolinguistic fragmentation index used in many empirical growth studies belongs to this class of indices. For an interpretation of this index see Vigdor (2002).

polarization index can reflect potential religious conflict in a society better than the fragmentation index.

There are several theoretical justifications for the polarization index. Rent-seeking models indicate that social costs are higher, and social tensions emerge more easily, when the population is distributed in two groups of equal size. In fact, Montalvo and Reynal-Querol (2002) have shown how to derive the polarization index from a simple rent seeking model. Therefore the index of polarization captures basically how far the distribution of the groups is from a bimodal distribution while the fragmentation index increases monotonically with diversity. It is also the case that potential conflict, measured by the polarization index, erodes social capital and also affects economic growth through this channel.

In addition, the index of polarization POL is related to that of Esteban and Ray (1994).

Montalvo and Reynal-Querol (2002)[3] show that the POL index is a polarization measure for a discrete metric while the index of Esteban and Ray (1994) uses an Euclidean metric in R.

3. The data

There are basically two measures of religious diversity that have been used in the economic literature. In their religious fragmentation index, Collier and Hoeffler (2000) use the data of Barro (1997) which comes from the World Christian Encyclopedia (WCE). However, his classification is not the same as the original one in the WCE because it mixes some of the religious groups and subgroups that appear in the original source[4]. Montalvo and Reynal-Querol (2000) use several sources[5] and the original WCE group classification (Jews, Christians, Muslims, Buddhism, Hinduism, Taoism, Confucianism, Chinese Religion, Bahaism, Syncretic cults, animist religions, other religions and no-religion) in order to construct their polarization index.

How does religious fragmentation compare with religious polarization? Fig. 1 shows the relationship between religious fragmentation and religious polarization, both calculated using the classification of the World Christian Encyclopedia. We observe that for low values of the polarization index, the relationship with the fragmentation index is positive and close to linear. In terms of the proportions of religious groups, this linear relationship is observed basically for countries where there is a large religion that accounts for more than 85% (high level of religious homogeneity).

However, for high values of the polarization index, the relationship between religious fragmentation and polarization is close to zero. The correlation between both indicators is as low as 0.05 for polarization higher than 0.6 (close to half of the observations). In these cases, there is no religion within a country that accounts for more than 75–80% of the total population. Therefore the correlation

[3]See this paper for the theoretical properties of the index and its comparison with the index of polarization of Esteban and Ray (1994).

[4]Jews, Catholics, Protestants, Muslims, Hindus (includes Jains and Sikhs), Buddhists, miscellaneous eastern religions (Chinese folk religions, Confucianism and new religionists), no professed religion and other religious groups.

[5]We use the classification of the WCE and cross-check the information of L'etat des Religions dans le Monde with The Statement's Yearbook and national sources. See Montalvo and Reynal-Querol (2000) and Reynal-Querol (2002b) for details.

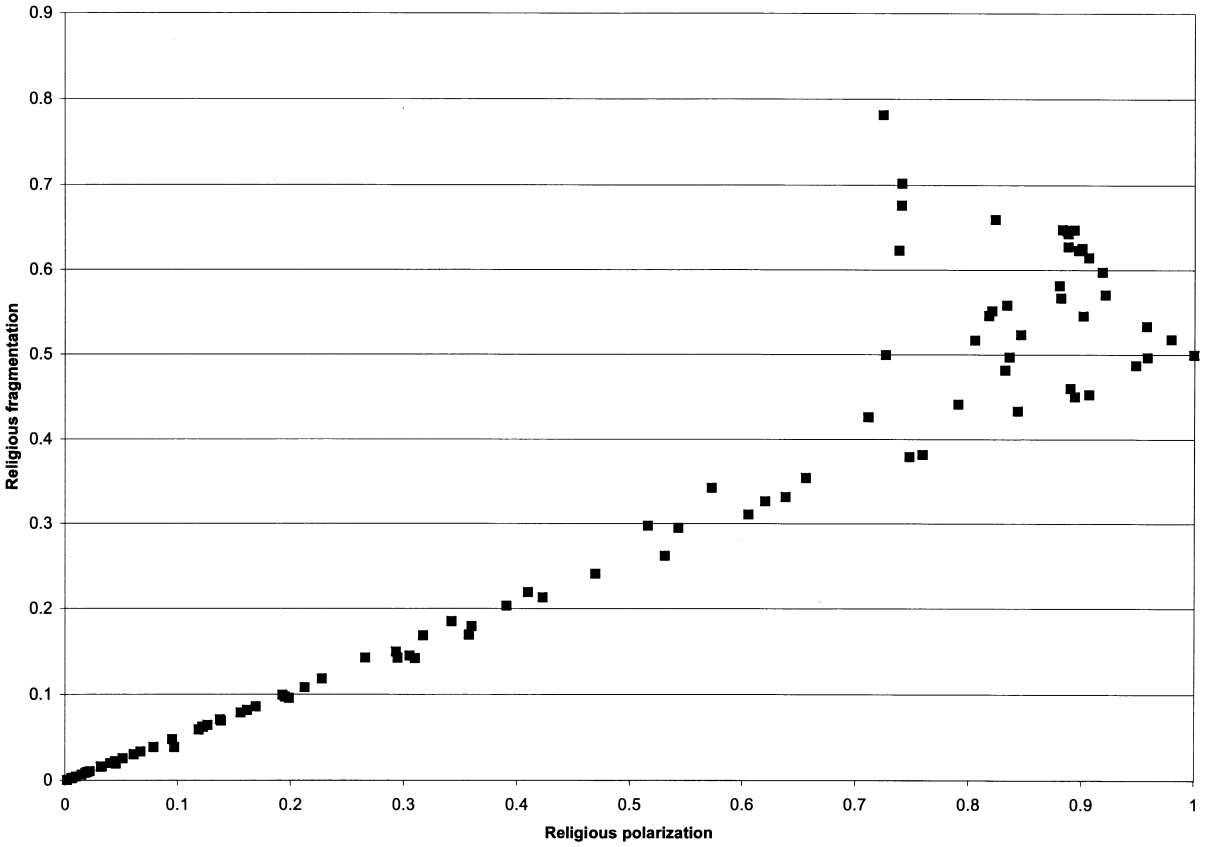

Fig. 1. Religious fragmentation versus religious polarization.

is low when there is religious heterogeneity, which is the interesting case. This fact is important when studying issues of development given that most of the African countries present a high degree of religious polarization.

4. Religious polarization and economic development

In this section, we estimate the augmented Solow model proposed by Mankiw et al. (1992) (hereinafter MRW) with the inclusion of religious diversity indices[6]. The basic empirical specification can be written as

[6]Recently, Temple and Johnson (1998) have used the same empirical specification to assess the importance of social capital in economic growth.

$$\ln \frac{Y(t)}{L(t)} = \beta_0 + \beta_1 \ln s_k + \beta_2 \ln s_h - \beta_3 \ln(n + g + \delta) + u$$

where Y/L is the output per worker, s_k is the rate of investment in physical capital, s_h is the rate of investment in human capital, n is the growth rate of population, g is the rate of technological change and δ is the depreciation rate.

Table 1 shows the results using the data set and the sample in MRW. The dependent variable is the log of GDP per working-age person in 1985. In column 1, we can see that religious fragmentation has no effect on long-term growth once the control variables in MRW are included. However it may be the case that what matters is not only the degree of religious diversity but also the identity of the religious groups represented in each country. Column 2 shows that religious fragmentation has no effect even when we include a set of religious dummies. Columns 3 and 4 indicate that religious polarization has a negative effect on the degree of development no matter if we include religious dummies or not. As before, we include the dummies in order to avoid the possibility that the significance of the index comes from the type of religions rather than from their polarization. In this way, we make sure that the polarization index captures only potential religious conflict independently of which religions coexist in the country. Columns 5 and 6 compare the effect of religious fragmentation and polarization and confirm the finding in previous columns: only religious polarization has a negative and significant effect on income per capita.

Table 2 shows the effect of religious fragmentation and polarization on growth. The results are similar to those in Table 1. Religious fragmentation does not have a significant effect on growth while religious polarization does. In fact religious polarization is significantly negative and explains 5% of

Table 1
Estimation of the Augmented Solow model with religious diversity variables

	Model					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln I/Y	0.703	0.656	0.670	0.587	0.649	0.562
	(5.25)	(4.82)	(5.17)	(4.48)	(4.94)	(4.03)
Ln$(n+g+\delta)$	−1.753	−1.558	−1.410	−1.1655	−1.315	−1.136
	(−4.20)	(−3.53)	(−3.31)	(−2.64)	(−3.00)	(−2.39)
Ln SEC	0.645	0.623	0.6017	0.582	0.608	0.588
	(8.58)	(8.13)	(8.15)	(7.75)	(8.20)	(7.44)
FRAG	−0.108	−0.100			0.226	0.142
	(−0.52)	(−0.27)			(0.94)	(0.35)
POL			−0.4218	−0.652	−0.521	−0.631
			(−2.51)	(−3.11)	(−2.63)	(−2.73)
Religious dummies	No	Yes	No	Yes	No	Yes
Constant	6.846	7.255	7.711	8.421	7.912	8.504
	(5.79)	(5.86)	(6.45)	(6.80)	(6.51)	(6.45)
R-squared	0.786	0.809	0.799	0.820	0.801	0.826
N	98	98	98	98	98	98

Dependent variable: Log GDP per working-age person 1985. Note: t-statistics in parentheses.

Table 2
Conditional convergence using religious diversity variables

	Model							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln Y60						0.041	−0.229	−0.256
						(0.75)	(−3.32)	(−3.67)
Ln I/Y							0.437	0.420
							(4.91)	(4.74)
Ln SEC							0.192	0.213
							(3.22)	(3.56)
Ln$(n+g+\delta)$								−0.536
								(−1.79)
FRAG		−0.197		−0.320	−0.240	−0.100		
		(−1.11)		(−1.03)	(−0.72)	(−0.49)		
POL	−0.275		−0.515		−0.415	−0.412	−0.298	−0.224
	(−2.20)		(−3.68)		(−2.61)	(−2.25)	(−2.14)	(−1.86)
Religious dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.582	−0.523	1.044	0.6479	1.170	0.674	3.989	2.773
	(7.78)	(6.54)	(6.51)	(2.85)	(4.17)	(1.20)	(5.75)	(2.87)
R-squared	0.047	0.012	0.288	0.123	0.347	0.295	0.553	0.569
N	98	98	98	98	98	98	98	98

Dependent variable: Log difference of GDP per working-age person, 1960–1985. Note: t-statistics in parentheses.

the variation in the growth rates (or 29% when the religious dummies are included). Only when we consider as explanatory variable the growth rate of population, the coefficient on religious polarization is just marginally significant. There are reasons to believe that when potential conflict among religious groups is high, the population tends to grow rapidly because each religious group tries to protect their relative power. This is just one of the possible endogeneity issues that are associated, in general, with the application of the specification of MRW. We cannot provide a full treatment of the issue in this paper but in Table 3, we show a preliminary approximation[7]. As it was expected, religious polarization (potential conflict) has a negative effect on investment and human capital but it has a positive effect on population growth.

5. A robustness check: updating MRW up to 1992

Since the paper by MRW (Mankiw et al., 1992) only considers data from 1960 to 1985, we have carried out a robustness check by updating the sample period up to 1992[8]. The data on real gross domestic product (RGDP) per working-age person and the investment share of RGDP come from the

[7] Montalvo and Reynal-Querol (2000) deal with the issue of direct versus indirect effects of religious polarization of economic growth in the context of Barro's specification (Barro, 1997).

[8] For the updating, we use the version 5.6 of the Penn World Table (PWT). There is a new version, 6.1, but missing data in some of the variables that do not come from the PWT, mainly enrolment in secondary education, produce a large reduction in the sample size. For this reason, we decided to use PWT5.6 instead of 6.1.

Table 3
Religious polarization and the determinants of economic growth: 1960–1985

Dependent variable	Independent variables				
	POL	Religious dummies	Constant	*R*-squared	Number of observations
Ln I/Y	−0.542	No	−1.587	0.142	98
	(−3.99)		(−19.54)		
Ln I/Y	−0.720	Yes	−2.271	0.307	98
	(−4.56)		(−7.02)		
Ln SEC	−1.156	No	−2.672	0.199	98
	(−4.89)		(−18.93)		
Ln SEC	−1.260	Yes	−2.634	0.349	98
	(−4.58)		(−8.34)		
Ln$(n+g+\delta)$	0.142	No	−2.707	0.151	98
	(4.14)		(−131.93)		
Ln$(n+g+\delta)$	0.185	Yes	−2.741	0.272	98
	(4.52)		(−58.19)		

Note: *t*-statistics in parentheses.

Penn World Table 5.6. We have updated the secondary enrolment variable using the UNESCO Yearbook. For the update of the average rate of growth of the working age population, we use the World Development Report as in MRW.

Table 4 replicates the estimation in Table 1 but using the updated sample. Notice that due to missing data the sample size is reduced from 98 countries to 83. The results of Table 4 confirm the

Table 4
Estimation of the Augmented Solow Model with religious diversity variables

	Model					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln I/Y	0.498	0.477	0.475	0.426	0.466	0.434
	(3.99)	(3.45)	(3.90)	(3.22)	(3.82)	(3.20)
Ln$(n+d+g)$	−0.449	−0.438	−0.365	−0.303	−0.347	−0.309
	(−4.25)	(−3.66)	(−3.33)	(−2.61)	(−3.11)	(−2.47)
Ln SEC	0.738	0.734	0.685	0.669	0.691	0.680
	(7.80)	(7.51)	(7.30)	(7.00)	(7.33)	(6.96)
FRAG	−0.662	0.215			0.225	0.400
	(−0.28)	(0.51)			(0.87)	(0.85)
POL			−0.425	−0.711	−0.519	−0.721
			(−2.17)	(−2.85)	(−2.32)	(−2.68)
Religious dummies	No	Yes	No	Yes	No	Yes
Constant	6.174	6.035	6.455	6.878	6.420	6.616
	(20.16)	(12.17)	(20.61)	(15.45)	(20.30)	(12.50)
R-squared	0.7786	0.7865	0.7910	0.8134	0.7930	0.8158
N	83	83	83	83	83	83

Dependent variable: log GDP per working-age person in 1992. Note: *t*-statistics in parentheses.

Table 5
Estimation of the Augmented Solow Model with religious diversity variables

	Model							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln Y60						0.096	–0.194	–0.225
						(1.28)	(−2.44)	(−2.80)
Ln I/Y							0.304	0.2821
							(3.41)	(3.17)
Ln SEC							0.282	0.306
							(3.84)	(4.16)
Ln$(n+d+g)$								–0.139
								(−1.78)
FRAG		–0.330		–0.384	–0.170	–0.213		
		(−1.57)		(−1.04)	(−0.77)	(−0.64)		
POL	–0.424		–0.753		–0.702	–0.541	–0.397	–0.307
	(−2.87)		(−4.98)		(−4.25)	(−2.77)	(−2.41)	(−1.81)
Religious dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.694	0.611	1.361	0.681	1.415	0.513	1.332	1.604
	(7.82)	(6.41)	(7.84)	(2.50)	(7.53)	(0.75)	(2.18)	(2.58)
R-squared	0.0846	0.0269	0.4178	0.2310	0.4220	0.4847	0.5781	0.5963
N	91	91	91	91	91	91	83	83

Dependent variable: Log difference GDP per working age person 1960–1992. Note: t-statistics in parentheses.

findings of Table 1: religious polarization has a negative and significant effect on GDP per working-age person in 1992 while religious fragmentation does not have any effect. The goodness of fit of the regressions is similar in both tables.

Table 5 shows the estimation of long-term growth regressions using religious diversity variables and the updated sample. The results are basically the same as those reported in Table 2: religious polarization has always a negative and significant effect on long-term growth while religious fragmentation has no effect. In fact using the updated sample the goodness of fit of the regressions improves in all the versions.

Finally, Table 6 presents pairwise regressions of each of the original variables in the augmented Solow model and religious polarization. The results obtained with the updated sample are very similar to those in Table 3. Religious polarization has a negative effect on the investment ratio and the enrolment in secondary education while it has a positive effect on working-age population growth. We also observe an increase in R^2 which, in the case of the investment ratio, reaches 0.42 using only religious polarization as explanatory variable. This result gives an indication of the importance of potential religious conflict in the process of investment.

6. Conclusions

This paper analyzes the effect of religious diversity on economic development. We have shown that the empirical performance of religious polarization is superior to the explanatory power of religious fragmentation. This is so for the original MRW sample as well as for an updated sample that includes

Table 6
Religious polarization and the determinants of Economic Growth: 1960–1992

Dependent variable	Independent variables				
	POL	Religious dummies	Constant	*R*-squared	Number of observations
Ln I/Y	−0.751	No	2.937	0.1715	90
	(−4.27)		(27.93)		
Ln I/Y	−0.977	Yes	3.320	0.4242	90
	(−5.20)		(15.40)		
Ln SEC	−1.094	No	2.164	0.2297	88
	(−5.06)		(17.47)		
Ln SEC	−1.174	Yes	2.230	0.3419	88
	(−4.53)		(7.46)		
Ln$(n+d+g)$	0.702	No	0.108	0.1878	98
	(4.71)		(1.22)		
Ln$(n+d+g)$	0.915	Yes	−0.101	0.3236	98
	(5.20)		(−0.50)		

Note: *t*-statistics in parentheses.

data until 1992. Although in this paper we do not perform a full set of robustness checks, we have shown elsewhere (Montalvo and Reynal-Querol, 2000) that religious polarization has a negative impact on growth through its effect on investment, government expenditure and the probability of civil wars. The results indicate that future empirical research on economic growth should consider seriously the effect of religious diversity and, in particular, religious polarization.

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