

Religion and Economic Development  
- A study on Religious variables influencing GDP  
growth over countries

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## **Abstract**

Religion is a popular topic to be considered as one of the major factors that affect people's lifestyles. However, religion is one of the social factors that most economists are very careful in stating a connection with economic variables. Among few researchers who are keen to find how religions influence the economic growth, Barro had several publications with individual religious activities or beliefs and Montalvo and Reynal-Querol on religious diversity. In this paper, I challenge their studies by using more recent data, and test whether their arguments hold still for different data over time. In the first part of the paper, I first write down a simple macroeconomics equation from Mankiw, Romer, and Weil (1992) that explains GDP growth with several classical variables. I test Montalvo and Reynal-Querol (2003)'s variables – religious fragmentation and religious polarization – and look at them in their continents. Also, I test whether monthly attendance, beliefs in hell/heaven influence GDP growth, which Barro and McCleary (2003) used. My results demonstrate that the results from Barro's paper that show a significant correlation between economic growth and religious activities or beliefs may not hold constant for different time period. My results also demonstrate neither religious fragmentation nor religious polarization is statistically significant with updated dataset. From these results, I suggest that religious variables do not have a significant, constant influence on economic growth.

## **1. Introduction**

Religion affects society and demography in sociological and psychological ways. Studies of religion promise to enhance economics at several levels: generating information about a neglected area of "nonmarket" behavior; showing how economic models can be modified to address questions about belief, norms, and values; and exploring how religion (and, by extension, morals and culture) affect economic attitudes and activities of individuals, groups, and societies. (Iannaccone, 1998) Then, how does it affect the economy?

The idea of connecting religion and development stemmed from the basic thought that religion influencing fertility rate. Clearly, religion matters when choosing the marital partner, marriage, divorce, and women's working rate. Lehrer (2004) argues that religious affiliation matters because it has an impact on the perceived costs and the perceived benefits of various interrelated decisions that people make over the life cycle. Religions affect fertility rate, but having different religions or various religions in a society may lead to quarrels in the society, thus I reached a hypothesis that having different religions in a society may be a cause to disturb an economic growth. Through history, we have seen many cases where the society – not only internationally, but also domestically - is under dispute among polarized rival religions. These cases hamper the society working together for economic growth, and sometimes even trigger off civil wars, destroying the local industries. Joan-Maria Esteban and Debraj Ray(1994) also agrees that the phenomenon of polarization is closely linked to the generation of tensions, to the possibilities of articulated rebellion and revolt, and to the existence of social unrest in general.

For millennia, we have seen various religions endeavoring to spread their faith, and increase the number of followers, which was the indicator of that religion's power or influence level. While there were changes in people's faith, we do not know how

those endeavors changed the economy – would they lead to holy war and destroy the economy, or a happy ending with synergy effects?

We here have one question that whether more religions – religious fragmentation - will lead to a slower economic growth, with many different reasons. Or, two strong rivaling religions – religious polarization – significantly affect the economy's growth. We might not be able to explain the underlying reasons how religious fragmentation or polarization affect people's behaviors and thus lead to the change in economy, but if it is found that the variables are significant, we may link our conclusion with other socio-behavioral literatures find possible explanations.

A study by Montalvo and Reynal-Querol (2002) states that the empirical performance of religious polarization is superior to the explanatory power of religious fragmentation. In their empirical studies, they have concluded that the religious fragmentation does not significantly affect the GDP growth but religious polarization has a significantly negative change on the growth rate. Is it just applied in that specific time period, or in the specific country they have observed, or applied in any area or time?

Another study by Barro and McCleary (2003) takes three religious variables – monthly church attendance, belief in hell, and belief in heaven. In order to deal with the isolation of direction of causation from religiosity to economic performance, the estimation relies on instrumental variables suggested by an analysis in which religious activities attendance and individuals' religious beliefs are the dependent variables. The instrumental variables they adopted were the dummy variables of state religion and religious regulation, the composition of religious coherence, and indicator of religious pluralism.

Besides some empirical studies, religious influence is often neglected in

economic researches. One of the main reasons why religion is excluded from developing economic theories is that religion is extremely hard to be numerized. People's thoughts such as how much they find themselves as religious persons cannot be included in calculations, partly because their answers may be too subjective, partly because the results are often not in numbers. In order to avoid the problem, one approach can be looking at the religious variables that can be numerized objectively, such as monthly attendance to religious activities. However, these types of data are limited in their availability over time. Another approach can be using religious composition of societies, the population distribution according to each religion in individual nations.

Montalvo and Reynal-Querol have not provided why they believe their conclusion is intuitively correct. Besides the empirical result, fragmentation seems to be a possible influence on the GDP growth rate, but only the polarization is found to be significant. With some questions left unanswered and possible further developments, this topic is worth investigation. They still open the room for further investigation on fragmentation and polarization as determinants of economic growth over time, and over countries.

Barro and McCleary has been working and publishing papers on possible relationship between religious variables and economic growth. In *Economic growth among countries* (2003), they stated that economic growth responds positively to religious beliefs, notably beliefs in hell and heaven, but negatively to church attendance. They also argue that growth depends on the extent of believing relative to belonging, and their results accord with a model that argues religious beliefs influence individual traits that helps individual's economic performance. Since the beliefs are the output of religion sector and church attendance is the input, higher attendance symbolize more input to religious sector and a push to economic growth.

This paper makes following contribution to the literatures. This research will use more recent data to test whether Barro and McCleary's model applies to data from the twenty-first century. If the results show that their findings are not constant over time, then it needs further researches in figuring better instrumental variables out. This paper will try to challenge whether Montalvo and Reynal-Querol's argument stands with newer data. Their paper uses the data until 1992, thus I am looking forward to get another conclusion that may accept or reject their argument that only religious polarization is statistically significant and see whether their arguments hold for just a specific time period or countries. From the results, it is anticipated to discover how spreading a faith affects a society's economy, and see how that is correlated with other variables, such as fragmentation or polarization.

The rest of this paper is aligned as follows. In section 2, besides two main literatures that are mainly referred in this paper, other literatures with religion and economics are reviewed. In section 3, the models of economic growth with religious variables are presented. Section 4 describes the datasets, and section 5 discusses the estimation with the models and following results from regressions. Finally, section 6 ends the paper with the conclusion.

## **2. Review of literatures on religion and economic growth**

Robert Barro is one of the most active researchers in the field of religion and economy, with Rachel McCleary. In their paper Religion and Political Economy in an International Panel (2002) they find a contradicting result with the common belief. In the study they find church attendance and belief in heaven or hell are positively related to education level, which shows an opposite result from what major of people believe to be – that people who received higher education and thus with more scientific knowledge will hold opposite thoughts to religious beliefs. They also find that urbanization is

negatively related to religious beliefs or actions, which is expectable since in many rural communities churches act as a gathering place of societal meetings and interactions. Also economic growth responds positively to the extent of some religious beliefs but negatively to church attendance – growth depends on the extent of believing relative to belonging.

Along with the paper on 2003 that discussed monthly attendance and beliefs in hell or heaven, Barro and McCleary (2006) further moves on to look at more diverse or more specific variables. Compared to the model in 2003, in the model in 2006 they added communist and ex-communist factors, and additional data from International Social Survey Program that has prayer questions and Gallup survey that asked participation in formal religious services. They used population averages for countries for attendance at formal religious services at least monthly, personal prayer at least weekly, belief in hell, belief in afterlife, and self-identification as religious. Among these, belief in hell and attendance of religious services were also used in their paper in 2003.

Besides Barro and McCleary, many of the economists and sociologists have reached to a similar conclusion, that it is hard to argue that religious activities, beliefs, or affiliations have significant effects on economic growth. Marcus Noland (2002) studied India, Malaysia, and Ghana, and his null hypothesis that religious affiliation is uncorrelated with performance is frequently rejected. The regressions do not yield any significant influence from a specific religion, and the results do not support the notion that Islam is inimical to economic growth. Rather he found out positive correlations between Islamic shares and economic growth, in both cross-country and within-country tests. In case of fertility rate, McQuillan (2004) and Lehrer (2004) observe that “religious values are likely to play a critical role in shaping demographic behavior only when religious authorities have at their disposal a menu of rewards and sanctions that will encourage the faithful to conform” and such conditions are relevant not only to

fertility, but to other demographic outcomes. Lehrer states that it seems that there might be a relation with economic outcomes, but opens the debate and concludes by asking for further researches.

Robert Grier (1997) looks at 63 former colonies in Latin America, and speculates the political and social-economic perspective of the region's underdevelopment. Many literatures have argued that the Spanish-speaking countries inherited characteristics of Spain which are not especially conducive to growth and development.<sup>1</sup> Grier had an empirical test the relation between economic growth and Catholicism or Protestantism, with the datasets from former British, Spanish, French colonies. He finds that Protestantism has a significant correlation with growth and development, and also controlling for Protestantism does not significantly impact the gap between British and French and Spanish colonies' development. Although in my study I do not try to measure the difference in impact of each individual religion on development, it is interesting enough to look at the argument that a specific religion might have had a significant impact in a culture and colonies, thus leading to a correlation between religion and economy. It is hard to be argued that religions are the major causality of different developments of colonies – geographic, historical, and international trends have to be taken into account – and needs further studies.

### **3. Model**

#### **3-1. Model with fragmentation and polarization**

There are two religious variables that will be added to the Solow model, in order to estimate the effects of religions on the growth rate. In order to take a look at

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<sup>1</sup> Examples of those 'Spanish' characteristics mentioned include a tendency toward hierarchical, authoritarian government and religion, a disdain for punctuality and the work ethic, and the lack of public spirit (see Andreski 1969, for further ideas and explanations)

religious variables that can be objectively observed and numerated, this paper uses percentage of population of each society in order to calculate religious fragmentation and polarization. Before the equations are discussed, it should be noted that this research is not focused on each religion's characteristics and thus consider each religion as an independent and identical group when dealing with fragmentation and polarization. That is, it does not matter which religion has the greatest number of followers, it is just the portion of the people that each religion has.

First, 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

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

where  $n_{ij}/N_i$  is the proportion of people affiliated to religion  $j$  in country  $i$ . Therefore FRAG increases when the number of groups increases, especially with diverse religions without a major religion.

For a second method that measures the religious diversity, the equation of religious polarization (POL) is the following

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

where  $\pi_{ij}$  is  $n_{ij}/N_i$ . On the opposite side of the fragmentation index, polarization index reaches a maximum of 1 when there are two religious groups of equal size, indicating that the two largest religious groups are having influence on the same number of people in the society. In this type of index, what matters is not only how many groups

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<sup>2</sup> 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).

there are but also if they view other groups as a potential threat for their interests (Montalvo and Reynal-Querol, 2002).<sup>3</sup>

This paper adopts the augmented Solow model proposed by Mankiw, Romer and Weil (MRW) in 1992. This is formulated as following

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

where  $s_k$  is the rate of investment in physical capital,  $s_h$  the rate of investment in human capital,  $n$  the growth rate of population,  $g$  the rate of technological change,  $\delta$  the depreciation rate.

Thus, incorporating previous variables mentioned into the augmented Solow model, our final equation will be as following

$$\ln \frac{Y(t)}{L(t)} = \beta_0 + \beta_1 \ln s_k + \beta_2 \ln s_h - \beta_3 \ln(n + g + \delta) + \beta_4 d_1 FRAG + \beta_5 d_2 POL + u_i$$

where the additional variables FRAG and POL will have dummy variables, in order to observe how each variable together or by itself affect the growth rate.

### **3-2. Model with monthly church attendance and belief in hell or heaven**

This part of model also uses the augmented Solow model from MRW, and adds three religious variables. The three religious variables here are in some way different from the religious fragmentation or polarization, which sees the religion's fraction of population in order to estimate its influential power and possible discords between or among religions in a single society. They are more related to choices of individuals, and

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<sup>3</sup> For further information of measurement of polarization such as distribution of income and wealth, see Esteban and Ray (1994).

heavily rely on the self-identification of respondents.

First dependent variable is monthly church attendance. Intuitively more frequent church attendance may require people to spend more time on religious activities, and thus might lower the productivity. On the other hand, religious activities may inspire volition and refresh, and also encourage punctuality in some religions.<sup>4</sup> However, a clear causality of monthly attendance and economic performance is yet to be discovered.

Second and third variables are belief in hell and belief in heaven. These two indicate the fraction of people who distinguished themselves as believers in hell or heaven, from fourth-wave of World Values Survey (2009). They do not indicate how much they believe in them, it is a yes or no survey. It is assumed that behaviors of people are influenced by their ways of thinking, and their beliefs based on religions may influence their actions.

Following Barro and McCleary's model, monthly church attendance will be taken account in every model, whereas inclusion belief in hell and belief in heaven in the regression will be varied.

Subsequently, our final regression model is as following:

$$\ln \frac{Y(t)}{L(t)} = \beta_0 + \beta_1 \ln s_k + \beta_2 \ln s_h - \beta_3 \ln(n + g + \delta) + \beta_4 monatt + \beta_5 d_1 belhel + \beta_6 d_2 belhvn + u_i$$

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<sup>4</sup> This was not the case in Catholic country under Spanish control; see Andreski (1969) for further reinformation.

## 4. Data

This research uses two types of datasets, one for religiosity and one for economic growth and other possible determinants for economic growth.

The first type, religiosity dataset mainly comes from Barro's religion adherence data, supplemented by World Christian Encyclopedia (WCE). Montalvo and Reynal-Querol (2000) use several different subgroups from different sources and WCE group classification (Jews, Christianity, Muslim, Buddhism, Hinduism, Taoism, Confucianism, Chinese religion, Bahaism, Syncretic cults, animist religions, other religions and no-religion) in order to construct the polarization index. In each case, the variable indicates the fraction adhering to a specific religion among people who expressed adherence to some religion.<sup>5</sup> In this paper, based on Barro's dataset, the following subgroups will be used; Catholic, Protestant, Other Christianities, Orthodox Christianity, Jews, Muslims, Hinduism, Buddhism, Eastern religions, Other religions, and No religion. It should be noted that referring to different sources may incur some difference in testing results since the religious subgroups may be different from one dataset to another.<sup>6</sup>

Figure 1 shows the relationship between religious fragmentation and polarization, both calculated by using datasets and classification mentioned above. We can see that at lower level of religious fragmentation, we see a high positive linearity between fragmentation and polarization, whereas in the higher level of religious fragmentation we see less clear correlation between the two. When we look at the

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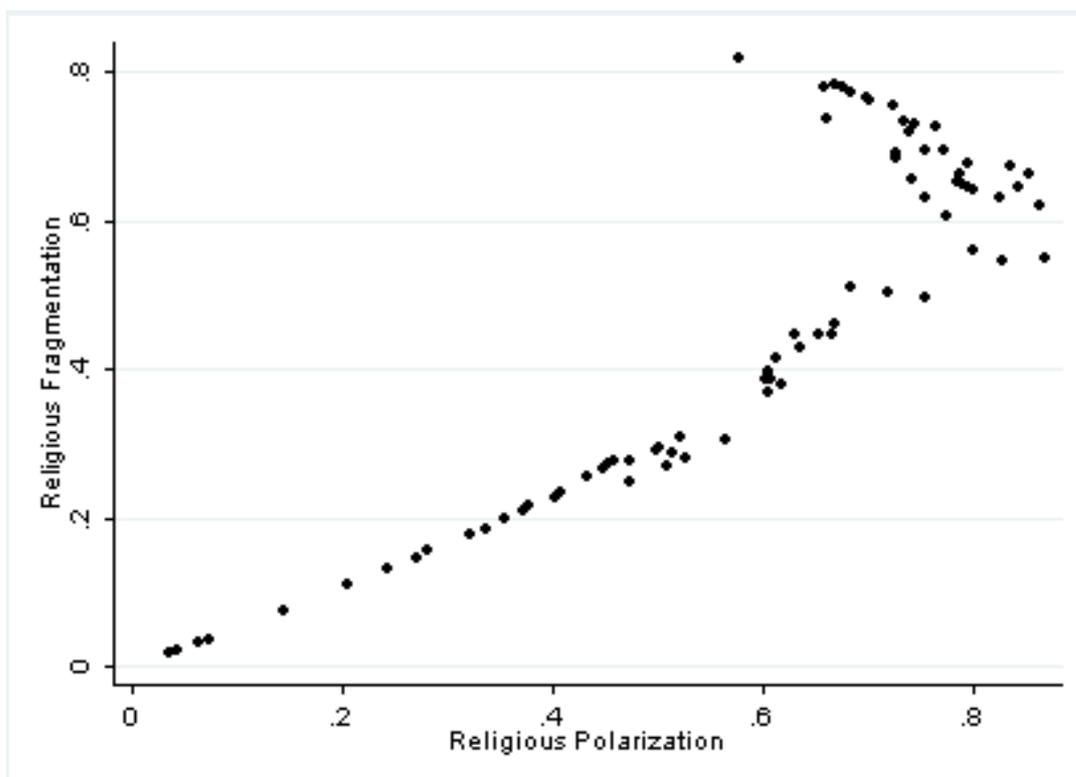
<sup>5</sup> Barro and McCleary (2003) mention that the composition of religious adherence across persons who exhibit some adherence may conceivably be exogenous with respect to church attendance and religious beliefs. However it is not an obvious thought to say that nonreligious adherence is totally exogenous with church attendance or beliefs, and it will not be reasonable to include the countries with a majority of people do not have a specific religion. In the dataset, there are just a few countries with a high fraction of people who distinguished themselves as nonreligious, some of which are China (0.503), Kazakhstan (0.402), Cuba (0.37), Czech Republic (0.369), and Estonia (0.36).

<sup>6</sup> For example, Barro and McCleary combined Buddhist and other Eastern religions due to the lack of sufficient data from Asian countries to distinguish those two categories. They state their data did not allow them to differentiate among theological subgroups, for example types of Muslims and Protestants, and this paper also does not distinguish different types of the subgroups mentioned above.

countries that have smaller fragmentation and thus smaller polarization, those countries have a major religion (with around 80% of population or more) in the society. Those countries' major religions were most of the time either Catholic or Islam.

However, on the higher degree of religious fragmentation, there is no clear linear correlation with polarization. For the countries with polarization index of higher than 0.6, the correlation is less than 0.1. In these cases, the countries do not have a major religion, but some religions divide the population with some shares – no religion is with more than follower share of 80% of population. Thus, when there is heterogeneity in a society, the correlation is low between religious fragmentation and polarization.

**Figure 1. Religious fragmentation and Religious Polarization (Year of 2000)**



**Table 1. Means and Standard Deviations for key variables in the research of fragmentation and polarization (Number of Observations: 81)**

Variable	Mean	Standard Deviation	Min	Max
Per Capita GDP (logged)	8.290	0.975	5.679	10.341
$n + g + \delta$ (logged)	-2.766	0.186	-3.211	-2.361
$I/Y$ (logged)	2.620	0.695	0.146	3.771
SEC <sup>7</sup> (logged)	2.552	1.024	-0.357	4.114
FRAG	0.459	0.242	0.018	1
POL	0.586	0.222	0.035	1
Catholic Fraction	0.334	0.361	0	0.943
Protestant Fraction	0.067	0.087	0	0.309
Other Christianities Fraction	0.083	0.110	0	0.508
Orthodox Christianity Fraction	0.061	0.168	0	0.782
Jewish Fraction	0.011	0.086	0	0.771
Muslim Fraction	0.210	0.328	0	0.991
Hindu Fraction	0.025	0.122	0	0.771
Buddhism Fraction	0.044	0.162	0	0.853
Eastern religion Fraction	0.024	0.077	0	0.447
Other religion Fraction	0.060	0.108	0	0.515
Nonreligious Fraction	0.081	0.127	0	0.503

These findings go along with what Montalvo and Reynal-Querol (2003) found, which reached the same conclusion that lower religious fragmentation corresponds to lower polarization, but in higher polarization there is no significant correlation between the two. This is notable in the sense that many of the countries with higher religious polarization are African countries, as Montalvo and Reynal-Querol mentioned, and is meaningful in development economics.

For religious variables such as monthly church attendance and beliefs in hell or

<sup>7</sup> For definition of secondary education attainment, I used the definition from Mankiw, Romer, and Weil (1992), the average percentage of the working-age population in secondary school for the time period.

heaven, Four-wave Aggregate (1981-1984, 1990-1993, 1995-1997, and 1999-2002) of the Values Studies from World Values Survey, or WVS was used. Barro and McCleary (2003) used the first three waves (from 1981 to 1999), and this research uses the fourth wave in order to test his model. Table 1 shows the means and standard deviations of the variables used to test influence of religious fragmentation and polarization on economic growth, and table 2 shows the means and standard deviations to test the significance of religious activities and beliefs on growth. As it can be seen in Table 2, the number of observations is smaller than that of Table 1, since only the countries with data of both monthly church attendance and belief in hell/heaven were used.

**Table 2. Means and Standard Deviations for key variables in the research in religious activity and beliefs (Number of Observations: 34)**

Variable	Mean	Standard Deviation	Min	Max
Per Capita GDP (logged)	8.581	0.753	6.484	10.225
$n + g + \delta$ (logged)	-2.872	0.188	-3.211	-2.557
$I/Y$ (logged)	2.809	0.410	2.090	3.543
SEC (logged)	2.895	1.004	-0.357	4.114
Monthly church attendance	0.457	0.248	0.112	0.911
Belief in Hell	0.552	0.278	0.131	1
Belief in Heaven	0.654	0.275	0.164	1
Catholic Fraction	0.374	0.375	0	0.943
Protestant Fraction	0.058	0.081	0.001	0.309
Other Christianities Fraction	0.086	0.115	0	0.452
Orthodox Christianity Fraction	0.134	0.240	0	0.782
Jewish Fraction	0.002	0.004	0	0.013
Muslim Fraction	0.150	0.279	0	0.961
Hindu Fraction	0.029	0.133	0	0.771
Buddhism Fraction	0.016	0.085	0	0.495
Eastern religion Fraction	0.005	0.021	0	0.123
Other religion Fraction	0.031	0.069	0	0.304
Nonreligious Fraction	0.115	0.122	0.001	0.369

Each system for Table 3 uses data in 2000 from Barro's religious adherence data and fourth-wave WVS. The dependent variables are monthly church attendance in column 1, belief in hell in column 2, and belief in heaven in column 3. The explanatory variables include four measures of economic development; real per capita gross domestic product (GDP),  $n + g + \delta$ , investment portion of GDP, and secondary education attainment. This table does not weight religions differently for their size or other characteristics.

**Table 3. Regressions for Church Attendance and Religious Beliefs for Country Surveys, 2000**  
(Number of observations: 34)

Explanatory Variable	(1) Monthly Church Attendance		(2) Belief in Hell		(3) Belief in Heaven	
	Coef.	(S.E.)	Coef.	(S.E.)	Coef.	(S.E.)
Per Capita GDP (logged)	-0.019	0.067	-0.158	0.094	-0.087	0.075
$n + g + \delta$ (logged)	0.472	0.470	0.569	0.658	0.838	0.523
$I/Y$ (logged)	-0.029	0.100	0.075	0.141	-0.024	0.112
SEC (logged)	-0.058	0.057	0.033	0.079	0.055	0.063
Catholic Fraction	-68.365	84.755	-26.904	118.692	24.053	94.293
Protestant Fraction	-68.461	84.732	-27.442	118.660	23.699	94.268
Other Christianities Fraction	-68.195	84.855	-26.824	118.832	24.280	94.405
Orthodox Christianity Fraction	-68.448	84.818	-26.870	118.780	24.043	94.363
Jewish Fraction	-72.692	88.645	-20.134	124.140	36.182	98.621
Muslim Fraction	-68.441	84.766	-26.776	118.707	24.116	94.306
Hindu Fraction	-68.812	84.781	-27.002	118.728	24.075	94.322
Buddhism Fraction	-70.138	85.382	-29.316	119.570	22.862	94.991
Eastern religion Fraction	-65.526	84.547	-21.549	118.401	25.175	94.062
Other religion Fraction	-68.090	84.973	-26.554	118.998	24.627	94.536
Nonreligious Fraction	-69.051	84.660	-27.605	118.559	23.025	94.188
R-Squared	0.877		0.808		0.876	

*Note:* Dummy variables for different continents (Asia, Europe, America, and Africa), not shown, are used in order to exclude any difference coming from geographic difference among countries. Constant terms, also not shown, are included for each system.

Table 3 gives us a noticeable result, that no explanatory variable for all three variables of monthly church attendance, belief in hell, and belief in heaven is statistically significant. Although some explanatory variable such as per capita GDP may be close to significance for explaining belief in hell, in the other cases it did not show any significance, so we may conclude that these explanatory variables and dependent variables' partial relationships are not significant in this direction. Thus we will continue looking at the test from a reverse direction, taking logged per capita GDP as dependent variable and religious variables as explanatory variables in Section 5.

For economic datasets, Penn World Table Version 7.0 of Heston, Summers, and Aten's (2011), available online, provides the data adjusted for purchasing power differences among countries. The World Development Indicators of World Bank (2011) provide the population growth rate over time, and population growth rate of year 2000 was calculated by the growth rate between 1999 and 2000. International data on education from Barro and Lee (2010) gives secondary education attainment records – the portion of secondary education receivers among the age groups from 16 to 64. It should be noted that  $g + \delta$  is assumed as 0.05.<sup>8</sup>

Another thing to be mentioned is the selection criteria of countries. Corresponding to Mankiw, Romer and Weil (1992), this paper excludes four types of countries.

First set of countries are countries where oil production takes a major part of domestic industry. The countries are as followings; Bahrain, Gabon, Iran, Iraq, Kuwait, Oman, Saudi Arabia, and United Arab Emirates.<sup>9</sup> These oil producers (excluding Russia – although Russia is currently a major oil producing country, its economic

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<sup>8</sup> For further information, see Mankiw, Romer, and Weil (1992).

<sup>9</sup> In addition, Lesotho is excluded because the sum of private and government consumption far exceeds GDP in every year of the sample, indicating that labor income from abroad constitutes an extremely large fraction of GDP. (1992)

dependence on oil production is comparatively lower than the countries mentioned) are excluded from the test because a large part of their GDP indicates the extraction of natural resource they have, which is not a development factor coming from increase from any human, technological or other resources. It cannot be expected that their GDP growth data will follow the standard growth models and thus religious or other economic factors will not have a significant influence in growth.

The second group of countries is the countries which received an information grade of “D” from Summers and Heston’s Penn World Table Version 5.6 (1992). MRW excluded these countries because this version of Penn World Table was most recent dataset and the countries with “D” had real income figures based on extremely little primary data, and thus measurement error is more likely occur in these countries. Although now we have broader choices of countries with more reliable data, even from the countries which received “D” in 1992, in order to test the model of Montalvo and Reynal-Querol who followed the selection of MRW, this paper also excludes the countries with grade of “D.”

The third group is countries with population with less than one million. These small countries were excluded from the research because due to their smaller economies, their economic growth can be varied by other factors rather than the standard explanatory variables.

The fourth group of countries is OECD countries before year 1992, also in order to follow MRW’s selection – thus current OECD member countries such as Mexico, Czech Republic and South Korea are included in the study. The OECD countries are excluded from the study because it can be assumed that their data have high-quality and thus have less opportunity to be affected by other demographic or economic factors.

## 5. Results

We apply the datasets mentioned in section 4 on the two different models discussed in section 3, and see whether Barro and McCleary, and Montalvo and Reynal-Querol's arguments are still applied to year 2000. We will first start with the discussion of effects of religious fragmentation and polarization on economic growth.

In order to eliminate some possible errors coming from the discrepancies among religions or regions, two types of dummy variables – religious dummies and continent dummies – are used. Table 4 discusses religious dummies are the religion with the largest share of population in the society. In Table 5, continent dummies for Asia, Europe, America, and Africa indicating the geographic factor are included.

Table 4 shows us that the standard economic dependent variables –  $n + g + \delta$ ,  $I/Y$ , and SEC are found to have statistically significant correlation with per capita GDP growth, except for some cases depending on the inclusion of FRAG and POL, or religious dummies. These three variables are widely used macroeconomic variables and there are enough discussions on them including that of MRW, this paper will not deal with their significance.

Looking at the religious variables FRAG and POL, we can see that none of the times they had a significant correlation with GDP growth. If regressed only with FRAG or POL, they were both negatively but not significantly related with GDP growth, which in part goes along with Montalvo and Reynal-Querol's findings. However when we regress both variables with dummy, they are rather positively related with growth, again not significantly. There seems to be some variations depending on the presence of dummy variables so in Table 5 geographic dummy is added.

**Table 4. Estimation of Augmented Solow Model with religious fragmentation and polarization, with religious dummies**

	Model					
	(1)	(2)	(3)	(4)	(5)	(6)
$n + g + \delta$ (logged)	0.627*** (0.119)	0.296** (0.127)	0.631*** (0.12)	0.324** (0.128)	0.621*** (0.121)	0.299** (0.127)
$I/Y$ (logged)	-0.44 (0.503)	-1.72** (0.559)	-0.427 (0.508)	-1.684** (0.569)	-0.415 (0.511)	-1.659** (0.561)
SEC (logged)	0.384*** (0.09)	0.398*** (0.093)	0.383*** (0.09)	0.398*** (0.095)	0.379*** (0.091)	0.384*** (0.094)
FRAG	-0.092 (0.311)	-0.558 (0.354)			-0.306 (0.681)	1.4 (0.82)
POL			-0.035 0.348	-0.32 (0.348)	0.269 (0.762)	0.909 (0.796)
Religious dummies	No	Yes	No	Yes	No	Yes
Constant	4.493 (1.222)	2.925 (1.537)	4.497 (1.223)	3.425 (1.411)	4.5 (1.23)	3.133 (1.544)
R-Squared	0.576	0.713	0.576	0.705	0.577	0.718
N	80	80	80	80	80	80

*Note:* The dependent variable is real per capita GDP growth in the year 2000. Standard errors of coefficients are shown in parentheses. The Protestant share dummy is a dropped category. For data sources, see the text.

\*p<.05      \*\*p<.01      \*\*\*p<.001

In Table 5 with continent dummy added, we reach to the same conclusion with Table 4 that religious fragmentation and polarization do not seem to have a strong correlation with economic growth. The significance of positive relation of  $n + g + \delta$  and SEC with growth, and negative relation of  $I/Y$  with growth agree with Montalvo and Reynal-Querol's findings. Although not significant, POL had both positive and negative relation with GDP growth, showing that it cannot be concluded that POL necessarily impacts the economic growth negatively.

**Table 5. Estimation of Augmented Solow Model with religious fragmentation and polarization, with continent dummies**

	Model					
	(1)	(2)	(3)	(4)	(5)	(6)
$n + g + \delta$ (logged)	0.607*** (0.128)	0.609*** (0.130)	0.617*** (0.133)	0.318** (0.127)	0.342** (0.130)	0.332** (0.128)
$I/Y$ (logged)	-1.244 (0.772)	-1.228 (0.768)	-1.268 (0.781)	-2.450*** (0.791)	-2.479*** (0.801)	-2.417*** (0.790)
SEC (logged)	0.391*** (0.094)	0.389*** (0.094)	0.390*** (0.094)	0.423*** (0.102)	0.426*** (0.104)	0.426 (0.102)
FRAG	-0.068 (0.342)		-0.286 (0.776)	-0.568 (0.376)		-1.445 (0.856)
POL		-0.014 (0.371)	0.264 (0.843)		-0.318 (0.375)	0.959 (0.842)
Continent Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Religious Dummies	No	No	No	Yes	Yes	Yes
Constant	1.955 (2.274)	1.978 (2.279)	1.790 (2.349)	1.419 (2.131)	1.226 (2.167)	1.200 (2.135)
R-Squared	0.598	0.598	0.599	0.743	0.736	0.748
N	80	80	80	80	80	80

*Note:* The dependent variable is real per capita GDP growth in the year 2000. Standard errors of coefficients are shown in parentheses. The Protestant share dummy and Europe dummy are dropped categories.

Montalvo and Reynal-Querol also tries to connect the religious polarization with growth of population. They argue that religious polarization has a negative effect on investment and human capital but it has a positive effect on population growth, with the data from 1960 to 1985. Table 6 replicates their model, but using the data from 2000. Opposite to their findings, only  $n + g + \delta$  without dummies had statistical significance and other variables were not influenced by religious polarization, thus it is hard to say that religious polarization has a strong influence on determinants of economic growth.

**Table 6. Religious polarization and the determinants of economic growth, 2000**

Dependent Variables	Independent Variables				
	POL	Religious dummies	Constant	R-Squared	Number of Observations
$I/Y$ (logged)	-0.331 (0.351)	No	2.814 0.219	0.011	80
$I/Y$ (logged)	-0.602 (0.350)	Yes	3.774 0.644	0.342	80
SEC (logged)	0.874 (0.510)	No	2.040 0.319	0.036	80
SEC (logged)	0.500 (0.491)	Yes	2.805 0.904	0.405	80
$n + g + \delta$ (logged)	-0.191* (0.092)	No	-2.654 0.058	0.052	80
$n + g + \delta$ (logged)	-0.098 (0.083)	Yes	-2.519 0.153	0.489	80

*Note:* Standard errors of coefficients are shown in parentheses. \* $p < .05$

Aside from the religious fragmentation and polarization, we now look at the monthly attendance and beliefs in hell and heaven. Barro and McCleary have argued that all three variables have either positive or negative, and significant relation with GDP growth. In Table 7, their study is replicated with a few changes in explanatory variables. In this paper I will use the three economic explanatory variables that were used in Table 5, rather than the variables that they used such as years of male secondary and higher school attainment, reciprocals of life expectancy at age 1, and average ratios for each period of government consumption. For the purpose of simplification of calculation, all religious data from fourth-wave of WVS which included data also from 1999, 2001 and 2002 were considered as the data in 2000.

**Table 7. Regressions for economic growth, 2000**

Explanatory Variable	(1)	(2)	(3)	(4)	(5)	(6)
<i>Attendance and Beliefs</i>						
Monthly church attendance	1.556*	0.205	0.878	0.386	0.230	-0.151
	(0.650)	(0.990)	(0.979)	(1.173)	(0.794)	(1.191)
Belief in hell	-1.624**	-1.317*			-2.933***	-1.968
	(0.522)	(0.647)			(0.705)	(1.331)
Belief in heaven			-0.557	-1.437	2.655*	1.124
			(0.897)	(1.023)	(1.051)	(1.994)
<i>Religion Shares</i>						
Catholic Share		-186.650		-136.879		-234.563
		(237.441)		(256.700)		(256.835)
Protestant Share		-187.525		-137.737		-235.360
		(237.426)		(256.647)		(256.775)
Other Christianity Share		-186.324		-136.628		-234.198
		(237.329)		(256.580)		(256.703)
Orthodox Christianity Share		-187.523		-137.945		-235.380
		(237.474)		(256.745)		(256.834)
Judaism Share		-163.049		-98.509		-223.662
		(245.512)		(268.114)		(272.698)
Muslim Share		-186.850		-137.447		-234.592
		(237.334)		(256.582)		(256.631)
Hindu Share		-186.581		-136.734		-234.587
		(237.622)		(256.913)		(257.064)
Buddhism Share		-195.282		-143.158		-245.141
		(241.087)		(260.882)		(261.496)
East Religion Share		-159.768		-120.548		-198.479
		(230.364)		(247.423)		(244.959)
Other Religion Share		-188.053		-138.160		-236.286
		(237.974)		(257.368)		(257.536)
Nonreligion Share		-188.546		-139.136		-236.138
		(237.587)		(256.776)		(256.787)

Constant	5.832	192.291	4.606	144.081	3.658	238.478
	2.347	(236.457)	2.899	(255.219)	2.316	(254.886)
Number of observations	34	34	34	34	34	34
R-squared	0.659	0.792	0.547	0.768	0.724	0.796

*Note:* The dependent variable is real per capita GDP growth in the year 2000. Standard errors of coefficients are shown in parentheses. Other explanatory variables were included but coefficients are not shown. The explanatory variables not shown are  $n + g + \delta$  (logged),  $I/Y$  (logged), and SEC (logged). Columns 2, 4, and 6 include the adherence shares of the ten religions discussed and non-religion. Separate constants are included in each column. For data sources, see the text.

\*p<.05      \*\*p<.01      \*\*\*p<.001

Table 7 interestingly shows an opposite result from what Barro and McCleary have found. Monthly church attendance and belief in heaven were most of the time not statistically significant, and showed significance just once varying with the joint regression or presence of religious shares. When they were significant, they both showed positive relation with GDP growth, which is again against their findings saying that monthly church attendance has a negative relation with growth. It should be noted that belief in hell showed significance in the tests. Except for the column 6, in other columns belief in hell had a strong negative correlation with economic growth. Whereas many people believe that people believe in hell will also believe in heaven and thus those two variables will not show a notable difference, Table 7 shows us that belief in hell and heaven are not necessarily shared by same individuals. Belief in hell may have some influence on individual traits that are related with working efficiency, or even with lifestyles.

In order to clarify why these discrepancies occurred, I again take continent dummies in Table 8, just like I did for religious fragmentation and polarization, in order to eliminate possible errors coming from geographic factors.

**Table 8. Regressions with attendance and beliefs, with continent dummies, 2000**

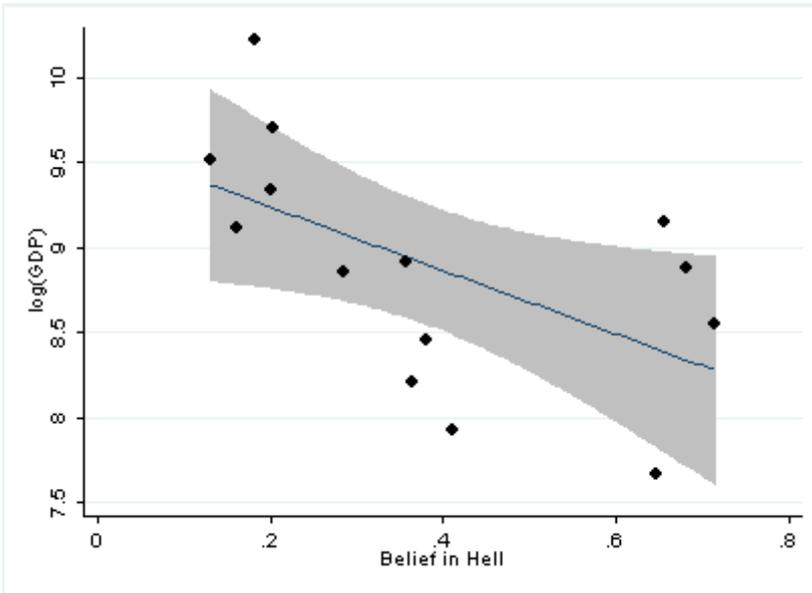
	Model		
	(1)	(2)	(3)
Monthly church attendance	1.209 (0.676)	1.201 (0.920)	0.257 (0.936)
Belief in hell	-1.246* (0.550)		-2.696* (1.144)
Belief in heaven		-1.046 (0.836)	2.343 (1.631)
Continent dummies	Yes	Yes	Yes
Constant	3.830 (2.769)	3.036 (2.975)	3.280 (2.738)
R-Squared	0.704	0.665	0.728
N	80	80	80

*Note:* The dependent variable is real per capita GDP growth in the year 2000. Standard errors of coefficients are shown in parentheses. Other explanatory variables were included but coefficients are not shown. The explanatory variables not shown are  $n + g + \delta$  (logged),  $I/Y$  (logged), and SEC (logged).

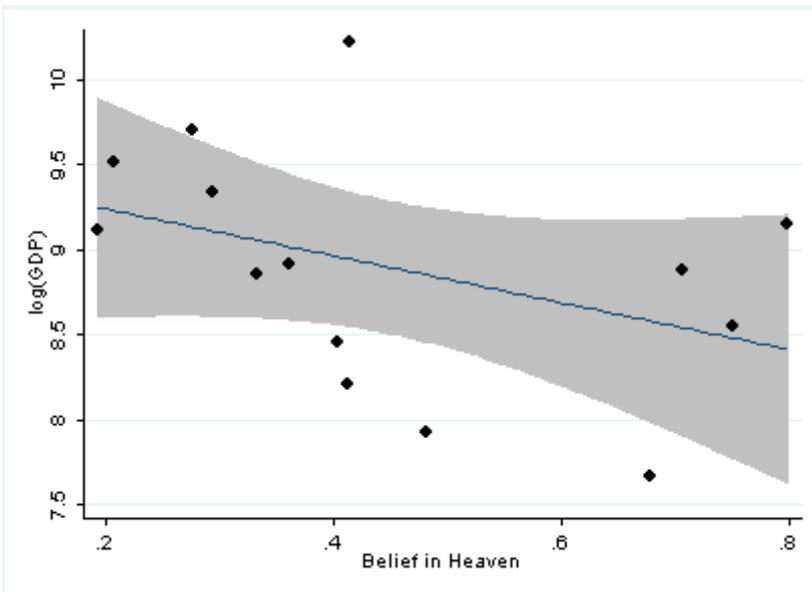
From Table 8 we can reach to a similar conclusion with that from Table 7, that the influence from monthly church attendance and belief in heaven are not significant. However, again belief in hell had a strong negative relation with growth, even with elimination of geographic difference.

As a by-product from the regression, among the continent dummies, the dummy for Europe showed a strong significance. It is indicating that European countries in the study may show a strong relation between beliefs. Figure 2-1 and 2-2 shows the regression between belief in hell or heaven and GDP growth in European countries. By looking at the countries which fall into the 95% confidence interval of the regression I will try to find out the common trait among those countries that may have been the cause of the relation.

**Figure 2-1. Regressions with GDP growth and belief in hell, Europe, 2000**



**Figure 2-2. Regressions with GDP growth and belief in heaven, Europe, 2000**



From both Figure 2-1 and 2-2, we can see a significant negative relation between per capita GDP and belief in hell and heaven, and a stronger negativity when considering belief in hell, according with our findings in Table 7 and 8. When looking at the countries that fall to the confidence interval the distinction between belief in hell and heaven are not meaningful.

The countries that are inside of 95% confidence interval for Figure 2-1 are seven countries: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Romania, and Russia. The countries that are inside of 95% confidence interval for Figure 2-2 are the seven countries mentioned above and Poland – most of the countries that show a strong relation between belief in hell and growth also have strong relation between belief in heaven and growth.

Then what really changed over time and caused the economic growth along with change in beliefs of people might not be a significant correlation between the two variables, but an external factor. One possibility is their joining year of European Union. Currently, every country mentioned above except Russia is member state of EU. Looking at their joining year, six countries – Czech Republic, Estonia, Hungary, Latvia, Lithuania, and Poland joined EU in 2004 and Romania in 2007. Considering that being a member state of EU requires stable economic background, it is possible that their economic growth had been the drives from government in order to meet the specific economic requirements. However, this cannot explain the changes in religious beliefs.

Another possibility is that the countries are former Soviet Union countries, under a forceful restriction of religious activities or beliefs. After the collapse of Soviet Union in 1991, religious affiliations in Eastern European countries experienced increase in followers with freedom of religion (Barker, 2000). As mentioned earlier, considering beliefs as outputs of religious activities, we can expect fall of Soviet Union influenced the beliefs. Along with religious beliefs, Eastern European countries experienced comparatively faster economic growth after 1991. It should be noted that data of Barro and McCleary include the data before 1991, so might have been influenced by the communist countries, and communism might have been the reason behind the correlation.

## **6. Conclusion**

This paper analyzes the effects of religious diversity, monthly church attendance and beliefs on economic development. Through empirical tests using the data from 2000, it is shown that explanatory power of neither religious fragmentation nor polarization is strong enough to argue that they strongly influence the economic growth of a society. Also, attendance to religious activities and belief in heaven showed a weak relation with growth. Although belief in hell was found to be strongly correlated with economic growth, it is difficult to be concluded as a causation of one direction or another, since there might be external – historical – factors that affected both, and further studies may even reject the correlation.

It is hard to say a causation when religion and economic growth are correlated, and Barro and McCleary(2003) also conclude that their instrumental variables cannot fully demonstrate the causation. The results from this paper indicate that both causation and correlation may not hold constant for more up to date datasets. Further empirical research requires more recent datasets for the test of current models, and should develop various instrumental variables for omission of possible errors.

## References

- Andreski, Stanislav. 1969. *Principles of Sociology*. London: McMillan.
- Barker, Eileen. 2000. "The opium wars of the new millennium: Religion in Eastern Europe and the Former Soviet Union." *The Pew Program on religion and the news*.
- Barrett, David B., George T. Kurian, and Todd M. Johnson. 2001. *World Christian Encyclopedia*. 2d ed. Oxford, England: Oxford University Press.
- Barro, Robert J. 1991 "Economic Growth in a Cross Section of Countries." *Quarterly Journal of Economics* 106:407-43
- Barro, Robert J. 1996. "Determinants of Economic Growth: A cross-country empirical study." *NBER Working Paper 5698*
- Barro, Robert J. 1997. "The determinants of Economic Growth." *MIT Press*
- Barro, Robert J. and Rachel M. McCleary. 2003. "Religion and Economic growth among countries." *American Sociology Review* 68(5): 706-781
- Barro, Robert J. and Rachel M. McCleary. 2006. "Religion and Political Economy in an International Panel." *Journal for Scientific Study of Religion*.
- Grier, Robin. 1997. "The Effect of Religion on Economic Development: A Cross National Study of 63 Former Colonies." *KYKLOS* Vol. 50 – 1997 – Fasc 1, 47-62
- Heston, Alan, Robert Summers and Bettina Aten. 2011. Penn World Table Version 7.0, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.
- Iannacone, Laurence R. 1991. "The Consequences of Religious Market Structures: Adam Smith and the Economics of Religion." *Rationality and Society* 3:156-77
- Iannacone, Laurence R. 1998. "Introduction to Economics of Religion." *Journal of Economic Literature* 36(3):1465-1495
- Lehrer, Evelyn L. 2004. "Religion as a Determinant of Economic and Demographic Behavior in the United States." *Population and Development Review* 30(4): 707-726
- Mankiw, Gregory, David Romer, and David N. Weil. 1992. "A contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics* 107(2), 407-437

- Montalvo, Jose, and Marta Reynal-Querol. 2000. "The effect of ethnic and religious conflict on growth." IVIE WP-EC 2000-04.
- Montalvo, Jose, and Marta Reynal-Querol. 2002. "A contribution to the measurement of religious diversity."
- Montalvo, Jose, and Marta Reynal-Querol. 2003. "Religious polarization and economic development." *Economic Letters* 80(2003) 201-210
- Noland, Marcus. 2005. "Religion and Economic Performance." *World Development* 33(8), 1215-1232
- Temple, Jonathan and Paul A. Johnson. 1998. "Social Capability and Economic Growth." *Quarterly Journal of Economics*. 113(3): 965-990