The statistical analysis of the relationship between Religion and macroeconomic indicators

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Abstract. In this paper we aim to verify if, in the present context, it is verified the Weber's hypothesis concerning the relationship between religious denomination and economic development. Using a study conducted on 36 countries, the sample is observed by countries' adherence to major religions. The variance of the macroeconomic indicators was synthesized with PCA method into two latent variables. The distribution of the scores for the two principal components was represented graphically. The results have validated the initial hypothesis, by the groups of countries identified using the cluster analysis.

Keywords: religious denomination, female employment, direct investment abroad, active population, Principal Component Analysis.

1. Introduction

This paper aims to verify if, in present context, one verifies the Weber's hypothesis concerning the relationship between religious denomination and economic development. Weber's theory considers that protestant countries decisively and strongly influence the configuration and the dynamic of labour market due to the paradigm associated with hard and legal work. The only way of gaining the life after death is working hard and sparing no effort. Thus, the feature of the Calvinist ethic system is professional work in community service, which demonstrated the superiority of this social organization.

Regarding the effects of various religious denominations on the structure and dynamics of the labour market, particularly on female workforce, there are few studies in the literature. Inglehart and Baker (2000) stress that known religious traditions have historically shaped the national culture of different societies. The fact that a society has been shaped by Protestantism or Confucianism or Islam leaves a cultural legacy with lasting effects that influence future developments. Compton (1991) conducts a study about the influence of Catholic and Protestant religious denominations on labour market, particularly on unemployment. The results showed that, under specific conditions, unemployment in Catholic communities, which follow the structure of Protestants' characteristics, remains higher by 17%, and the reason is given by endogenous factors that explain approximately 80% of this gap. Ewing (2000) empirically demonstrates the effects of individuals' growth and education in the spirit of Catholic principles on future wages. Feldmann (2007) founds that female labour force and female employment rate are higher in Protestant countries than in countries with other predominant religion.

2. Data and Methodology

For a sample of 36 countries, which range from major Orthodox religion to Protestantism, Catholicism, Islam and Judaism, we observed a series of macroeconomic indicators used in the literature for the analysis of economic growth (Barro, Sala-i-Martin, 2003): Gross Domestic Product per capita, expressed in

Purchasing Power Parity (current international dollars per capita), Employment rate of active population, Unemployment rate, Active population, Direct Investment Abroad (billions of US dollars). The data we have used are taken from different databases, like International Monetary Fund, The World Bank, LABORSTA, OECD Employment Outlook, EUROSTAT (European Commission Statistics) and different national government agencies and institutions. The CIA database offered information on population structure by religious denominations.

To identify the main determinants of economic growth, we applied Principal Components Analysis for summarizing the macroeconomic indicators. Its objective is to reduce a large set of variables to a small set containing the most information from the initial set. (Escofier, B., Pages, J., 1998). P.C.A. requires the identification of the main k components (factorial axes) which are linear and uncorrelated combinations of the original variables.

$F_k = a_{1k}X_1 + a_{2k}X_2 + ... + a_{pk}X_p$, where X_j are the initial variables, with $j = 1, p$.

In order to identify homogenous groups of countries based on the observed variables, we used the hierarchical cluster analysis. The method starts with clusters formed by one case that merge together until they form one big cluster. The first step in the cluster analysis is the proximity matrix (similarity matrix) or the distance matrix. The distance between two cases is measured using the Squared Euclidean distance. It represents the geometrical distance in a multidimensional space (the sum of the squared differences between all the "i" variables on two cases): $d_{Euc}^2(x, y) = \sum_i (x_i - y_i)^2$

The distances are calculated in order to group the cases into clusters. The rule used for clustering the cases is the Ward's method: the cluster membership is based on the sum of the squared deviations from the cluster mean. The optimal number of clusters is decided on subjective reasons: as the cases form groups, the clusters that merge are bigger and bigger and they are composed of more and more dissimilar cases.

Moreover, in order to determine the difference in employment rate by religious denominations, we built an ANOVA regression model with the following expression (Jaba, 2002):

$Y = \beta_0 + \beta_i D_i + \varepsilon$, where: Y is the dependent quantitative variable (employment rate); Di is the independent dummy variables with two possible values (1 - yes, 0 - no). The number of dummy variables is equal to the number of denominations minus 1 (the denomination considered for reference); βi – the regression coefficients; ε – the residual variable with mean equal to zero and normally distributed. The significance of the βi stresses the importance of the differences among confessions concerning the mean level for the output variable.

3. Main Findings

The selected macroeconomic indicators are correlated with different sign and intensity (Table 1). GDP per capita (PPP) suggests a positive causality with employment rate of active population, Direct Investment abroad, employment rate of female population and a negative dependence with Unemployment. Direct Investment abroad (billions of U.S. dollars) is positively correlated only with Active population and GDP (PPP) per capita. Annual unemployment has no direct influence on other factors, but has strong and negative relationship with GDP (PPP) per capita, total employment rate and female employment rate. Active population has a strong direct relationship direct investment abroad. Employment rate of active population positively influence female employment rate and GDP per capita in PPP; it is negatively correlated with the unemployment rate. Female employment rate is positively influencing the employment rate of active population and GDP per capita in PPP, while it is inverse correlated with the unemployment rate.

Correlation	GDP per capita PPP	Direct investment abroad	Unemployment rate	Active population	Employment rate	Female employment rate
GDP per capita PPP	1.000	.555	-.511	.065	.570	.546
Direct investment abroad	.555	1.000	-.100	.587	.202	.251
Unemployment rate	-.511	-.100	1.000	-.033	-.438	-.355
Active population	.065	.587	-.033	1.000	.150	.144
Employment rate	.570	.202	-.438	.150	1.000	.814

| Female employment rate | .546 | .251 | -.355 | .144 | .814 | 1.000 |

Table 1: Correlation matrix between the macroeconomic indicators

Original variables are correlated separately with the two main components (see table 2): Variables GDP (PPP) per capita, employment rate and female employment rate are positively and strongly correlated with the first factorial axis; The unemployment rate has a negative and relatively strong and correlation with the first factorial axis; Active population variables and Direct Investment abroad are positively and closely correlated with the second factorial axis.

On the basis of the correlation coefficients value, showed in the obtained correlation matrix after the rotation of axes, we define two components: demographic and economic output (Component 1) and demographic and economic input (Component 2).

	Component	
	1	2
Employment rate	**.876**	.091
Female employment rate	**.841**	.130
GDP per capita PPP	**.782**	.297
Unemployment rate	**-.699**	.062
Direct investment abroad	.232	.887
Active population	-.019	.873

Table 2. Rotated Component Matrix

The countries are represented on the factorial map of the two principal components (see Fig. 1), thus allowing to identify clusters of countries according to two criteria, demographic and economic input (DEI) and demographic and economic output (DEO).

The first component (DEO) distinguishes between two groups of countries, namely: a group of countries positively correlated with the first factorial axis, the demographic-economic output, consists of highly developed countries (United Kingdom, Canada, Sweden, Iceland, United States of America, Denmark, Finland, New Zealand); a group of countries negatively correlated with the first factorial axis is composed of countries that recorded low economic growth rates (Mali, Iran, Egypt, Morocco, Kyrgyzstan, Turkey). Malaysia performs the best in this cluster, being an atypical case.

The two groups of countries distinguished by the demographic-economic output factors are different in terms of religious confession. The developed countries within the considered group are Protestant (United Kingdom, Sweden, Iceland, United States of America, Denmark, Finland and New Zealand), except Canada, which is Catholic, while the poorest states, in terms of our hypotheses, define almost all the Islamic countries. Also, most Catholic countries are positioned on the factorial map showing positive scores for the first component, as these states have a higher than average level of economic development. The Orthodox countries have a lower level of economic development than the Catholics, but superior to Islamic states, with most of the scores in the negative side of the first axis.
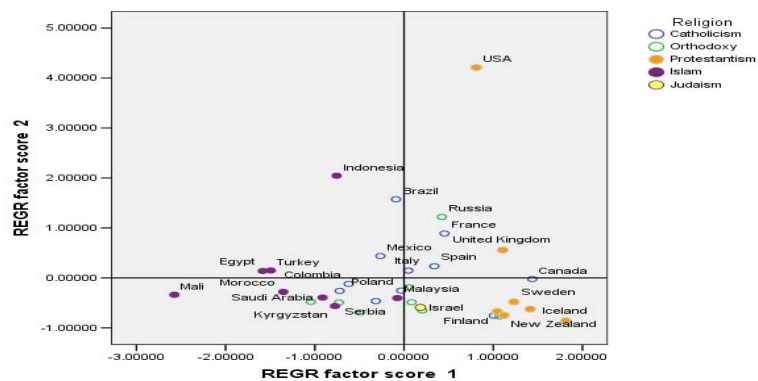

Fig.1. Distribution of countries according to labor market performance and major religion

The performance of the economic and labor market indicators is different according to countries' religious denomination (Fig. 2)

Regarding the demographic-economic input factors, we identify a cluster of countries with a significant volume of human capital resources (United States of America, Indonesia, Brazil, Russia). These states are heterogeneous in terms of religious affiliation of the population: the USA is preponderant Protestants (about 51.3% of population), Indonesia is an Islamic state (86.1% of population), Brazil is predominantly Catholic (73.6% of the population) and Russia is mainly Orthodox (71.8% of the population). A separate cluster of countries is composed by the states with a level of population above the average, namely Egypt, Iran, Turkey, Ukraine, Italy, France and United Kingdom. Also this cluster shows a strong heterogeneity in terms of religious denomination.

We analyze the distribution of labor market indicators by groups of countries distinguished by a dominant religion. Since the studied variables are expressed in different units, in order to observe the differences between the considered macroeconomic indicators, which are low compared with the GDP variable, it is useful to standardize the variables.

Among the studied variables, GDP differs most between the five clusters of countries determined by the religious (Catholic, Orthodox, Protestant, Islam, and Judaism).Thus, the Protestant states record significantly higher GDP rates than the Orthodox and Islamic states and higher than the Catholic ones. Israel is characterized by a GDP ranking below the Protestant average and above the average of the Catholic states. Also, it is noted that the Catholic states present the greatest variation of the GDP, compared to other clusters. The average GDP for the Catholic states is higher than the Orthodox and Muslim states.

There are important differences between the four clusters also due to the employment rate of the active population. The highest average level of this indicator is observed for the protestant cluster, which is the most homogeneous, and the lowest level is recorded for the Islamic one, the most heterogeneous of the considered clusters. The Catholic, Orthodox and Protestant countries record average values for the employment rate of the active population above the average of active population for the 36 countries' sample, while the average for Israel and Muslim countries is lower than that.
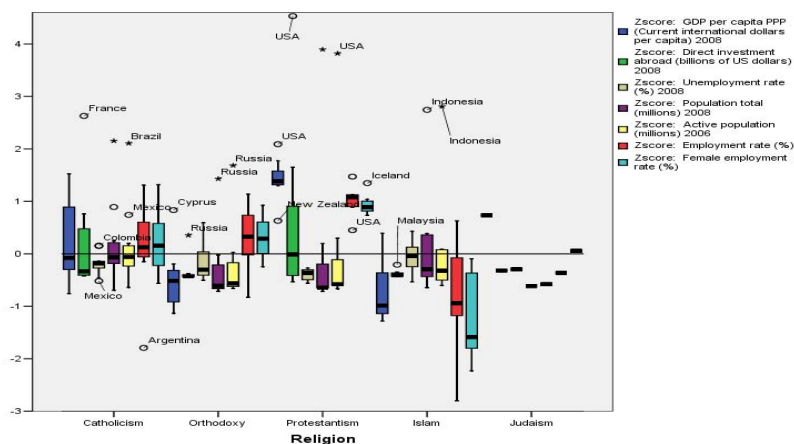

Fig.2. The distribution of macroeconomic indicators by religion

In the Protestant countries, the female employment rate records levels above the average of the Catholic, Orthodox, Protestant and Jewish clusters. Moreover they are the most homogeneous countries. These results confirm the research hypothesis, according to which the female employment is the highest for Protestant than all of the analyzed denominations.

Moreover, we try to determine by how much the employment rate differs among the main groups of religions. To check this hypothesis, we built an ANOVA regression model:

$$Y = \beta 0 + \beta 1*Catholic + \beta 2*Orthodox + \beta 3*Islam + \beta 4*Judaic,$$

with Employment rate - dependent variable, Religion - independent variable. Religion is defined in the model by four dummy variables; Protestant denomination is considered the reference category.

The estimated model is:

Employment Rate = 52.244 – 7.370*Catholic - 6.103*Orthodox –17.125*Islam – 11.834*Judaic

    (Sig=0.000)   (Sig=0,023)   (Sig=0,075)   (Sig=0,000)   (Sig=0,094)

The dummy variable coefficients are statistically significant; therefore, the employment rate on the total population is significantly higher in the protestant states than in predominantly Catholic or Muslim ones.

The ANOVA regression model for female employment rate is:

Female Employment = 48.817 – 8.043*Catholic – 7.478*Orthodox – 26.942*Islam – 10.477*Judaic

    (Sig=0.000)   (Sig=0,025)   (Sig=0,050)   (Sig=0,000)   (Sig=0,176)

We observe a better performance of the protestant countries' labor market, in terms of female employment rate. The Protestant states' female employment rate is higher by about 8% than in the Catholic countries and about 26.9% from the Islamic countries.

4. Conclusions

For the labour market analysis, according to the dominant religion of a state, we observed a sample of countries covering five groups where the predominant religion ranging from Catholicism to Protestantism and Orthodox, Islam and Judaism. Macroeconomic indicators used in the analysis were divided into two categories: demographic-economic input indicators and demographic-economic output indicators. The first category of indicators do not distinguish between the countries with different religions; however, the indicators of the second category of states distinguish two main groups: one group with higher performance in the labor market, the vast majority of states being Protestant and another with underperformances of the labor market which consists mainly of Muslim states.

The best results recorded on the labor market by the Protestant countries compared with the Catholic and Islamic states are confirmed both by analyzing the average level of demographic-economic indicators for each group of countries distinguished by the predominant religion; also, by testing the significance of differences between religions on the employment rate for total and female population.

5. Acknowledgement

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