CONVERGENCE IN GOVERNMENT SPENDING. AN ECONOMETRICAL APPROACH

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Abstract: The government systems differ across and between countries due to different political traditions and historical processes, which explains how each national system is adapted to the economic and social changes throughout time. The share of government spending in GDP and also its share in GDP is important in any study of public sector because data are more readily available and easier to quantify than regulatory measures. To establish the degree of convergence in government spending, we focus primarily on presenting one of the concepts that was imposed in the convergence process, namely the beta convergence. We also present some of the theoretical background as fundamental research on fiscal convergence, which is relatively limited. In the empirical part of the analysis, we study the degree of fiscal convergence of the 28 European Union member countries, using as indicator the volume of general government expenditure during 2004 - 2014. We have chosen this time frame as it includes the largest single expansion of the European Union integration process and together with the pre-, the crisis and the post-crisis period. The methodology which is widely used in the professional literature is the one of Barro and Sala-i-Martin, which implies the estimation of an equation regarding economic growth. Therefore, in our paper we employ the Barro and Sala-i-Martin methodology as presented, above in order to determine if there is a convergence process or rather a tendency towards divergence amongst the 28 European countries, taking into consideration the evolution of the general government expenditure. Results indicate that countries with lower initial level of general government expenditure per capita revealed its faster growth rate, while those with higher initial level of general government expenditure per capita exhibited its slower growth rate during the period 2004-2014.

Keywords: government expenditures; beta convergence; European Union.

JEL classification: H53; O47; C22.

Introduction
The purpose of this paper is to analyze the degree of fiscal convergence of the 28 EU member states, using as indicator the volume of general government expenditures. We will focus primarily on presenting one of the concepts that was imposed in the convergence process, namely the beta convergence and also some of the theoretical background as fundamental research on fiscal convergence. In the second part of the research we will present the data and also the methodology which is widely used in the professional literature and that implies the estimation of an equation regarding the economic growth. In the last part of the analysis we will present our empirical findings regarding the process of convergence in public sector activity, namely government expenditures.
1. Beta convergence and convergence in government spending

One of the concepts that have imposed itself in the process of convergence is the beta convergence. It is based on the neoclassical growth theory and was introduced in the economic literature by Barro and Sala-i-Martin (1992 and 1991:112). Although it has been challenged by some economists such as Friedman (1992) and Quah (1993) who states that their regression model of the economic growth can give a wrong indication of the presence and extension of beta convergence, the concept has been widely employed in the economic literature (Boyle, McCarthy, 1997: 258). It has become indispensable as an instrument in the computing and econometric analysis as well as the description of this process, used either in its simple form (absolute beta convergence) or in its developed form (beta conditional convergence).

The concept of beta convergence can take three basic forms, within the range allowed by the neoclassical model of convergent growth (Iancu, 2009: 25):

a) the absolute beta convergence is the alternative that only takes into consideration the assumption of the high growth rates of the poor countries as against the rich ones, irrespective of the differentiated evolution of the sample countries of the determinants of growth (technological, institutional, and behavioral). Thus, it is necessary to find those solutions that are based on realities, but not exceeding the limits of neoclassical methodological area.

b) the beta convergence clubs, include in the studied panel, those countries/regions that show some technological, institutional and economic policy homogeneity. The main assumption accepted for this solution requires that the same group should not show significant initial differences among the countries/regions of the club as regards the GDP per capita (Iancu, 2007: 35).

c) the conditional beta convergence, that takes into account the assumption that the average growth rate of an economy is an increasing function of its distance from its balanced growth level of income (Young, Higgins and Levy, 2008: 1085).

Barro and Sala-i-Martin (1992: 224) states that given the fact that countries initially poor will grow faster than the initially more affluent ones, the absolute beta convergence process takes place, this means on the one hand, a gradual reduction of the coefficient of variation of GDP/capita, and on the other hand, a reverse relation between the growth rate of GDP per capita and the initial level of GDP/capita. Given that countries have different structural features; these will tend to different levels of equilibrium income, thus registering a conditional beta convergence process.

Starting from the methodology used by Barro and Sala-i-Martin to measure the beta convergence, in the statistical and econometrical analysis, we will investigate the fiscal convergence in the 28 Member States of the European Union. This methodology applied to fiscal convergence shows that the process of convergence exists if the countries with a low level of public expenditure per capita exhibit a growth rate higher than countries with a high per capita government spending.

The economic literature regarding the convergence of government spending is quite limited. A relevant study is the one of Scully (1989): basing his study on data regarding economic growth for 115 market economies between 1960 and 1980, he finds that nations with relatively large government share in 1960 generally grew more slowly than nations with relatively small public sectors. His regression analysis also reveals that the coefficients of the government share were sufficiently large to
indicate a substantial depressing effect on economic growth. Romero-Avila and Strauch (2008) used time series to investigate whether there have been persistent trends in economic growth and fiscal variables over the last 40 years. The results indicate that government consumption and transfers negatively affect GDP per capita growth rates, while public investment has a positive impact on growth rates for 15 selected European Union countries between 1960 and 2001. Vojinovic, Prochniak and Oplotnik (2015) examine the influence of the EU integration process on the area of local self-government in selected EU member states. They proved that convergence really occurred at a significant rate during 2004 - 2013 as well as during the sub period 2004 to 2009, while during the sub period 2010 - 2013 some divergence or slowing down in convergence has been present.

2. Empirical findings of beta convergence processes
In the empirical part of our analysis, we will investigate the degree of fiscal convergence of the 28 EU member states, using as indicator the volume of general government expenditure for the period 2004 - 2014. This time frame was chosen, as it includes the largest single expansion of the EU integration process and in the meantime the pre-crisis, crisis and the post-crisis period. The research is based on the most recent data available from the Eurostat Government Finance Statistics and OECD data base for 2014. The methodology, widely used in the economic literature is the one of Barro and Sala-i-Martin, implies the estimation of an equation regarding economic growth, and it is based on the so called catching up process in which macroeconomic variables, like GDP per capita or the general per capita government expenditures, grow faster in those countries which record a low level of these variables.

In our paper we will use the same methodology to establish whether there is a convergence process or rather a tendency towards divergence amongst the selected 28 European countries. The methodology used to measure the β convergence generally involves estimating a growth equation in the following form (Barro and Sala-i-Martin, 1990: 17, Vojinovic, Prochniak and Oplotnik, 2015: 833):

$$\log\left(\frac{y_{i_{t_0 + T}}}{y_{i_{t_0}}}\right) = \alpha - \beta \log(y^i_{i_{t_0}}) + \varepsilon^i_{i_{t_0}, t_0 + T}$$

(1)

where:

- $y^i_{t_0}$ - the initial level of the volume of general government expenditure per capita in $t_0$;
- $y^i_{t_0 + T}$ - the level of the volume of general government expenditure per capita at the end of the period;
- $\varepsilon^i_{i_{t_0}, t_0 + T}$ - the residual random variable;
- $\alpha$ – constant (absolute term);
- $\beta$ – the parameter that expresses the inclination of the regression line;
- $i$ – country (the 28 member states of the European Union).
The convergence process exists when a negative relationship between the variable’s growth rate and the initial level is significant. So, the negative sign of the $\beta$ parameter is the expression of the inverted relation between the average annual growth rate of the general government expenditure per capita and the initial level of the government expenditures per capita (for instance, when the rich countries experience a higher growth than the poor ones).

We have first drawn a graph that is indented to reveal a relationship between the above mentioned variables.

![Graph showing annual growth rates of general per capita government expenditures between 2004 and 2014 and the initial level of per capita general government expenditures](image)

**Figure 1:** Annual growth rates of general per capita government expenditures between 2004 and 2014 and the initial level of per capita general government expenditures

Source: created by the authors

As seen in Figure 1, the new EU member states recorded a lower level of per capita general government expenditures and higher growth between 2004 and 2014 than the older EU member states. The position of certain countries on the graphic and also the negative slope of the regression line, confirms the beta convergence hypothesis, according to which the initially poorer countries have the tendency to grow faster than the initially rich ones. Regarding the initially poorer countries, the graph reveals that these countries have an initially lower level of per capita general government expenditures and a higher average annual growth rate - Romania, Bulgaria, Czech Republic and Hungary (on the left upper side of the graph), while the countries that in 2004 presented a higher initial level of general per capita
government expenditures, such as Denmark, Sweden, France, Finland, UK recorded between 2004 and 2014 a decreased or even negative economic growth (these countries are to be found on the lower right side of the graphic).

In order to investigate the validity of the hypothesis on which the regression model is based on, we will use various statistical tests. To determine model parameters we will use the generalized least squares method and the estimation of the parameters will be done using Eviews software. The results are:

Table 1: The regression model parameter estimates

<table>
<thead>
<tr>
<th>Dependent Variable: LOG(GROWTH RATE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method: Least Squares</td>
</tr>
<tr>
<td>Included observations: 28</td>
</tr>
</tbody>
</table>

LOG(GROWTH RATE) = α + β * LOG(GOEXPEND)

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>α</td>
<td>4.128786</td>
<td>0.444303</td>
<td>9.292733</td>
</tr>
<tr>
<td>β</td>
<td>-0.412662</td>
<td>0.050513</td>
<td>-8.169414</td>
</tr>
</tbody>
</table>

R-squared 0.719644
Mean dependent var 0.518724
Adjusted R-squared 0.708861
S.D. dependent var 0.452548
S.E. of regression 0.244182
Akaike info criterion 0.086947
Sum squared resid 1.550251
Schwarz criterion 0.182104
Log likelihood 0.782747
Hannan-Quinn criter. 0.16037
Durbin-Watson stat 1.915859
F-statistic 66.73933
Prob(F-statistic) 0.000000

Source: authors’ estimates using Eviews

The tendency of catching up of the richer economies by the poorest is reflected both by reducing the dispersion of general per capita government expenditures and by the negative sign of the annual rate of β convergence of general per capita government expenditures in the sample, all economies are assumed to converge towards the same steady-state.

The values of the estimated coefficients in our sample are α = 4.128786 and β = -0.412662. The α coefficient represents the average annual growth rate of general government expenditures in case the initial level of general government expenditures per capita was zero, while the β coefficient shows the decrease of the average annual growth rate of general per capita government expenditures (the dependent variable) in case the initial level of general per capita government expenditures increases with a unit. Thus, based on our results, we can say that convergence really occurred at the significant rate and they indicate how countries exhibited beta convergence throughout all the examined period 2004-2014.

In order to test the significance of the parameters, we have used the Student test (Stancu, 2011: 62). If the t-statistic in absolute value is higher than the critical one (1.96 for a 5% significance level), all the parameters are significant. As seen in table 1, the α parameter is significant for a significance level α = 0.05, as |t<sub>calc</sub>| = 9.29 > |t<sub>tab</sub>| = 1.96. For parameter β, the value of the statistic of the test, |t<sub>calc</sub>| = - 8.16 > |t<sub>tab</sub>| = 1.96.
and the probability associated to $\beta$ is zero. This confirms its the significance and the rejection of the null hypothesis $H_0$.

The results confirm that both parameters are significant in the sample as well as in the total population, so the model was correctly specified, identified and estimated. In our sample the intensity of the correlation is a strong one as the Adjusted R-squared value is 0.708861. The Fisher test confirmed the significance of the R-squared, since $F_{calc} = 66.73$ is above $F_{tab} = 3.10$, the null hypothesis is rejected so the initial level of per capita general government expenditures has a significant influence on the annual growth rate of general per capita government expenditures, the intensity of the correlation in the total population being quite strong.

### Table 2: Testing the model errors’ related model hypothesis $\varepsilon_t$

<table>
<thead>
<tr>
<th>Dependent Variable: LOG(GROWTH RATE)</th>
<th>Method: Least Squares</th>
<th>Included observation: 28</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOG(GROWTH RATE) = 4.128786 - 0.412662*LOG(GOEXPEND)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence of errors</td>
<td>$DW_{calc}$</td>
<td>1.915859$^*$</td>
</tr>
<tr>
<td>(Durbin Watson Test)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homoscedasticity of errors</td>
<td>$F_{calc}$</td>
<td>1.689333 (Prob=0.2055)</td>
</tr>
<tr>
<td>(White Test)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normality of errors</td>
<td>$JB_{calc}$</td>
<td>0.603286 (Prob=0.739602)</td>
</tr>
<tr>
<td>(JarqueBera Test)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^*$ For a $\alpha = 0.05$ significance level, one exogenous variable and 28 observations, the Durbin-Watson critical values are: $d_1 = 1.328$ and $d_2 = 1.476$.

Source: authors’ estimates using Eviews

In what concerns the testing of the fundamental hypothesis regarding the errors of the model, here are our conclusions:

- the independence of the residual variable $\varepsilon_t$ hypothesis is confirmed since the Durbin Watson statistic ($1.915859$) is greater than the critical value $d_2 = 1.476$ and lower than $4-d_2 = 2.524$;

- the homoscedasticity of the residual variable $\varepsilon_t$ hypothesis, is confirmed, as the probability related to the Fisher statistic (Prob=0.2055) is higher than 5%, there is no correlation between the residual variable, the exogenous variable and the square of the exogenous variable;

- the normality of the residual variable hypothesis. The Jarque-Berra test, which is an asymptotic test, usable in the case of a large volume sample (Andrei and Bourbonnais, 2008: 113) confirmed the hypothesis, as the associated probability of accepting the null hypothesis (Prob=0.739602) is larger than 5%.

Results indicate that the countries with lower initial level of per capita general government expenditures revealed a faster economic growth than those with a higher initial level of per capita general government expenditures.

### Conclusions

The public sector, through taxation and expenditures, affects the allocation of resources in the economy. This raises a series of questions concerning the impact of government on resource allocation in the economic growth. Over time, European countries have a long tradition in terms of decentralization, although their systems
vary from a country to another, depending on several characteristics. To find out how this process has been implemented through integration of EU member states, we investigated the beta convergence using the general government expenditures between 2004 and 2014. The results indicate that the fiscal convergence really occurred at the significant rate and also that the convergence has been evidenced for all the countries. Therefore, we can affirm that the poorer countries that have registered a lower initial level of per capita general government expenditure revealed its faster growth (Romania, Bulgaria, Czech Republic), while countries that in 2004 had a higher initial level of general per capita government expenditures namely Denmark, Sweden, France, Finland or UK, had a low growth rate or even negative one between 2004 and 2014.

References