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**CONVERGENCE IN GOVERNMENT SPENDING COMPONENTS IN EU15:
A SPATIAL ECONOMETRIC PERSPECTIVE**

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Abstract

This paper contributes to the empirical literature on convergence by applying convergence model to components of government expenditures (by function) in EU15 during 1995-2010, using the data from United Nations Statistics Division. Moreover, we extend the traditional convergence model to allow for spatial correlation between countries in the sample, by estimating spatial autocorrelation (SAC) model for each component of government expenditures. This approach is important in that it provides more efficient coefficients, and offers policy-makers useful information regarding fiscal policies determinants that are attributable to other countries. We find that spatial aspects play an important role for Defence, Health and Education. More precisely, half-life convergence for Defence occurs in 6.37 years, for Health in 3.11 years and for Education in 5 years.

Keywords: convergence, government expenditure by functions, spatial econometrics

JEL Classification: C23, H1, H5, O47

Introduction

Solow's (1956) growth model predicts convergence in national incomes of different countries, whereby low-income countries growth at higher rates than high-income countries, resulting in equalisation of per capita incomes. The issue of income convergence has often been investigated in empirical literature (for an extensive overview of this issue and the findings of empirical papers please see Islam, 2003). However, as noted by Coughlin et al. (2007), models of income convergence can also be applied to test for convergence of state fiscal policies. Namely, Coughlin et al. (2007) hypothesise that if taxes are a constant proportion of income, it follows from Solow's (1956) model that growth rates of tax revenue and government expenditures should be equal to the growth rate of income. Indeed, Scully (1991), Annala (2003) and Coughlin et al. (2007) find evidence of fiscal policy convergence.

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Following this line of reasoning we set out to investigate whether government spending composition (by function) is converging in EU15 countries. Namely, fiscal policy in European Monetary Union is determined by the Maastricht Treaty and the Stability and Growth Pact (SGP), and these require national fiscal policies in the euro zone and in candidate countries to keep their fiscal deficits below 3% of GDP and their public debt below 60% of GDP. Overall, these requirements should lead to a convergence in national fiscal policies. As noted by Ferreiro et al. (2013), the Lisbon Strategy, SGP and Broad Economic Policy Guidelines suggest a potential positive impact of fiscal policy on long-term growth. Moreover, it is suggested that this impact should come from the changing composition of government expenditures towards those that are considered to be productive. Governments of countries at a similar stage of development should, therefore, strive towards the same distribution of public expenditure, which should imply convergence in the government spending composition of EU countries. Moreover, as observed by Ferreiro et al. (2014), improving the quality of public finances has become a key policy challenge for European policy makers, and this approach stresses the need to increase the share of productive expenditures in overall expenditures.

Investigating convergence of the functional decomposition of government expenditures is important since, if EU countries are to accept a single model of fiscal policy and government spending, they should be reducing differences in the size and composition of their spending, i.e. their spending structures should be converging. This convergence is especially expected to exist among the EU15 countries, which can be considered structurally similar. Empirical investigations of this sort of convergence are still very rare, and their results are mixed. These are to be reviewed in the next section.

An underlying assumption of majority of empirical investigations that deal with the issue of convergence is that of cross-sectional independence. However, as noted by Rey and Montouri (1999), Abreu et al. (2004) and Coughlin et al. (2007), this assumption is often violated as economic linkages between countries often surpass country boundaries, which are established politically. It is, therefore, crucial to account for possible spatial interactions between neighbouring countries.

Spatial approach has been used in papers dealing with income convergence, and they typically find evidence that it indeed exists (see, for example, Conley and Ligon, 2002; Le Gallo, 2004 etc). The same approach has been used to investigate spatial aspect of fiscal convergence (see, for example, Scully, 1991, Annala, 2003, Coughlin et al., 2007). In this paper, hence, we apply the spatial approach to the analysis of the convergence of government expenditures composition by functions. Incorporating spatial aspects is important for two reasons. Firstly, the presence of spatial dependence would suggest that those estimates that did not account for this dependence are biased, and, hence, provide less efficient coefficients. Secondly, this approach might offer fiscal policy-makers useful information regarding those determinants of fiscal policies that are attributable to other countries. This approach has not as yet been used in the analyses of convergence in the structure of government expenditures, to the best of our knowledge.

This paper is organised as follows. Section 1 reviews scientific literature dealing with government expenditure structure convergence; Section 2 explains Research methodology presenting the theoretical model, data and empirical approach, while Section 3 discusses the Results. Conclusions are given in the final section.

1. Review of the scientific literature

In what follows we present a brief literature review of only those papers that deal with convergence in government expenditure structure, as this is our main topic of interest.

Afexentiou and Apostolos (1996) examine government expenditure convergence within the expanded European Union in the period 1961-1991. They use three main classes of government spending, namely, government final consumption expenditure, transfers and subsidies, and in general do not find convergence.

Nixon (2000) investigates convergence of government expenditures on health in the EU (1960-1995) and finds a common trend in that Southern Mediterranean countries, which generally exhibit upward convergence towards the mean in health expenditure, and convergence towards the EU mean in improving directions for health outcomes. In contrast, EU countries of the North exhibit downward convergence towards the EU mean or below it in health expenditure, whilst their health outcome measures have generally been displaying a decreasing advantage over the EU mean over the periods of analysis.

Skidmore et al. (2004) provide theoretical background as well as empirical analysis of the convergence in government spending. They analyse all countries of the world (for which the data was available from Penn World Tables) over eight five-year periods from 1960-2000 using panel data estimation techniques. Three measures of government expenditures are used: government consumption, government investment and government education expenditures. Their results indicate that the mentioned measures of government spending (in per capita terms) are converging.

Sanz and Velazquez (2001) explore the convergence of the functional distribution of government expenditures in OECD countries during the period 1970-1998. Using similarity index, as well as β -, σ -, and γ - convergence they find that there has been convergence in this functions, and that majority of them have already arrived close to their respective steady states (in 1998).

Sanz and Velazquez (2004) investigate whether OECD member states have harmonized their composition of government expenditures by function during 1970-1997. Using Tukey box-plots, σ -convergence and cluster analysis they find evidence of an approaching process in the composition of government expenditures in the period under investigation. Public services, defence and education are found to be the components with the fastest harmonization process.

Ferreiro et al. (2013) explore whether there is a convergence in the composition of public expenditures towards productive expenditures in the EU. They investigate two sub-periods: 1990-1998 and 1999-2007 using statistical measures of dispersion, Tukey box-plots and cluster analysis. They find no evidence of convergence in the composition of public spending by functional classification, and moreover, there is no upward convergence in the productive components of public expenditures, as would be expected.

Ferreiro et al. (2014) investigate whether there has been a convergence in the size and composition of public expenditures in the EU over the period 1995-2007. Using γ - and X-convergence, as well as unit root tests, they do not find support for the existence of convergence, regardless of whether economic or functional classification of expenditures is used. Consequently, they conclude, the strategy of the quality of public finances is unlikely to be efficiently implemented.

Apergis et al. (2013) analyse 17 EU members during 1990-2012 in terms of the degree of convergence in their public expenditures. Their main idea is that countries converge to convergence clubs and not to a unique equilibrium. Using Phillips and Sul (2007) approach, which allows for endogenous determination of convergence clubs, the find that there is a uniform convergence group with respect to total public expenditures. A different picture emerges, however, when these expenditures are divided by functions.

Coughlin et al. (2007) investigate state and local policy convergence using spatial econometric techniques. They use the data on 48 contiguous states for two years: 1977 and 2002, and investigate β -convergence in per capita gross state product and nine fiscal policy variables. They find that both spatial error and spatial lag coefficients are statistically significant, pointing towards the importance of accounting for spatial dependence in these models. Overall they find that state and local fiscal policies have been converging.

2. Research methodology

Theoretical background

Skidmore et al. (2004) provide a simple theoretical model that predicts convergence in government spending (and its components) under certain assumptions. Skidmore et al.'s (2004) model relies on two equations. A starting point is equation (1) which assumes that the current level of government spending, G_t is a share, τ_t , of previous period's output, Q_{t-1} .

$$G_t = \tau_t Q_{t-1} \quad (1)$$

The second equation assumes that output per capita, $\frac{Q_t}{L_t}$, is a function of privately input capital, K_t , and social input of government, G_t .

$$\frac{Q_t}{L_t} = q_t = f\left(\frac{K_t}{L_t}, \frac{G_t}{L_t}\right) = f(k_t, g_t) \quad (2)$$

whereby lower case letters represent per capita values. After substituting equation (2) into equation (1), assuming that the production function is of the Cobb-Douglas type and after additional transformations, equation (3) is obtained, which relates current per capita government spending growth to lagged values of private, k_{t-1} , and public, g_{t-1} , inputs in per capita terms, population growth, n_t , and the share of government spending in output, τ_t .

$$\ln\left(\frac{g_t}{g_{t-1}}\right) \approx \ln A \tau_t - n_t + \alpha \ln k_{t-1} + (\beta - 1) \ln g_{t-1} \quad (3)$$

Equation (3) implies that under the assumption of diminishing returns to government spending ($\beta < 1$), higher levels of past government spending lead to a lower growth rate of current government spending, ceteris paribus. In other words, equation (3) implies convergence in government spending (if the sign on g_{t-1} is negative).

In our model we follow the approach by Skidmore et al. (2004) in that we assume that a negative sign on a certain government spending component, when regressed against its own growth rate, suggests convergence. We do not include any additional variables for two reasons. Firstly, our sample consists of EU15 countries which are assumed to be structurally similar and striving towards the same balanced growth path, differing only in their initial conditions. Secondly, we do not have a theoretical model which would suggest control variables for each of the ten government spending components, so keeping the model as simple as possible is the best strategy. The details of the applied model are provided below.

Data

In order to test the convergence in government spending components we use the data from United Nations Statistics Division. The details are provided below (table no.1 and table no. 2). The data is yearly and spans from 1995 to 2010 (the time dimension is dictated mainly by software requirements which need the data to be balanced as well as data availability).

Table no. 1. Data sources

Government expenditure component	Indicator	Source
serv	Percentage of expenditures on General public services in general government final consumption	United Nations Statistics Division (2015)
def	Percentage of expenditures on Defence in general government final consumption	United Nations Statistics Division (2015)
ord	Percentage of expenditures on Public order and safety in general government final consumption	United Nations Statistics Division (2015)
econ	Percentage of expenditures on Economic Affairs in general government final consumption	United Nations Statistics Division (2015)
hous	Percentage of expenditures on Housing and community amenities in general government final consumption	United Nations Statistics Division (2015)
health	Percentage of expenditures on Health in general government final consumption	United Nations Statistics Division (2015)
env	Percentage of expenditures on Environment protection in general government final consumption	United Nations Statistics Division (2015)
recr	Percentage of expenditures on Recreation, culture and religion in general government final consumption	United Nations Statistics Division (2015)
edu	Percentage of expenditures on Education in general government final consumption	United Nations Statistics Division (2015)
sprot	Percentage of expenditures on Social protection in general government final consumption	United Nations Statistics Division (2015)

Table no.2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
serv	240	0.107	0.047	0.007	0.290
def	240	0.070	0.038	0.013	0.244
ord	240	0.071	0.021	0.031	0.114
econ	240	0.078	0.028	0.004	0.128
env	240	0.017	0.010	0.000	0.039
hous	240	0.016	0.011	0.002	0.044
health	240	0.275	0.039	0.125	0.368
recr	240	0.031	0.009	0.012	0.053
educ	240	0.220	0.032	0.161	0.305
sprot	240	0.115	0.063	0.029	0.246

Empirical approach

As hinted above, in order to establish whether or not convergence occurs, we will use β -convergence analysis. This is a well-established approach in macroeconomic growth analyses, rooted in the neo-classical growth model, which predicts convergence in income for homogenous countries such as those forming the EU, and especially EU15. Instead of testing the convergence of incomes, we will be testing convergence of public expenditures composition.

β -convergence is usually tested for by regression analysis whereby the dependent variable is the first-difference of the logarithm of income per capita (Y_t) and the independent variable is the logarithm of the income level for each country. More formally β -convergence is tested via regression of the type:

$$\ln Y_t - \ln Y_{t-1} = \alpha + \beta \ln Y_{t-1} + \varepsilon_t \quad (4)$$

β -convergence is taken to exist if the estimated coefficient, β , which measures the speed of convergence, is found to be negative. We adapt this analysis to the exploration of the functional distribution of public spending in the EU. The main goal is to assess whether countries that have a higher share of a certain type of expenditures (in GDP) increase this percentage to a lesser degree than countries in which this share is smaller. In doing this we will follow the approach proposed by Sanz and Velazquez (2001). Thus, for each of the functions we will estimate the following equation:

$$\frac{1}{T} \left[\ln \left(\frac{G_{fit}}{\sum_f^s G_{fit}} \right) - \ln \left(\frac{G_{fi,t_0}}{\sum_f^s G_{fi,t_0}} \right) \right] = \alpha_{fi} + \beta_f \ln \left(\frac{G_{fi,t_0}}{\sum_f^s G_{fi,t_0}} \right) + \varepsilon_t \quad (5)$$

where G_{fit} stands for government expenditure in a certain function, f , (for example, education) of country i in year t , s refers to the number of functions of government expenditures (ten in this case), α_{fi} is the country dummy, β_f coefficient indicating the existence and the speed of convergence. ε_t is the error term.

Furthermore, as argued in the Introduction, the existence of spatial dependence can create a bias and efficiency problems for estimates of β , hence this aspect should be taken into account. Mainstream econometrics has been increasingly incorporating spatial statistical methods in recent years. Spatial dependence occurs in a number of situations, particularly when data are collected at the country level, as is the case in this paper. Namely, it is reasonable to expect that policy variables, such as government spending, in one country in EU15 are correlated with policy variables in neighbouring countries. However, in spite of the fact that including spatial effects into econometric modelling is gaining more and more attention, applications regarding government spending composition and convergence are practically inexistent, to the best of our knowledge. Only Coughlin et al. (2007) used an approach similar to ours, *albeit* on a different sample and for just two years. The main goal of this study is, therefore, to analyse whether there is convergence in ten government spending components in the EU15, after accounting for possible spatial dependencies.

Following Islam (2003) and Arbia and Piras (2005), we use panel data in order to help differing between heterogeneity and spatial dependence. Namely, there are no tests to make a specific distinction, and inclusion of country fixed effects captures omitted variables potentially presenting a spatial dimension. The approach we adopt evolves in two steps. We firstly estimate “regular” fixed effect convergence model as given by equation (5). We then add spatial component, i.e. estimate spatial autocorrelation (SAC) model for each component of government expenditures. In order to do this we adapt equation (5) so that it accounts for these issues, which results in the following model:

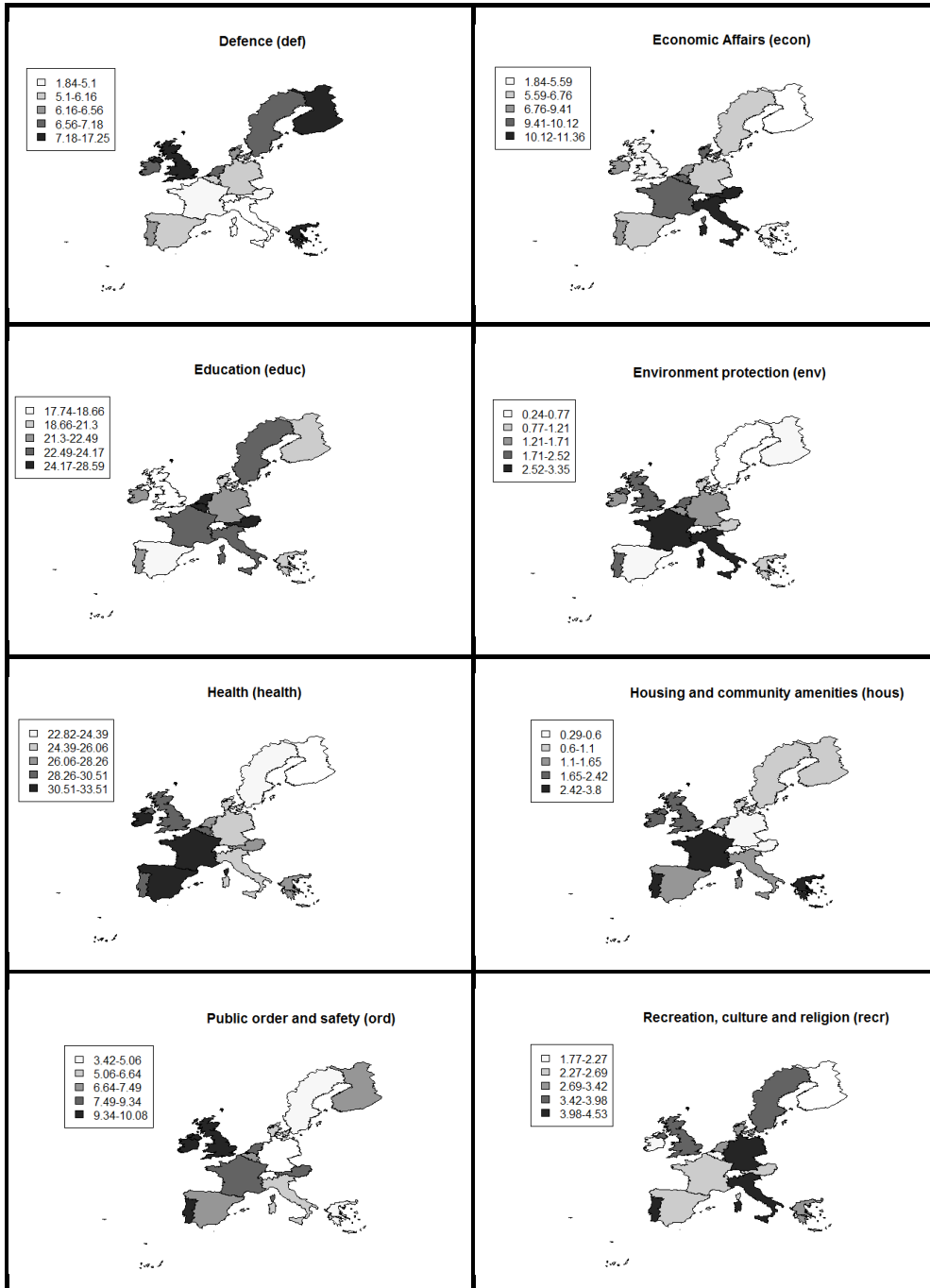
$$\begin{aligned} & \frac{1}{T} \left[\ln \left(\frac{G_{fit}}{\sum_f^s G_{fit}} \right) - \ln \left(\frac{G_{fi,t_0}}{\sum_f^s G_{fi,t_0}} \right) \right] = \\ & = \alpha_i + \beta_f \ln \left(\frac{G_{fi,t_0}}{\sum_f^s G_{fi,t_0}} \right) + \rho_f \sum_{j=1}^n W_{ij} \left(\ln \left(\frac{G_{fit}}{\sum_f^s G_{fit}} \right) - \ln \left(\frac{G_{fi,t_0}}{\sum_f^s G_{fi,t_0}} \right) \right) + \varepsilon_{fit} \end{aligned} \quad (6)$$

$$\varepsilon_{fit} = \lambda_f \sum_{j=1}^n W_{ij} \varepsilon_{fit} + \eta_{fi}$$

Fixed effectsspatial autocorrelation model is given by equation (6), whereby spatial lag component is given by $\rho_f \sum_{j=1}^n W_{ij} \left(\ln \left(\frac{G_{fit}}{\sum_f^s G_{fit}} \right) - \ln \left(\frac{G_{fi,t_0}}{\sum_f^s G_{fi,t_0}} \right) \right)$, ρ_f is the spatial autoregressive coefficient that has to be estimated; spatial error component is given by $\lambda_f \sum_{j=1}^n W_{ij} \varepsilon_{fit}$, and λ_f is the spatial error coefficient that has to be estimated.

The shape and the composition of the spatial weights matrix is crucial in spatial econometrics literature. In equation (6) it is labelled W_{ij} . This matrix, generally, captures neighbouring relationships, by assigning a value 1 to those countries/observations/locations that are neighbours and 0 to those that are not. In our baseline specification we use 3-nearest neighbours row-standardised spatial weights matrix, and later on test the robustness of our results by changing the definition of this matrix.

In order to get a preliminary idea of the spatial distribution of average share of each component in total government expenditures among EU15 countries, Figure no. 1 depicts these shares divided into five quantiles whereby lighter colour denotes lower average value.



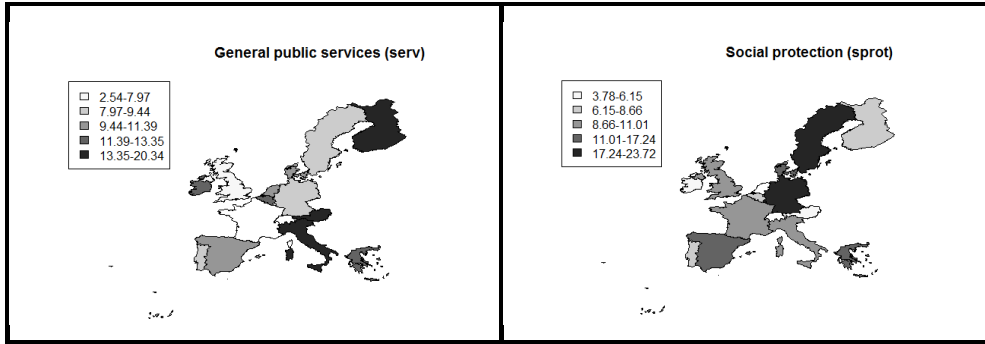


Figure no. 1. Average share of each component in total government expenditures among EU15 countries during the period 1995-2010

Source: Eurostat and author's calculations

3. Results and discussion

The results of the estimation of a fixed effect panel data model as given by equation (5) for a set of 15 EU countries over the period 1995-2010 are given below (table no. 3).

Table no. 3. Fixed effects model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	<u>g_serv</u>	<u>g_def</u>	<u>g_ord</u>	<u>g_econ</u>	<u>g_env</u>	<u>g_hous</u>	<u>g_health</u>	<u>g_recr</u>	<u>g_educ</u>	<u>g_sprot</u>
Lnserv(-1)	-0.224*** (0.037)									
Lndef(-1)		-0.125*** (0.030)								
Lnord(-1)			-0.248*** (0.041)							
Lnecon(-1)				-0.286*** (0.051)						
Lnenv(-1)					-0.199*** (0.034)					
Lnous(-1)						-0.287*** (0.052)				
Lnhealth(-1)							-0.272*** (0.049)			
Lnrecre(-1)								-0.217*** (0.042)		
Lneduc(-1)									-0.137*** (0.038)	
Lnsprot(-1)										-0.168*** (0.030)
_cons	-0.534*** (0.088)	-0.374*** (0.085)	-0.666*** (0.111)	-0.756*** (0.138)	-0.935*** (0.160)	-1.278*** (0.231)	-0.347*** (0.065)	-0.763*** (0.15)	-0.212*** (0.057)	-0.388*** (0.071)
N	225	225	225	225	225	225	225	225	225	225

Note: Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The negative and statistically significant value confirms the hypothesis of convergence among EU15 for all of the government expenditure components. We next set out to investigate whether the presence of spatial dependence (as given by equation no. 6) changes the above conclusions (table no. 4).

Table no. 4. SAC estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	g_serv	g_def	g_ord	g_econ	g_env	g_hous	g_health	g_recr	g_educ	g_sprot
Spatial										
rho	-0.024 (0.186)	-0.366** (0.177)	0.119 (0.149)	0.134 (0.183)	0.004 (0.177)	0.007 (0.205)	-0.304* (0.170)	-0.128 (0.239)	-0.380** (0.169)	-0.070 (0.214)
lambda	-0.048 (0.194)	0.302** (0.142)	-0.259 (0.176)	-0.043 (0.201)	-0.069 (0.186)	0.006 (0.207)	0.308** (0.142)	0.0865 (0.234)	0.479*** (0.115)	0.059 (0.208)
Variance										
sigma2_e	0.017*** (0.001)	0.005*** (0.0005)	0.002*** (0.0002)	0.0282*** (0.002)	0.240*** (0.0211)	0.0254*** (0.002)	0.003*** (0.0003)	0.006*** (0.0005)	0.0005*** (0.00004)	0.00795*** (0.0007)
Total										
Lnserv(-1)	-0.232*** (0.0678)									
Lndef(-1)		-0.115*** (0.0292)								
Lnord(-1)			-0.314*** (0.0918)							
Lnecon(-1)				-0.366*** (0.142)						
Lnenv(-1)					-0.215*** (0.0664)					
Ln hous(-1)						-0.315*** (0.111)				
Lnhealth(-1)							-0.249*** (0.0538)			
Lnrecre(-1)								-0.214*** (0.0796)		
Lneduc(-1)									-0.148*** (0.0360)	
Lnsprot(-1)										-0.171*** (0.0596)
N	225	225	225	225	225	225	225	225	225	225

Note: Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

It should be noted that, as observed by LeSage and Pace (2009), interpretation of the obtained coefficients is not as straightforward as in linear regressions, since spatial regression models additionally include information from neighbouring regions/ observations. In these models, therefore, one can differentiate between “direct” and “indirect” effects, while the “total “ average effect of a change in an independent variable on the dependent variable is the combination of the two. Our results (table no.4) refer primarily to total effects. As stressed earlier, specification given in (6) accounts for the unobserved factors that influence the dependent variable, and also decrease the bias that arises due to potential spatial dependences.

The convergence coefficient is negative and highly statistically significant throughout. In addition, the results suggest that spatial lag (ρ) and error (λ) are statistically significant for convergence of the following components: Defence, Health and Education. The value of β of -0.115 on Defence, for example, implies a half-life of 6.37 years. Half-life for Health is 3.11 years, while for Education it is 5 years. The implied half-life speeds of convergence in „regular” fixed effects was 5.88, 2.75 and 5.4 years for Defence, Health and Education, respectively. Therefore, accounting for spatial dependencies influences the results and implied speeds of convergence.

Previous research in political science and international politics has suggested that as the number of neighbours a country has increases, so does the likelihood of country’s involvement in a violent conflict (Russett, 1967; Vasquez, 1995). Although a common border is not the only condition for the outbreak of war or conflict it is an important factor. As the risk of war increases for a country the expenditures on defence are expected to rise and vice-versa. This emphasizes the importance of spatial effects in the literature on defence expenditures and economic growth as demonstrated recently in the research by Yildirim and Ocal (2016). It may be argued that common borders in a similar vein facilitate health and education expenditures. Countries sharing a border may have a more similar education and health system given their geographical and historical relationship. Indeed, some authors argue that EU economic integration leads to convergence in various sectors, and find health sector to be one of these (as found in Hitiris and Nixon, 2001 and Panopoulou and Pantelidis, 2012). The literature on health economics stresses various reasons why there might be spatial dependence connected to local and/or regional health care spending (see, for example, Moscone and Knapp, 2005, Revelli, 2006 and Moscone et al., 2007). This happens because local authorities tend to mimic activities and expenditures of their neighbours in cases of especially good performance and, moreover, contiguous authorities share common observable and unobservable characteristics and react to common policy environments. We argue that similar factors are important at the country level also, as confirmed by our empirical results. As for education expenditures, one of the reasons for the existence of educational spillovers among neighbouring countries is that school expenditures occurring in one country provide benefits to other countries via the migration of educated population. Likewise, school expenditures of one country may influence the utilities of residents of other countries because children grow up and move outside the country in which they once attended school.

As a robustness check we test different spatial weights matrices. We, hence, additionally use 1- and 5-nearest neighbours row-standardised spatial weights matrix, and also inverse distance squared spatial weights matrix. The results remain largely similar, with the exception that in some cases spatial aspect becomes important for General public services

and Recreation, culture and religion function also. In addition, we also test convergence using five lags instead of just one for each function. In this case the number of observations decreases to 165, while the main conclusions do not change significantly. All of the robustness tests are unreported but available upon request.

Conclusions

This paper investigates whether there is convergence in the functional distribution of government expenditures in EU15. This sample of countries is chosen as they can be considered structurally similar and convergence likely to exist. The adopted methodology extends traditional a-spatial approach to assessing convergence in that it specifies the model more accurately and applies spatial econometrics techniques to estimate it. There are indeed reasons to believe that the omission of a space dimension from the analysis of the β -convergence of government expenditures composition by functions is likely to produce biased results. The proximity and numerous linkages between neighbouring EU countries imply that the size and the structure of their fiscal variables are likely to be interdependent. Moreover, given that EU countries are to accept a single model of fiscal policy, their spending structures should be converging. Combined with the fixed effects estimation technique, the approach adopted in this paper allows the treatment of both the unexplained heterogeneity and spatial dependence. This paper, therefore, contributes to a better understanding of the determinants of certain expenditure functions that can be attributable to other countries.

The main result and implication of this paper is that accounting for spatial issues is indeed important. It changes the estimates of the speed of convergence, and is especially important for the following functions: Defence, Health and Education. More precisely, we find that half-life convergence for Defence is 6.37 years, for Health 3.11 years and for Education 5 years.

With reference to possible future line of investigation, we first point to a conceptual issue related to the data used in this paper. Namely, we employed the data on various types of government expenditures that were available through official international databases. While our aim was to obtain the data on various types of government expenditure expressed as a share of *total general government expenditures*, the (non)availability of data left us no other choice but to employ the data expressed as a share of general government *final consumption*. The former, however, captures the total size of government more accurately. Namely, apart from government final consumption, it also includes gross capital formation and transfer payments.

Another issue related to the data availability refers to a relatively short time span of the data under investigation. Namely, a study of convergence would unquestionably benefit from a longer time dimension of data. Unfortunately, to the best of our knowledge, such long data set covering EU countries has not been used in any other study.

Another venue for the extension of our paper includes an investigation of assessing other types of convergence. While the concepts of β -convergence and σ -convergence are closely related, β -convergence is necessary but not sufficient for σ -convergence. Intuitively, this is either because economies can converge towards one another but random shocks push them apart or because, in the case of conditional β -convergence, economies can converge

towards different steady-states. This and a number of other limitations of the β -convergence approach suggest that the concept of σ -convergence is more revealing of the reality (Monfort, 2008). Likewise, spatial heterogeneity could be related to the concept of convergence clubs, which accounts for the possibility of multiple, locally stable, steady-state equilibrium to which economies with similar fundamentals converge (Durlauf and Johnson, 1995). This is where we envisage a potential extension of our research.

Finally, although our results confirm the existence of convergence of defence, health and education expenditures in EU15 it does not necessarily have to lead to convergence in defence, health and education outcomes. The number of papers dealing with these issues, i.e. investigating efficiency of government spending by components is increasing (see, for example Obadić and Aristovnik, 2011; Aristovnik, 2012a; Aristovnik, 2012b); however, more work needs to be done in this area. This is where we see another extension of our work.

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References

- Abreu, M., De Groot, H. and Florax, M., 2004. *Space and growth: A survey of empirical evidence and methods*. Tinbergen Institute Discussion Paper TI 04-129/3.
- Afexentiou, P. and Apostolos, S., 1996. Government Expenditures in the European Union: Do they converge or follow Wagner's law?. *International Economic Journal*, 10(3), pp. 33-47.
- Annala, C., 2003. Have state and local fiscal policies become more alike? Evidence of beta convergence among fiscal policy variables. *Public Finance Review*, 31(2), pp. 144-165.
- Apergis, N., Christou, C. and Hassapis, C., 2013. Convergence in public expenditures across EU countries: evidence from club convergence. *Economics and Finance Research*, 1(1), pp. 45-59.
- Arbia, G. and Piras, G., 2005. Convergence in per-capita GDP across EU-NUTS2 regions using panel data models extended to spatial autocorrelations effects. *Statistica*, 67(2), pp. 157-172.
- Aristovnik, A., 2012a. Measuring relative efficiency in health and education sector: the case of East European countries. *Actual problems of economics*, 136(10), pp. 305-314.
- Aristovnik, A., 2012b. The relative efficiency of education and R&D expenditures in the new EU member states. *Journal of business economics and management*, 13(5), pp. 832-848.
- Case, A. C., Hines, J. and Rosen, H. S., 1993. Budget spillovers and fiscal policy interdependence. *Journal of Public Economics*, 52(3), pp. 285-307.
- Conley, T.G., and Ligon, E., 2002. Economic distance and cross-county spillovers. *Journal of Economic Growth*, 7(2), pp. 157-87.

- Coughlin, C., Garret, T. and Hernandez-Murillo, R., 2007. Spatial Dependence in Models of State Fiscal Policy Convergence. *Public Finance Review*, 35(3), pp. 361-384.
- Durlauf, S. N. and Johnson, P., 1995. Multiple Regimes and Cross-Country Growth Behaviour. *Journal of Applied Econometrics*, 10(4), pp. 365-84.
- Ferreiro, J., Carrasco, C. and Gomez, C., 2014. Convergence of Public Expenditures and Implementation of a Single Model of Public Finances in the European Union. *Revista de Economia Mundial*, 37(May-August), pp. 75-102.
- Ferreiro, J., Garcia-del-Valle, M.T. and Gomez, C., 2013. An Analysis of the Convergence of the Composition of Public Expenditures in European Union Countries. *American Journal of Economics and Sociology*, 72(4), pp. 799-825.
- Hitiris, T. and Nixon, J., 2001. Convergence of health care expenditure in the EU countries. *Applied Economics Letters*, 8(4), pp. 223-228.
- Islam, N., 2003. What Have We Learnt from the Convergence Debate?. *Journal of Economic Surveys*, 17(3), pp. 309-362.
- Le Gallo, J., 2004. Space-time analysis of GDP disparities among European regions: A Markov chains approach. *International Regional Science Review*, 27(2), pp. 138-63.
- LeSage J.P. and Pace R.K., 2009. *Introduction to Spatial Econometrics*. s.l: Chapman and Hall/CRC.
- Monfort, P., 2008. *Convergence of EU Regions: Measures and Evolution. European Union, the Directorate-General for Regional Policy. Working Paper 1/2008*.
- Moscone, F. and Knapp, M., 2005. Exploring the spatial pattern of mental health expenditure. *The Journal of Mental Health Policy and Economics*, 8(4), pp. 205-217.
- Moscone, F., Knapp, M. and Tosetti, E., 2007. Mental health expenditure in England: a spatial panel approach. *Journal of Health Economics*, 26(4), pp. 842-864.
- Nixon, J., 2000. *Convergence of health care spending and health outcomes in the European Union, 1960-1995, University of York, Centre for health economics, Discussion paper 183*.
- Panopoulou, E. and Pantelidis, T., 2012. Convergence in per capita health expenditures and health outcomes in the OECD countries. *Applied economics*, 44(30), pp. 3909-3920.
- Phillips, P. C. B. and Sul, D., 2007. Transition modeling and econometric convergence tests. *Econometrica*, 75(6), pp. 1771-1855.
- Revelli, F., 2006. Performance rating and yardstick competition in social service provision. *Journal of Public Economics*, 90(3), pp. 459-475.
- Rey, S.J., and B.D. Montouri., 1999. U.S. regional income convergence: A spatial econometric perspective. *Regional Studies*, 33(2), pp. 143-56.
- Russett, B. M., 1967. *International Regions and the International System: A Study in Political Ecology*. Chicago: Rand-McNally.
- Sanz I. and Velazquez, F.J., 2001. *The evolution and convergence of the government expenditure composition in the OECD countries: an analysis of the functional distribution*. European Economy Group, Universidad Complutense de Madrid, Working Paper 9/2001.
- Sanz, I. and Velazquez, F.J., 2004. The Evolution and Convergence of the Government Expenditure Composition in the OECD Countries. *Public Choice*, 119(1-2), pp. 61-72.

- Scully, G., 1991. The convergence of fiscal regimes and the decline of the Tiebout effect. *Public Choice*, 72(1), pp. 51-59.
- Skidmore D., Toya, H. and Merriman, D., 2004. Convergence in Government Spending: Theory and Cross-Country Evidence. *Kyklos*, 57(4), pp. 587-619.
- Solow, R., 1956. A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics*, 70(1), pp. 65-94.
- United Nations Statistics Division, 2015. *Government final consumption expenditure by function at current prices*. [online] Available at: <http://data.un.org/Data.aspx?q=government+expenditure&d=SNA&f=group_code%3a301> [Accessed 15 November 2015].
- Vasquez, J. A., 1995. Why Do Neighbours Fight? Proximity, Interaction, or Territoriality. *Journal of Peace Research*, 32(3), pp. 277-293.
- Yildirim, J. and Ocal, N., 2016. Military expenditures, economic growth and spatial spillovers. *Defence and Peace Economics*, 27(1), pp.87-104.