

# **An analysis of the convergence of the composition of public expenditures in EU countries**

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## **Abstract:**

The economic literature on fiscal policies is paying increasing attention to the impact of the composition of public expenditures on long-term economic growth. Public policy endogenous growth models recommend to change the composition of public expenditures to items considered as productive expenditures. Based on these models, European institutions are encouraging the rise in the share of some of these outlays, like public investments, R&D, active labour market policies, etc. The paper analyses whether these recommendations are followed by EU countries and whether a convergence to a new pattern of public finances with a higher share of productive expenditures in these countries is arising in the European Union.

**Key words:** Public expenditures, European Union, convergence, quality of public finances

# **An analysis of the convergence of the composition of public expenditures in EU countries**

## **1. Introduction**

The European Monetary Union (EMU) approach to economic policy requires its Member states to implement an orthodox strategy of macroeconomic policy that gives a special role to monetary policy, while at the same time downgrades fiscal policy. Fiscal policy in EMU is determined by the Maastricht Treaty and the Stability and Growth Pact (SGP); these require national fiscal policies in the eurozone and in candidate countries to avoid excessive fiscal deficits (fiscal deficits below 3% GDP and stocks of public debt below 60% GDP) and, simultaneously, to reduce the size of public sectors.

These principles are based on a theoretical background according to which fiscal policy cannot affect the economic activity in the long-run (as measured by potential output). An active fiscal policy can only be implemented on a short-term basis, correcting cyclical disequilibria through the working of built-in stabilizers. The long-term effects would arise from the so-called non-Keynesian effects of fiscal policy. The literature about the non-Keynesian effects of fiscal policy has given rise to the development of a number of studies focusing on the expansionary impact of fiscal consolidation.

For the orthodox view, demand-side policies do not affect economic activity in the long run, that is, fiscal policy does not influence the path of potential output. However, recently fiscal policy is gaining relevance. The Lisbon Strategy, the current Broad Economic Policy Guidelines (BEPG) and the reformed SGP accept the potential positive impact that fiscal policy can have on economic activity in the long-run, both in terms of the level and the long-term rate of growth of the potential output. This impact would come from the composition of public expenditures. Thus, the share of 'productive' expenditures should be increased.

This strategy should have generated a convergence in national fiscal policies, both in the sign (and size) of fiscal imbalances, in the size of public revenues and spending and in the composition of these items. Fiscal rules arising from the Maastricht Treaty and the

Stability and Growth Pact seem to have led to a convergence of public imbalances, the size of public deficits and the stock of public debt, but the outcome is not so evident in the case of the size of public sectors and in the composition of public expenditures. In the latter case, although some studies support the hypothesis of convergence in the composition of public expenditures (European Commission, Directorate-General for Economic and Financial Affairs, 2002; Sanz and Velazquez, 2004) other argue that either there is no convergence or, at best, the convergence is quite limited (Ferreiro et al forthcoming; Starke et al, 2008)

The paper analyses whether there is a generalized change in the composition of public expenditures towards those productive public expenditure in EU. With this aim, we analyse the composition of public expenditure in the EU countries for the periods 1990-98 and after 1999. Using Tukey box-plots we analyse whether the composition of public expenditures is converging in the EU countries and whether this convergence involve a higher share of productive expenditures.

The paper structures as follows. The next section explores the theoretical basis of the fiscal policy in the EU. Section 3 discusses the evolution of the composition of public expenditure in EU countries, focusing the analysis on the evolution of those items that are defined in the literature as productive public spending. Section 4 analyses the convergence in the composition of public expenditures by means of a cluster analysis. Final section summarizes and concludes.

## **2. The role of fiscal policy in the European Union: theoretical bases**

The European Monetary Union has involved the implementation of a strategy of macroeconomic policy that gives a special role to monetary policy, downgrading fiscal policy to a secondary role, always subordinated to monetary policy. Fiscal policy is, thereby, focused on the generation and maintenance of the right environment for the effective working of monetary policy.

These theoretical foundations have led to a fiscal policy set by the rules and norms set in the Maastricht Treaty and the Stability and Growth Pact. In this sense, the working of national fiscal policies in the EU is based on the following principles:

- i) The implementation of sound and sustainable fiscal policies.
- ii) The reduction of the size of public deficits and the stocks of public debt.
- iii) The reduction of the size of public expenditure and taxation.

According to this approach, fiscal policy only affects economic activity in the short run. However, fiscal policy does not generate effects on the long run, that is, it can not affect the potential output. The long-term effects of fiscal policy would arise from the non-Keynesian effects of fiscal policy. One of the main conclusions of this approach is that fiscal consolidation has an expansionary impact on the economic activity both in the short-term and in the long-term (Afonso, 2001, 2006; Alesina and Perotti, 1995, 1997; Alesina et al, 2002; Alesina, Perotti and Tavares, 1998; Briotti, 2004, 2005; European Commission, Directorate-General for Economic and Financial Affairs, 2003, 2004, 2007; Giavazzi, Japelli and Pagano, 1999, 2000; Giavazzi and Pagano, 1990; Giudice, G., Turrini, A. and in't Veld, J., 2003, 2007; Hemming et al, 2002; Kumar, Leigh and Plekhanov, 2007; McDermott and Wescott, 1996; van Aarle and Garretsen, 2003).

Thus, fiscal policy in the European Union plays a passive role, subordinated to the monetary policy of the ECB. The objective of fiscal policy is the creation of a sound economic environment via the reduction-removal of fiscal imbalances that gives rise to low inflation rates and that helps to an effective working of the monetary policy of the European Central Bank. Moreover, the counter-cyclical fiscal policy must be only based on the working of built-in stabilizers, and, consequently, only cyclical fiscal deficit are allowed, although with a size below 3% GDP<sup>1</sup>.

This view about the fiscal policy is based on the axiom that demand-side policies do not affect the economic activity in the long-run, that is, that fiscal policy does not influence the path of potential output. However, fiscal policy is currently gaining relevance in the EU putting the issue of the quality of public finances at the core of fiscal policies (Deroose and Kastrop, 2008; European Commission, Directorate-General for Economic and Financial Affairs, 2008). The Lisbon Strategy and the current Broad Economic Policy Guidelines (BEPG) accept the positive impact that the fiscal policy can have in the long-run, both in terms of the level and the rate of growth of potential output. This

impact would come from the composition of public expenditure, not from the size of public expenditures or revenues or from the fiscal balance.

These arguments are now being accepted by the European institutions<sup>2</sup>. For the Commission and the ECOFIN Council, public budgets can contribute to foster economic growth and employment through three channels: “supporting a stable macroeconomic framework via sound public finances, making tax and benefit systems more employment friendly and redirecting public expenditures towards physical and human capital accumulation.” (Council of the European Union, 2001, p. 1). The Broad Economic Policy Guidelines for the 2005-08 period states in the guideline three that “To promote a growth- and employment-orientated and efficient allocation of resources Member States should, without prejudice to guidelines on economic stability and sustainability, re-direct the composition of public expenditure towards growth-enhancing categories in line with Lisbon strategy (...) This can be achieved by redirecting expenditure towards growth-enhancing categories such as research and development (R&D), physical infrastructure, environmental friendly technologies, human capital and knowledge” (European Commission, 2005, p. 41).

The reformed SGP states that the Commission’s Report that must evaluate the existence of an excessive deficit “shall appropriately reflect developments in the medium-term economic position (in particular potential growth, prevailing cyclical conditions, the *implementation of policies in the context of the Lisbon agenda and policies to foster research and development and innovation*) and developments in the medium-term budgetary position (in particular, fiscal consolidation efforts in “good times”, debt sustainability, *public investment and the overall quality of public finances*)”<sup>3</sup>.

The public-policy endogenous growth models (PPEGMs) are the theoretical basis of this new fiscal policy strategy. These models are an extension of the endogenous growth theory, according to which the economic growth is determined by the accumulation of productive factors and by technical progress (Barro, 1990; Barro and Sala-i-Martin, 1995; Grossman and Helpman, 1991; Jones, 1995; Lucas, 1988; Rebelo, 1991; Romer, 1986, 1990). These models focus on the role that fiscal policy can play in enhancing economic growth: shifting the revenue stance away from distortionary forms of taxation and towards non-distortionary forms, and switching expenditures from unproductive to

productive forms are growth-enhancing (Angelopoulos et al, 2006; Aschauer, 1989; Barro, 1990, 1991; Baier and Glomm, 2001; Barro and Sala-i-Martin, 1995; Devarajan et al, 1996; Gemmel and Kneller, 2001; Gupta et al, 2005; King and Rebelo, 1990; Kneller et al, 1999, 2001; Kocherlatoky and Yi, 1997; Romero de Avila and Strauch, 2003; Zagler and Dürnecker, 2003).

PPEG models define as 'productive' expenditures those that, by complementing private sector production and generating positive externalities to firms, have a positive effect on the marginal productivity of capital and labour, and 'unproductive' expenditures would be those that give direct utility to households (Angelopoulos, Economides and Kamman, 2006; Devarajan et al, 1996; European Commission, Directorate-General for Economic and Financial Affairs, 2004).

Although the empirical evidence is mixed, for a number of studies 'productive' expenditures include the following outlays: public investment, R&D, education, active labour market policies, health, defence, public order and general administrative costs, transport and communication (Afonso et al 2005; Afonso and González Alegre, 2008; Angelopoulos et al 2006; Aschauer, 1989; Atkinson and van den Noord, 2001; Barro, 1990, 1991; Bleaney et al, 2001; Bloom et al, 2001; Devarajan et al, 1996; Easterly and Rebelo, 1993; Gemmel and Kneller, 2001; Kneller et al, 1999, 2001; Lamo and Strauch, 2002; Nourzad and Vrieze, 1995; Romero de Avila and Strauch, 2003; Sanchez-Robles, 1998; Thöne, 2003).

However, empirical studies show that the impact of public expenditures depends on the kind of taxation (distortionary or a non-distortionary) that finances that expenditure (Kneller et al, 1999, 2001; Kocherlatoky and Yi, 1997; Romero de Avila and Strauch, 2003). Another caveat is the existence of non-linear relations between economic growth and the size of public spending (Cameron, 1978). Thus, although public spending may have a positive impact on growth, the trend reverse expenditure exceeds a certain threshold, being this limit different for each type of spending (European Commission, Directorate-General for Economic and Financial Affairs, 2002; Gupta et al, 2005).

Finally, empirical studies face additional problems. First, national statistics on government outlays are not fully comparable (Florio, 2001). Second, the theoretical

classification of public outlays into 'productive' or 'unproductive' is not available at macroeconomic level. This forces to use data coming from national accounts, either on the basis of the economic or the functional classification, and to assume that in each case all the spending in a certain category is either productive or unproductive (European Commission, Directorate-General for Economic and Financial Affairs, 2004). Finally, the current level of aggregation of public expenditures, both in the functional-COFOG and the economic classifications, is too high for a right assessment of the impact of specific outlays on economic growth (Deroose and Kastrop, 2008).

### **3. An analysis of the convergence in the size and composition of public expenditure in EU countries**

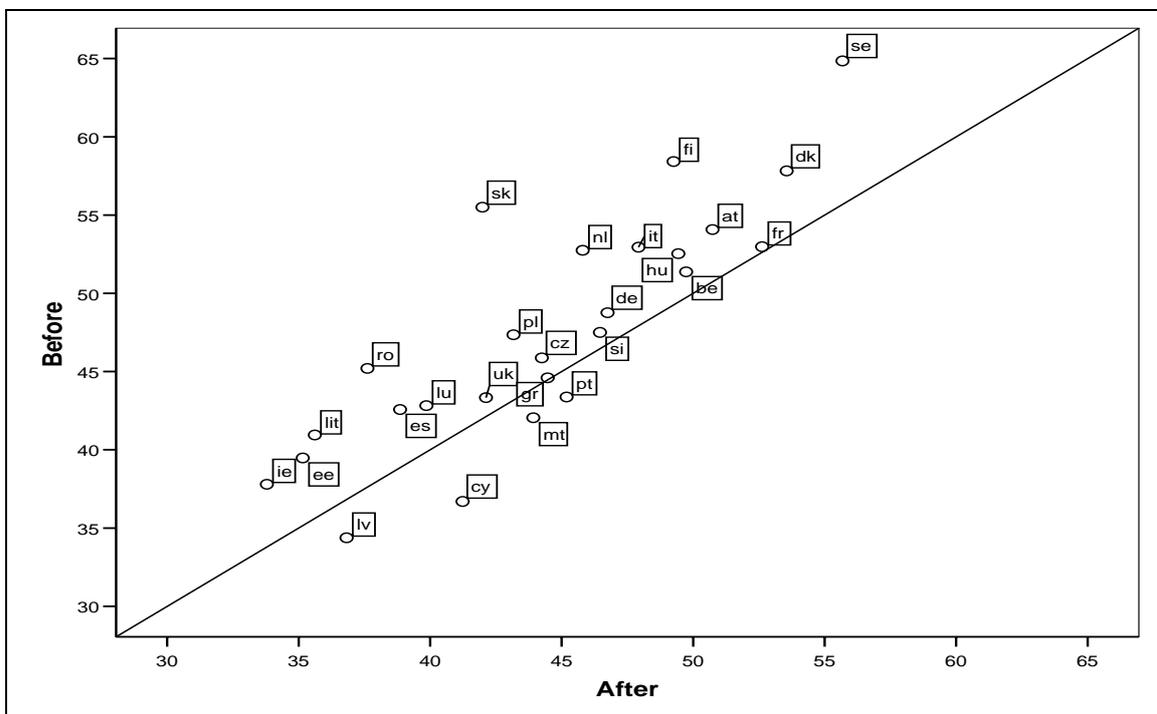
The objective of the next sections is to analyse whether EU countries have converged in the composition of their public expenditures. With this aim, we have compared the evolution of public expenditures between two sub-periods: 1990-98 (the sub-period called "before" EMU) and 1999-07 ("after" EMU). In order to avoid business cycle effects on public expenditures and expenditure composition we have calculated the average size and the composition of public spending for each of the two sub-periods analysed. Data on economic expenditures, both for the size of public expenditures (as a percentage of GDP) and for the composition of public expenditures (COFOG and economic classification) have been obtained from the Eurostat Government Finance Statistics at the Eurostat website.

The first analysis of the convergence of public expenditures will be carried out using statistical measures of dispersion and boxplots<sup>4</sup>. A convergence process in fiscal variables involves that after EMU, the member states have a more similar percentage in each item than that existing in the period before EMU. Therefore, we study whether the dispersion of each item has diminished comparing to the period before EMU. We use in our analysis two measures of dispersion: standard deviation and interquartile range. The standard deviation is a good measure of dispersion when there are not outliers. The interquartile range is a robust measure, since it is not affected by outliers. Standard deviation explains the dispersion of the whole distribution. Interquartile range only explains 50% of the cases. The information provided by both measures is completed with boxplots.

### 3.1. Is the size of public expenditures converging in EU countries?

As figure 1 shows the size of public expenditures has fallen in 22 out of the 26 countries analysed. This evolution is in accordance to the view, previously analysed, that a fall in the size of public sector has a positive impact on economic growth. Nonetheless, this fall does not mean necessarily that public expenditures are converging in the European Union.

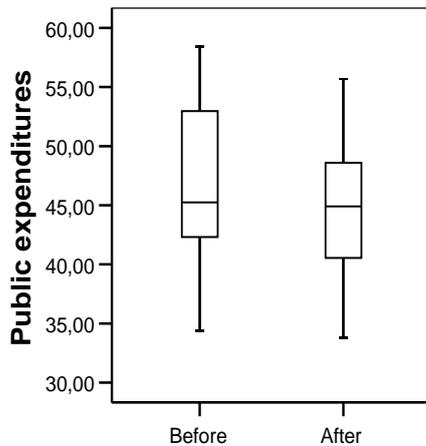
Figure 1. Evolution of the size of public expenditures (% GDP)



Source: our calculations

To reach a conclusion about this behaviour, we have made a box-plot analysis. In this sense, we can talk of convergence when we detect a lower standard deviation and a lower interquartile range. Figure 2 shows clearly that public expenditures are converging in the EU to a lower percentage of the respective domestic GDPs<sup>5</sup>.

Figure 2. Box plot of the size of public expenditures (%GDP)



### 3.2. Is the composition of public expenditures converging in EU countries?

The composition of public expenditures has been analysed in terms on the economic and functional (GOFOG) classifications. In both cases, the source of data is the same: the Eurostat Government Finance Statistics. Unfortunately, not all EU countries have available data before 1999, and, consequently, these countries have been excluded from the analysis. Furthermore, the period for which data are available in the two subperiods (26 countries for the economic classification and 20 countries for the functional classification) is not the same for all the countries<sup>6</sup>. Nonetheless, in as much we are calculating the average for the two sub-periods this problem does not affect to the outcome.

If EU countries had implemented the recommendations from the PPEGMs, the shares of those public expenditures considered as productive expenditures should have increased, and viceversa. Although the theoretical distinction between productive and unproductive might be clear, however, as we mentioned in previous sections, the definition of a specific public expenditure as productive or unproductive must be taken with caveats. Nonetheless, based on theoretical and empirical studies, we have considered as productive expenditures the following items:

- in the functional classification: defence, public order and safety, economic affairs (includes sectorial R&D and transport and communication),

environmental protection, housing and community amenities, health and education;

- in the economic classification: capital transfers and gross capital formation

Table 1 and 2 shows the evolution of the different categories of public expenditures in both kinds of classification. These show the change in the shares of each kind of expenditure as a percentage of total public expenditure. As can be seen, the picture is not clear and we can not pose the existence of a common pattern for all the EU countries or even for a single country. Furthermore, the conclusion would be dependent on the initial size/share of each kind of expenditure.

In any case, since our main interest focus on the hypothesis of a convergence in the public expenditures composition, we have analysed in this section that pattern of behaviour by means of statistical measures of dispersion and of boxplots (tables 3 and 4 and figures 3 and 4). The analysis of the boxplots and, mainly, of the standard deviations (columns 5, 6 and 7 of tables 3 and 4) and the interquartile ranges (columns 8, 9 and 10 of tables 3 and 4) allows to reach a significant number of conclusions about the convergence process that might be taken place in some items of public expenditure, both in terms of the economic and the functional classifications.

Table 1. Evolution of the composition of public expenditures. Functional (COFOG) classification

	<b>INCREASE</b>	<b>DECLINE</b>
<b>General public services</b>	Czech Republic, Malta, Finland	Belgica, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Netherland, Austria, Portugal, Sweden, United Kingdom
<b>Defence</b>	Estonia, Italy, Latvia	Belgium, Czech Republic, Germany, Ireland, Greece, Spain, France, Cyprus, Luxembourg, Malta, Portugal, Finland, Sweden, United Kingdom
<b>Public order and safety</b>	Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Netherland, Austria	Estonia, Cyprus, Latvia, Malta, Portugal, Finland, Sweden, United Kingdom
<b>Economic affairs</b>	Belgium, Estonia, Ireland, Greece, Spain, Netherlands, Austria, Sweden	Czech Republic, Denmark, Germany, France, Italy, Luxembourg, Malta, Portugal, Finland, United Kingdom, Cyprus, Latvia
<b>Enviroment protection</b>	United Kingdom, Cyprus, Latvia, Sweden, Finland, Belgium, Denmark, Estonia, Ireland, Greece, Spain, France, Italy, Netherland, Portugal	Czech Republic, Germany, Malta, Austria, Luxembourg
<b>Housing and comunities amenities</b>	Belgium, Germany, Ireland, Greece, Spain, France, Italy, Latvia	United Kingdom, Sweden, Finland, Czech Republic, Denmark, Estonia, Cyprus, Luxembourg, Malta, Netherland, Austria, Portugal
<b>Health</b>	Finland, Sweden, United Kingdom, Belgium, Czech Republic, Denmark, Germany, Ireland, Greece, Spain, Italy, Latvia, Malta, Netherland, Portugal, France	Estonia, Cyprus, Luxembourg, Austria
<b>Recreation, culture and religion</b>	United Kingdom, Finland, Belgium, Czech Republic, Denmark, Estonia, Ireland, Greece, Spain, France, Italy, Latvia, Portugal, Luxembourg	Sweden, Germany
<b>Education</b>	Portugal, Austria, Finland, Sweden, United Kingdom, Belgium, Czech Republic, Denmark, Germany, Ireland, Spain, Italy, Cyprus, Latvia, Luxembourg, Netherlands	Estonia, Greece, France, Malta
<b>Social protection</b>	Sweden, Belgium, Czech Republic, Denmark, Germany, Estonia, France, Italy, Cyprus, Luxembourg, Austria, Portugal	Finland, United Kingdom, Ireland, Greece, Spain, Latvia, Malta, Netherlands

Source: our calculations

Table 2. Evolution of the composition of public expenditures. Economic classification

	<b>INCREASE</b>	<b>DECLINE</b>
<b>Intermediate consumption</b>	Belgium, Czech Republic, Denmark, Germany, Ireland, Greece, Spain, Italy, Luxembourg, Netherlands, Poland, Romania, Finland, Sweden, United Kingdom	Estonia, France, Cyprus, Latvia, Lithuania, Hungary, Malta, Austria, Slovenia, Slovakia
<b>Compensation of employees</b>	Belgica, Czech Republic, Denmark, Estonia, Ireland, Greece, Spain, France, Italy, Latvia, Lithuania, Hungary, Netherlands, Poland, Portugal, Romania, Slovenia, Slovakia, Sweden	Germany, Cyprus, Luxembourg, Malta, Austria, United Kingdom
<b>Subsidies</b>	Belgium, Denmark, Estonia, Spain, Malta, Slovenia, Slovakia, Sweden	Czech Republic, Germany, Ireland, Greece, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Netherlands, Slovenia, Slovakia, Sweden
<b>Property income</b>	Belgium, Lithuania, Malta, Slovakia,	Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Luxembourg, Hungary, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Finland, Sweden, United Kingdom
<b>Social benefits other than social transfers in kind</b>	Belgium, Czech Republic, Germany, Estonia, Greece, Italy, Cyprus, Hungary, Austria, Poland, Portugal, Romania, Slovakia, United Kingdom, Lithuania, Luxembourg	Denmark, Ireland, Spain, France, Latvia, Malta, Netherlands, Finland, Sweden, United Kingdom
<b>Social transfers in kind</b>	Belgium, Czech Republic, Denmark, Germany, Estonia, Ireland, Spain, France, Italy, Latvia, Cyprus, Hungary, Luxembourg, Slovenia, Slovakia, Finland, Sweden, Romania, Portugal, Poland, Hungary, Malta, Netherlands, Austria	Lithuania
<b>Other current transfer</b>	Belgium, Czech Republic, Denmark, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Slovenia, Slovakia, Finland, Sweden, United Kingdom	Germany, Romania
<b>Capital transfers</b>	Belgium, Estonia, Ireland, Italy, Cyprus, Latvia, Luxembourg, Malta, Austria	Czech Republic, Denmark, Germany, Greece, Spain, France, Lithuania, Hungary, Netherlands, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, United Kingdom
<b>Gross capital formation and adquisitions less disposals of non-financial assets</b>	Belgium, Denmark, Ireland, Greece, Spain, Latvia, Lithuania, Hungary, Malta, Netherlands, Poland, Romania, Slovenia, Sweden	Czech Republic, Germany, Estonia, France, Italy, Cyprus, Luxembourg, Austria, Portugal, Slovakia, Finland, United Kingdom

Source: our calculations

Table 3. Measures of dispersion of the composition of public expenditures. Economic classification

	Mean		Median		Standard deviation		(7=5/6)*100	Interquartile range		(10=8/9)
	after (1)	before (2)	after (3)	before (4)	after (5)	before (6)		after (8)	before (9)	
Intermediate consumption	13.75	12.83	12.64	11.89	4.91	5.14	95.66	7.80	5.48	142.23
Compensation of employees	25.48	25.24	25.65	25.29	5.08	5.13	99.05	7.32	5.92	123.62
Subsidies	3.04	3.52	2.83	3.14	1.39	1.41	98.47	1.50	2.48	60.20
Property income	5.88	9.29	5.83	8.13	3.26	6.17	52.87	3.73	7.38	50.49
Social benefits other than sbk	30.93	30.50	30.42	30.87	4.08	3.78	108.09	6.94	5.71	121.59
Social benefits in kind	6.65	5.23	5.28	3.44	5.48	4.76	115.07	9.95	8.35	119.21
Other current transfers	4.53	3.34	4.40	3.44	1.50	1.31	114.10	2.28	1.75	130.28
Capital transfers	2.81	3.30	2.77	2.83	1.68	2.66	63.03	2.32	2.00	115.85
Gross capital formation	6.61	6.56	6.72	5.91	2.87	2.47	115.94	5.46	3.82	142.76

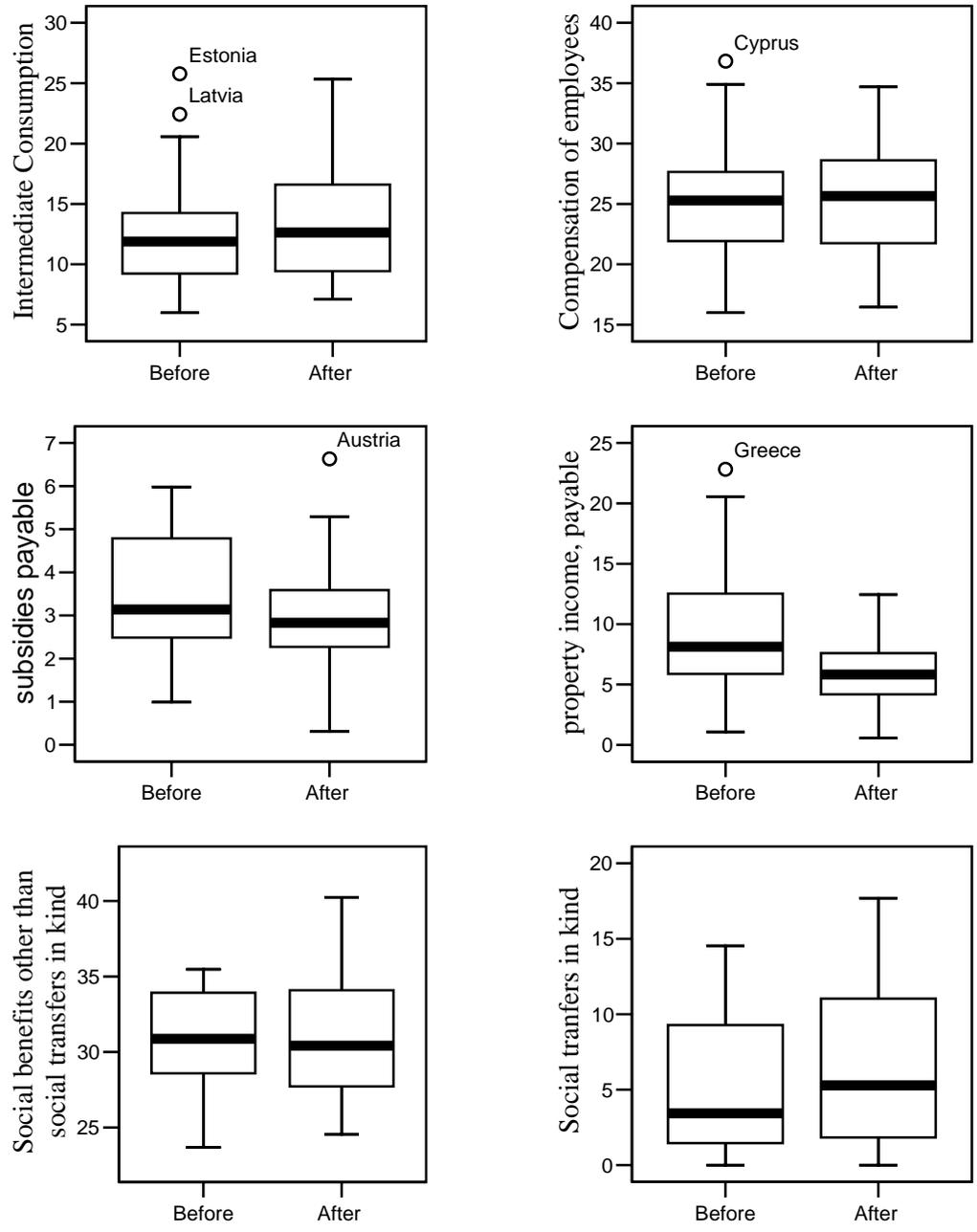
Source: our calculations

Table 4. Measures of dispersion of the composition of public expenditures. Functional classification

	Mean		Median		Standard deviation		(7=5/6)*100	Interquartile range		(10=8/9)
	after (1)	before (2)	after (3)	before (4)	after (5)	before (6)		after (8)	before (9)	
General public services	14.77	17.60	14.22	16.82	3.67	6.22	58.95	4.90	7.75	63.23
Defence	3.27	3.59	3.11	3.25	1.48	1.73	85.61	1.44	1.69	84.82
Public order and safety	3.86	3.70	3.65	3.58	1.40	1.70	82.31	2.43	2.63	92.36
Economic affairs	10.58	11.30	10.64	10.95	3.05	3.99	76.50	3.63	3.81	95.31
Environmental protection	1.55	1.44	1.53	1.30	0.64	0.76	84.53	0.97	0.91	106.55
Housing	2.10	2.44	1.98	2.13	1.13	1.38	82.22	1.30	1.27	102.64
Health	12.78	10.96	13.11	11.73	2.71	2.54	106.71	2.09	2.35	88.99
Recreation	2.61	2.30	2.44	2.25	1.21	1.07	112.96	1.24	1.04	119.15
Education	12.58	11.89	12.05	11.45	2.89	2.79	103.50	3.53	2.76	127.72
Social protection	35.89	34.80	36.95	34.57	6.18	6.05	102.20	10.86	10.03	108.21

Source: our calculations

Figure 3. Box-plots of the dispersion of public expenditures. Economic classification (in percentage of total public expenditure)



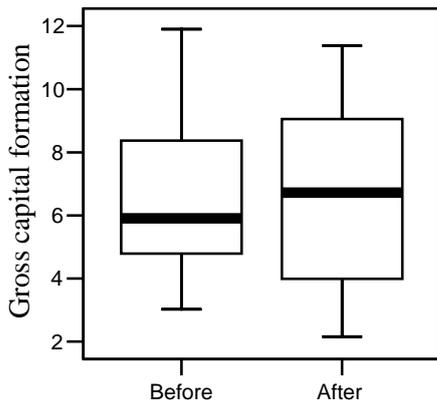
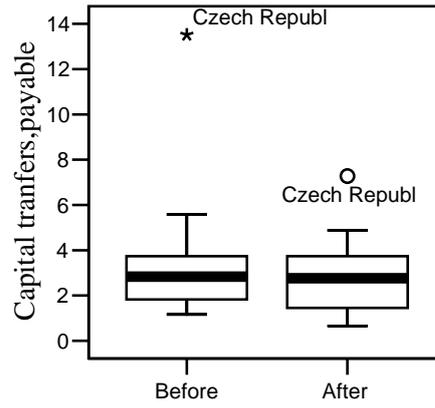
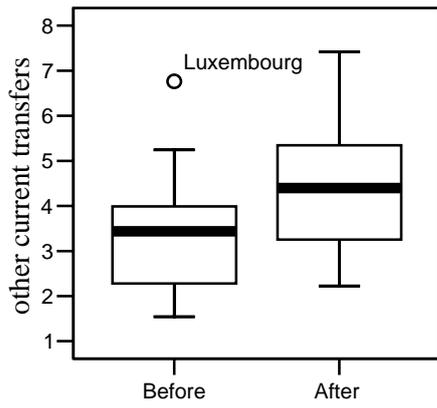
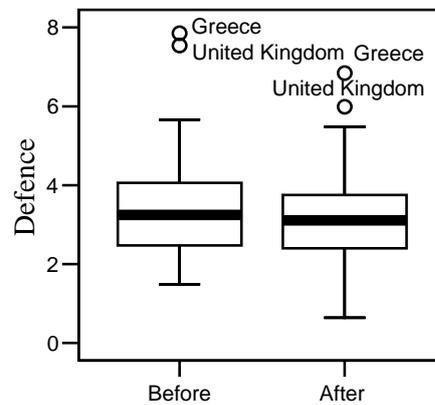
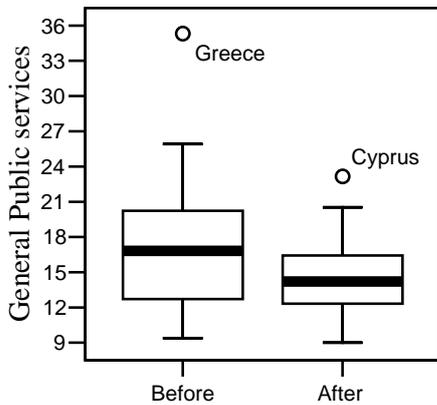
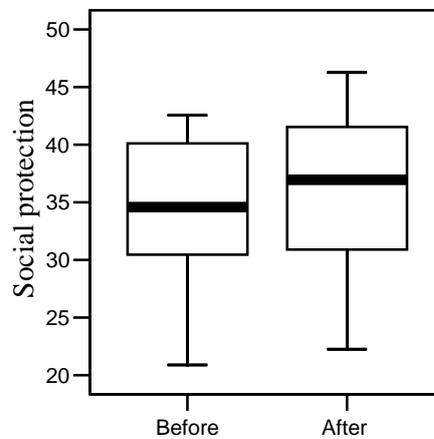
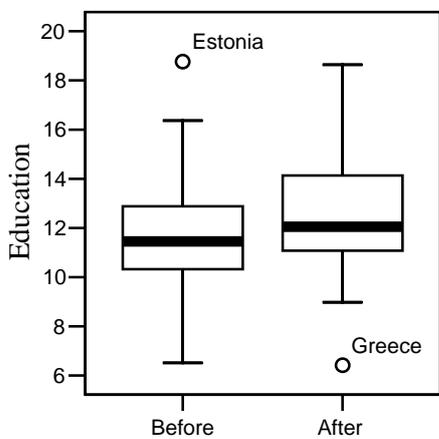
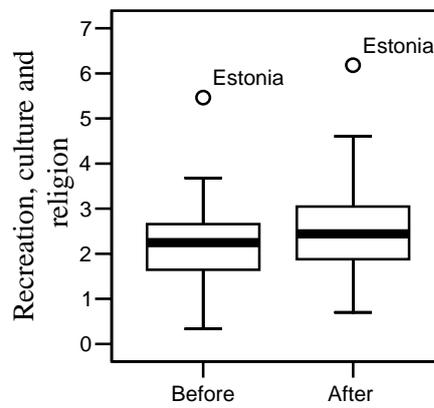
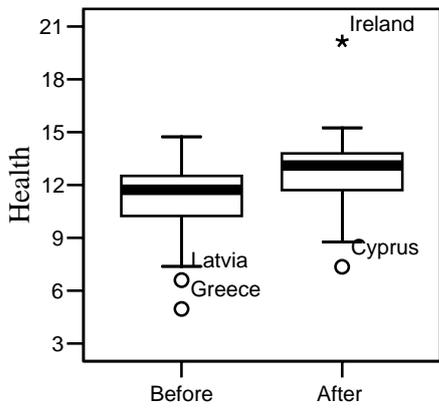
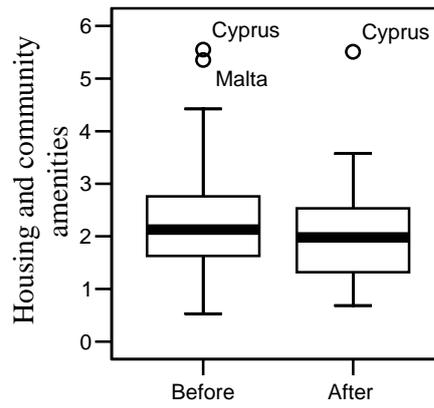
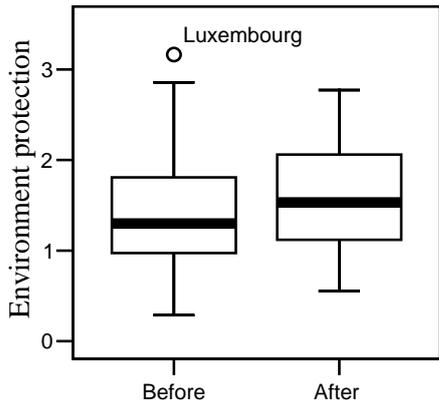
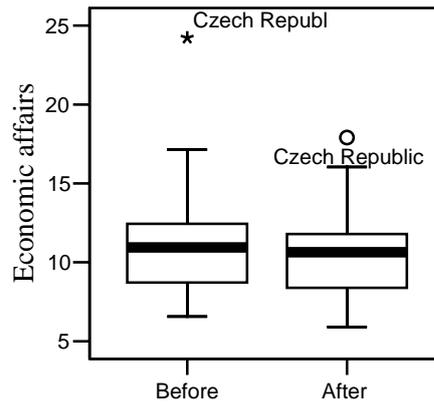
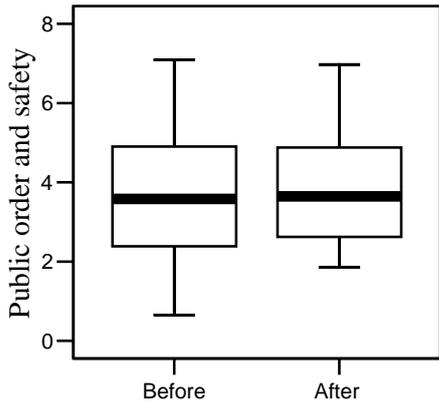


Figure 4. Box-plots of the dispersion of public expenditures. COFOG classification (in percentage of total public expenditure)





If we identify convergence with a reduction in standard deviation, in interquartile range and in the upper and lower adjacent values, we can detect in terms of the economic classification a convergence process to lower shares in the items of subsidies and property income (to lower shares) and a strong divergence in social transfers in kind and other current transfers (to higher shares), in gross capital formation (to similar shares) and in social benefits other than social transfers in kind (although in this case the shares are stable). In the case of intermediate consumption and compensation of employees, the standard deviation falls because the outliers detected disappear: once considered this behaviour, we detect a divergence process to higher shares. Finally in the case of capital transfers, the ruling out of the far outlier hides a diverging process to higher shares of this item.

In terms of the COFOG classification a strong convergence to lower shares is detected in general public services, defence and economic affairs, and to higher shares in public order and safety. On the contrary, a diverging process to higher shares is detected in recreation, culture and religion, education and social protection. The analysis of the other items is less clear due to the existence of outliers. Nonetheless, the box-plots show a divergence to higher shares in the case of health, and a convergence to lower shares in housing and community amenities and a convergence to higher shares in environment protection.

To conclude, the empirical evidence of a convergence process of the productive items of public expenditure is quite mixed. Having followed the recommendations of the PPEGMs, EU countries should have converged in the composition of public expenditures with an increase in the shares of this kind of expenditures. However, only three categories of productive public expenditures have increased their shares: public order and safety, health and education, and in the two latter a diverging process is detected, sign of a different pace of evolution. Actually, as the box-plots show, only in the case of education a generalized rise is detected, whilst in health the convergence is explained by the increase in the lower adjacent value and the increase in the main is mainly explained by the appearance of a far outlier with the highest share (Ireland).

#### **4. A cluster analysis of the composition of public expenditures in EU Member States**

The previous analysis is now complemented with a cluster analysis of the components of public spending using the economic and the COFOG classification. The existence of a convergence process should have led to a lower number of clusters. To elaborate the clusters and to study their evolution before and after 1999, we have used a cluster analysis, in particular the Ward's criterion (Ward, 1963). To identify cluster of cases we have calculated factor coordinates. Principal component analysis (PCA) gives the more explicative factor of the whole set of countries. An ascending hierarchical classification has been applied to coordinates estimated by PCA using Ward's criterion<sup>7</sup>. Test values<sup>8</sup> show the main features of each cluster (using 5% as critical probability frontier<sup>9</sup>). In the cluster analysis of the economic classification, the data matrix is formed by 20 countries and 10 active variables: the shares as percentage of total public expenditure of the 9 items in this classification plus the size of public expenditure (as percentage of GDP). In the cluster analysis of the COFOG classification, the data matrix is formed by 20 countries and 11 active variables: the shares as percentage of total public expenditure of the 10 items in this classification plus the size of public expenditure (as percentage of GDP).

Table 5. Clusters of EU countries according to the composition of public expenditures

Economic classification

Before EMU	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Countries	Austria, Denmark, Germany, France, Finland, Netherlands, Luxembourg, Sweden	Belgium, Greece, Italy, Ireland, Spain	Czech Republic	Cyprus, Malta, Portugal	Estonia, Latvia, United Kingdom
Significant shares above average	Size public expenditure Social benefits other than stk Subsidies Social transfers in kind	Property income	Capital transfers	Compensation of employees	Intermediate consumption
Significant shares below average		Subsidies		Gross capital formation Social benefits other than stk	Property income Subsidies Size of public expenditure
After EMU	Cluster 1	Cluster 2	Cluster 3	Cluster 4	
Countries	Austria, Czech Republic, Germany, Luxembourg	Belgium, France, Greece, Italy, Malta, Netherlands, Portugal Spain	Cyprus, Denmark, Finland, Sweden, United Kingdom	Estonia, Ireland, Latvia	
Significant shares above average	Size public expenditure Social benefits other than stk Subsidies Social transfers in kind	Property income	Intermediate consumption Compensation of employees	Gross capital formation Intermediate consumption	
Significant shares below average		Other current transfers Intermediate consumption	Capital transfers Social transfers in kind	Social benefits other than stk Property income Size of public expenditure	

COFOG classification

Before EMU	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
Countries	Denmark, Finland, France, Netherlands, Sweden, United Kingdom	Austria, Germany, Luxembourg	Belgium, Ireland, Italy, Portugal, Sweden	Greece	Czech Republic, Malta	Cyprus	Estonia, Latvia
Significant shares above average	Size public expenditures Social protection	Environment protection Social protection	General public services	General public services Defence	Economic affairs Environment protection	Housing s	Education Public order and safety Recreation
Significant shares below average	Environment protection Economic affairs		Social protection	Health		Social protection	Size public expenditures
After EMU	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5		
Countries	Estonia, Latvia, Portugal, United Kingdom	Czech Republic, Ireland, Luxembourg, Malta, Spain	Cyprus	Greece	Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Sweden		
Significant shares above average	Public order and safety Education Recreation	Economic affairs Environment protection Health	General public services Housing and community amenities	Defence	Size public expenditures Social protection		
Significant shares below average	Size public expenditure	Defence Size public expenditures	Health Social protection	Education	Environment protection Public order and safety Economic affairs		

Source: Our calculations

Table 6. Relevant expenditures in the formation of clusters. Economic classification

BEFORE EMU							
Clusters	Variables	Cluster average	Overall average	Cluster standard deviation	Overall standard deviation	Test Value	Probability
Cluster 1	Size public expenditures	52.90	46.89	4.77	7.07	3.03	0.001
	Social benefits other than stk	33.16	30.50	1.88	3.68	2.57	0.005
	Subsidies	4.38	3.52	0.87	1.37	2.23	0.013
	Social tranfers in kind	7.74	5.23	4.55	4.64	1.93	0.027
Cluster 2	Property income	17.33	9.29	4.25	6.02	3.36	0.000
	Subsidies	2.29	3.52	0.69	1.37	-2.26	0.012
Cluster 3	Capital transfers	13.51	3.30		2.66	3.84	0.000
Cluster 4	Compensation of employees	33.78	25.24	3.04	5.00	3.13	0.001
	Social benefits other than stk	25.73	30.50	2.33	3.68	-2.37	0.009
Cluster 5	Intermediate consumption	22.92	12.83	2.15	5.01	3.69	0.000
	Property income	3.73	9.29	2.99	6.02	-1.69	0.045
	Subsidies	2.04	3.52	0.46	1.37	-1.97	0.024
	Size public expenditures	39.06	46.89	3.67	7.07	-2.03	0.021
AFTER EMU							
Clusters	Variables	Cluster average	Overall average	Cluster standard deviation	Overall standard deviation	Test Value	Probability
Cluster 1	Subsidies	4.70	3.04	1.38	1.35	2.68	0.004
	Capital transfers	4.66	2.81	1.65	1.63	2.47	0.007
	Social tranfers in kind	12.62	6.65	2.10	5.34	2.44	0.007
	Social benefits other than stk	34.93	30.93	4.45	3.98	2.19	0.014
	Compensation of employees	18.13	25.48	1.29	4.95	-3.23	0.001
Cluster 2	Property income	8.49	5.88	2.52	3.18	2.92	0.002
	Other current transfers	3.76	4.53	0.73	1.46	-1.86	0.031
	Intermediate consumption	10.96	13.75	2.27	4.79	-2.07	0.019
Cluster 3	Intermediate consumption	17.79	13.75	4.16	4.79	2.12	0.017
	Compensation of employees	29.47	25.48	3.57	4.95	2.02	0.021
	Social tranfers in kind	2.34	6.65	2.03	5.34	-2.03	0.021
	Capital transfers	1.23	2.81	0.65	1.63	-2.44	0.007
Cluster 4	Gross capital formation	10.05	6.61	1.66	2.80	2.25	0.012
	Intermediate consumption	19.11	13.75	2.56	4.79	2.05	0.020
	Social benefits other than stk	26.64	30.93	0.60	3.98	-1.97	0.024
	Property income	2.18	5.88	1.46	3.18	-2.13	0.017
	Size public expenditures	35.21	44.65	1.18	5.74	-3.01	0.001

Source: our calculations

Table 7. Relevant expenditures in the formation of clusters. COFOG classification

BEFORE EMU							
Clusters	Variables	Cluster average	Overall average	Cluster standard deviation	Overall standard deviation	Test Value	Probability
Cluster 1	Size public expenditures	53.48	46.89	5.03	7.07	2.66	0.004
	Social protection	40.00	34.80	1.54	5.90	2.52	0.006
	Environment protection	0.96	1.44	0.47	0.74	-1.88	0.030
	Economic affairs	8.53	11.30	1.95	3.88	-2.04	0.021
Cluster 2	Environment protection	2.23	1.44	0.67	0.74	1.95	0.025
	Social protection	40.80	34.80	0.97	5.90	1.86	0.031
Cluster 3	General Public services	21.37	17.60	3.13	6.07	1.56	0.059
	Health	12.24	10.96	1.33	2.47	1.30	0.097
	Social protection	31.33	34.80	3.11	5.90	-1.48	0.069
Cluster 4	General public services	35.32	17.60		6.07	2.85	0.002
	Defence	7.54	3.59		1.73	2.28	0.011
	Health	4.96	10.96		2.54	-2.36	0.009
Cluster 5	Economic affairs	20.69	11.30	3.54	3.88	3.51	0.000
	Environment protection	2.67	1.44	0.19	0.74	2.42	0.008
Cluster 6	Housing	5.55	2.44		1.38	2.26	0.012
	Social protection	20.89	34.80		5.90	-2.30	0.011
Cluster 7	Education	17.57	11.89	1.20	2.72	3.03	0.001
	Public order and safety	6.87	3.70	0.23	1.66	2.78	0.003
	Recreation	4.00	2.30	1.47	1.04	2.36	0.009
	Size public expenditures	36.93	46.89	2.55	7.07	-2.05	0.020
AFTER EMU							
Clusters	Variables	Cluster average	Overall average	Cluster standard deviation	Overall standard deviation	Test Value	Probability
Cluster 1	Public order and safety	5.74	3.86	1.01	1.36	3.00	0.001
	Education	16.21	12.58	1.92	2.81	2.81	0.002
	Recreation	3.58	2.61	1.54	1.18	1.80	0.036
	Size public expenditures	39.79	44.65	4.05	5.74	-1.85	0.032
Cluster 2	Economic affairs	14.20	10.58	2.58	2.97	3.06	0.001
	Environment protection	2.27	1.55	0.36	0.62	2.90	0.002
	Health	14.65	12.78	2.92	2.64	1.78	0.038
	Defence	2.14	3.27	1.00	1.45	-1.97	0.024
	Size public expenditures	40.13	44.65	3.82	5.74	-1.98	0.024
Cluster 3	General public services	23.16	14.77		3.67	2.29	0.011
	Housing	5.51	2.10		1.13	3.00	0.001
	Health	7.35	12.78		2.71	-2.00	0.023
	Social protection	22.25	35.89		6.18	-2.21	0.014
Cluster 4	Defence	6.84	3.27		1.48	2.41	0.008
	Education	6.41	15.28		2.89	-2.13	0.016
Cluster 5	Size public expenditures	49.70	44.65	3.02	5.74	3.47	0.000
	Social protection	40.41	35.89	3.25	6.03	2.96	0.002
	Environment protection	1.18	1.55	0.45	0.62	-2.37	0.009
	Public order and safety	2.97	3.86	0.65	1.36	-2.58	0.005
	Economic affairs	8.63	10.58	1.47	2.97	-2.58	0.005

Source: our calculations

Table 5, 6 and 7 show the results of the cluster analysis. The different variables that appear in each cluster are ranked in terms of their relevance (test values) in the formation of the clusters. The variables that contribute to the formation of the clusters are those with a probability lower than 5%.

In the analysis of the economic classification of public expenditures before EMU, the first five factors<sup>10</sup> explain 89.1% of total inertia, with all countries being well explained by these 5 factors. Ward's criterion has been applied to these four factors. Using three criteria (the ratio inertia inter/inertia total<sup>11</sup>, the structure of dendograms and the significance of the classes) we have obtained five clusters. In the analysis of the data after EMU, we have kept 5 factors, explaining 86.2% of total inertia, with all countries being well represented by these factors. The Ward's criterion has been used getting 4 clusters

The cluster analysis reinforces the conclusion reached in previous section. Thus, the convergence in the size of public expenditures makes this variable less relevant in the formation of the clusters, and after EMU only matters for cluster 4 (Estonia, Ireland and Latvia) instead of the two countries (1 and 5) and 12 countries in which it was relevant in the previous period. Furthermore, items where we detected a divergence process are now more relevant affecting a higher numbers of clusters and/or clusters: intermediate consumption (cluster 5 vs clusters 2-3-4), social transfers in kind (cluster 1 vs clusters 1-3), other current transfers (now in cluster 2), compensation of employees (cluster 4 vs cluster 3) and capital transfers (clusters 3). Finally, we must stress that all items matter in the formation of clusters in both sub-periods, what involves the maintenance of significant differences in the respective shares in public budget. In sum, the cluster analysis shows that there is no significant process in the composition of public expenditures in the EU and, also, that there is no convergence process in the productive expenditures.

In the analysis of the COFOG classification, before EMU, the first five factors explain 84.7%% of total inertia, with all countries being well explained by these 5 factors.

Ward's criterion has been applied to these factors. Using the same three criteria three criteria we have obtained seven clusters. In the analysis of the data after EMU, we have kept 5 factors, explaining 86.4% of total inertia, with all countries being well represented by these factors. The Ward's criterion has been used getting 5 clusters

Again, the cluster analysis reinforces previous conclusions. The convergence in some outlays leads to a lower number of clusters; moreover, the higher convergence in the composition of public expenditures (in comparison with that detected in the economic classification) makes the size of public expenditures a more relevant variables, influencing in the sub-period after EMU in three clusters (1, 2 and 5) instead of the 2 clusters before EMU. In any case, like in the economic classification, all items matter in the formation of clusters in both sub-periods, what involves the maintenance of significant differences in the respective shares of public expenditure. In sum, the cluster analysis shows that there is no significant process in the composition of public expenditures in the European Union.

## **5. Summary and conclusions**

The current strategy of fiscal policy in the EU is changing in recent years. Fiscal policies pay a higher attention to the quality of public finance and to the composition of public expenditures. Having followed these principles, the EU Member States should have increased the share of those components than can be defined as productive expenditures.

The analysis made in the paper shows that, in practice, national fiscal policies have only converged in the size of public expenditures with a generalized fall in the size of public budget. However, differences in the composition of public spending remain both if we analyse the economic or the functional classification, although a higher convergence is detected in the case of the COFOG classification. In any case, the analysis do not show an generalized increase or and upwards convergence in the productive components of public expenditures.

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### **Notes**

1. See European Commission, Directorate-General for Economic and Financial Affairs of European Commission and European Central Bank (2006, 2004a, 2004b, 2001).
2. The ECB also stresses the need to combine the measures of consolidation of fiscal imbalances with the improvement in the quality of public finances, changing the composition of public spending towards productive expenditures (European Central Bank, 2008a, 2008b).
3. Article 1.3 Council Regulation (EC) No 1467/97 of 7 July 1997, as amended by Council Regulation (EC) No. 1056/05 of 27 June 2005 (*italics added*).
4. A boxplot (Tukey, 1977) summarizes the distribution of a set of data by displaying the centering and spread of data using five elements: the smallest observation, the first quartile, the third quartile, the media and the largest observation. First and third quartiles are termed the hinges, and the difference between them represents the interquartile range (IQR). Median is depicted using a line through the center of the box.

The inner fence is defined as the first quartile minus  $1.5 \cdot \text{IQR}$  and the third quartile plus  $1.5 \cdot \text{IQR}$ . Whiskers and staple show the values outside the first (lower adjacent value) and third quartiles (upper adjacent value) but within the inner fences. The staple is a line drawn at the last data point within (or equal) each of the inner fences. Whiskers are horizontal lines drawn from each hinge to the corresponding staple. Any data lying more than  $1.5 \cdot \text{IQR}$  lower than the first quartile or  $1.5 \cdot \text{IQR}$  higher than the third quartile is considered as outlier. To characterize outliers, the outer fence is defined as the first quartile minus  $3.0 \cdot \text{IQR}$  and the third quartile plus  $3.0 \cdot \text{IQR}$ . Data between the inner and outer fenced are named near outliers (circles), and data outside the outer fence (stars) are far outliers.

5. The mean of public expenditures (as a percentage of GDP) falls from 46.89% to 44.65%; the median falls from 45.24% to 44.90%, the standard deviation falls from 7.25 to 5.89 and the interquartile range falls from 10.79 to 8.72.

6. In the functional classification, available dates are: 1990-2007 (Denmark and Luxembourg), 1990-2006 (Belgium, Ireland, Greece, Italy, Portugal, Finland, United Kingdom), 1991-2007 (Germany), 1995-2006 (Czech Republic, Estonia, Spain, Malta, Netherlands, Austria, Sweden), 1995-2006 (France) and 1998-2006 (Cyprus, Latvia). In the economic classification, available dates are: 1990-2007 (Austria, Belgium, Denmark, Germany, Greece, France, Finland, Italy, Luxembourg, Netherlands, Portugal, United Kingdom), 1993-2007 (Latvia, Slovakia, Sweden) 1995-2007 (Czech Republic, Estonia, Ireland, Lithuania, Malta, Poland, Spain, Slovenia), 1996-2007 (Hungary), 1998-2007 (Cyprus, Romania)

7. This criterion maximizes the variance among clusters and minimizes the variance within clusters.

8. Test value (Lebart et al, 1995)) is a descriptive index used in the correspondence analysis built following the methodology of hypothesis tests. A variable is not a relevant to form a group if the  $n_k$  values of this variable seem to have been randomly extracted among the  $n$  observed values. The more doubtful the hypothesis of a random extraction, the best this variable will characterize the group of  $n_k$  individuals. For the categories of nominal variables, the order allows to get those categories whose proportion within the group is sufficiently different from the overall proportion, because it is higher (a positive test value) or lower (a negative test value). Critical probabilities are used to classify the variables by order of relevance. The most relevant or critical variable is that with the lowest probability. In the study we use 5% as the frontier of critical probability.

9. The exception is cluster 3 before EMU in the COFOG classification, where 10% is used as critical frontier.
10. The factors are linear combination of the initial variables.
11. The value of this ratio is 0.6456 before EMU and 0.525 after EMU in the economic classification. In the COFOG classification these values are 0.7718 and 0.6856, respectively

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