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**Has the European integration approximated
the composition of government expenditures?**

by

Ismael Sanz and Francisco J. Velázquez



Leverhulme Centre
for Research on Globalisation and Economic Policy

The Authors

Ismael Sanz is a Research Assistant of the European Economy Group (Universidad Complutense de Madrid), Francisco J. Velázquez is a Lecturer of the European Economy Group (Universidad Complutense de Madrid).

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Has the European integration approximated the composition of government expenditures? A comparative analysis between the EU and Non-EU countries of the OECD

by

Ismael Sanz and Francisco J. Velázquez

Abstract

Globalization and growth-maximizing governments may cause countries to converge towards a similar composition of government expenditures. These convergent forces may be even more intensive in the case of EU Member States engaged in the European integration process. The results obtained, through calculation of a constructed dissimilarity index and by adapting the usual indicators of convergence (β , σ and γ -convergence), reveal that there has been an harmonization process. In addition, this approach of structures of government expenditures has been greater in the EU than in the Non-EU countries of the OECD. Nevertheless, EU member states are converging towards a different steady state composition of government expenditures.

JEL classification: H11, H50, H60.

Keywords: composition of government expenditures, European economic integration, globalization, convergence.

Outline

- 1. Introduction*
- 2. Convergent forces of the composition of government expenditures.*
- 3. Similarity among government expenditure structures in the EU and OECD.*
- 4. Convergence in the composition of government expenditure.*
- 5. Conclusions*

Non-Technical Summary

This paper we have shown that globalization may cause countries to tend towards similar functional distributions of government expenditure. On the one hand, globalization will tend to increase competitiveness and hence the shares devoted to government productive expenditures, while decreasing resources allocated to non-productive expenditures. Alternatively, citizens may increase their demand for social welfare expenditure as their countries are more open to trade, because this type of expenditure reduces the exposure to external risk. In addition, following some economic growth models and assuming growth-maximizing governments, countries with similar productive structures should tend to the same optimal functional distribution of government expenditure. These convergent forces may be expected to be even more intensive in the case of EU Member States. To test this, we have explored if, in the period 1970-1997, there has been a convergence process in the OECD and if this convergence has been greater in the EU than in the Non-EU countries of the OECD.

The results obtained, through the construction of a dissimilarity index and by adapting the usual indicators of convergence (β , σ and γ) to the analysis of government expenditure composition, reveal that there has been an alignment of its functional distribution among OECD countries. Nevertheless, in 1997 the margin for future convergence seems to be very small. That is, functions appear to be close to the steady state. In addition steady states are different for each country. So there are individual factors, such as preferences and historical and institutional factors, which determine that each country has its own functional distribution of public expenditure in the long term.

Still, three of the eight functions do not show σ -convergence. By areas, σ -convergence show that three functions out of eight are converging in the EU, the same number of functions as in the Non-EU countries. However, comparing the speed of the σ -convergence and the dissimilarity index reduction show that this harmonization (divergence) has been greater (lesser) in the EU than in the Non-EU countries at least for four functions: health, education, transport and communications and other expenditures, whereas only housing show a higher convergence pattern for the Non-EU area. Functions showing higher convergence in the EU accounted for 52,68% of the total government expenditure of the OECD countries in 1997, while housing only accounted for 2,78%.

Thus we may infer that the composition of government expenditures of the EU Member States are converging and faster than the Non-EU countries of the OECD. Overall, therefore, there is some indication that the European integration process is fostering convergence in the composition of government expenditures. Harmonization of the structure of public spending in EU member states could reflect the convergence in income and demographic factors which are the most important determinants of the composition of government expenditures.

1. Introduction

The globalization process has led to a growing interdependence of fiscal policies affecting, *inter alia*, the composition of government expenditures. Sanz and Velazquez (2001) show that there was convergence in the structure of government expenditures by functions in the OECD during the period 1970-1997. Convergent forces may be expected to be even more intensive in the case of EU Member States involved in the integration process. First, interdependencies of economic policies are greater with respect to government expenditures as can be inferred from the Stability and Growth Pact, and co-operation in areas such as protection systems, transport and communications and research and development. Second, these economies may have more similar productive structures, which under the assumption of growth-maximizing governments could lead to similar public expenditure compositions. Therefore, we might expect a greater convergence process in the composition of government expenditures in the EU than in the OECD.

In this study we will assess whether this harmonization process has been larger for the case of the EU Member States, so that convergence may be partially attributed to the European integration process. With this purpose, section 2 examines the convergent forces leading to similarity in the composition of government expenditures by functions. Further, it analyzes why a higher convergence for EU Member States than for the Non-EU countries of the OECD should be expected. In section 3 an annual dissimilarity index is constructed in order to explore the differences between the structures of government expenditure within the OECD, comparing two areas: EU and the Non-EU. Section 4 adapts the usual indicators of the income convergence literature to examine the composition of public expenditure in the EU and the Non-EU countries of the OECD. Moreover, we investigate whether this convergence is conditional rather than absolute and whether opportunities for future convergence remain. Section 5 sets out the main conclusions.

2. Convergent forces of the composition of government expenditures.

Following Barro (1990), Devarajan et al. (1996) elaborate an endogenous growth model, where a representative infinite-lived agent chooses consumption and capital to maximize a utility function subject to a budget constraint. A production function for a single good has three inputs: private capital and two components of government spending:

productive and non-productive expenditures.¹ In this way, these authors obtain an expression for the steady-state growth in terms of the shares of each component in total government expenditures. Indeed, Davoodi and Zou (1998) and Xie et al. (1999) use this model, though differentiating government expenditure by levels (federal, state and local) instead of its productive character. Thus, assuming a Cobb-Douglas production function, these authors conclude that the growth-maximizing shares of each component in total government expenditures are:

$$\phi_c^* = \frac{\beta_c}{\sum_{f=c}^3 \beta_c} \quad \sum_{c=1}^3 \phi_c^* = 1 \quad c = 1,2,3. \quad (1)$$

Where β_c is the elasticity of growth with respect to component c of public expenditure, c is one of the three levels of administration considered and ϕ_c^* is the optimal share of component c of spending in total public expenditure. Therefore, there is an optimal composition of government expenditures in which the share of each component equals its relative growth elasticity. This model can be extended to N components of government expenditure and applied to any composition of government expenditures: by economic type, by levels of government or by functions. Thus, if governments maximize growth and output elasticities with respect to each component (β_c) are similar across countries, we should expect convergence towards similar compositions of government expenditures.

Note that we assume that governments maximize economic growth as in Devarajan et al. (1996), Davoodi and Zou (1998) and Xie et al. (1999). As these authors acknowledge, governments might pursue objectives other than maximizing economic growth such as welfare maximization, stabilization, provision of public goods, redistribution or satisfaction of the demand of interest groups and bureaucrats. Nevertheless, Barro (1989) and Xie et al. (1999) find that existing components of government expenditure are consistent with governments maximizing growth. Indeed, these authors claim that if government maximizes the utility attained by a representative household, subject to a Cobb-Douglas production function, growth and welfare maximization yield the same solutions. Further, as Tanzi and Zee (1997) note, endogenous growth models deal with long-run economic growth, and in the long run we should expect a positive relationship between economic growth and welfare improvement. Finally, focusing on growth maximization provides a measure of the cost of seeking other objectives.

We also assume similar output elasticities with respect to each component. This assumption is implicitly made when empirically estimating this model with panel data (Devarajan et al., 1996 and Kneller et al., 1999). Further, Gemmell and Kneller (2002) show that the long-run growth elasticities of productive expenditures exhibit a high degree of uniformity across EU and OECD countries. This seems reasonable for a sample of countries, which are fairly homogenous. In fact, the globalization process in this area has generally harmonized the macroeconomic conditions faced by OECD countries, their productive structures and deepened the interdependencies of economic policies including fiscal policy.

Globalization may also affect directly the composition of government expenditures. Keen and Marchand (1997) elaborate a model in which, in the absence of international cooperation, increasing competence will encourage governments to raise the allocation to productive expenditures, and contract non-productive spending. In addition, Tanzi (2000), Tanzi and Schuknecht (2000) and Masson (2000) point out that globalization will decrease government revenues because of fiscal competition, increased mobility of factors and electronic commerce, further reducing expenditures devoted to social protection. In fact, there may be little incentive for countries to have large social welfare systems, because as pointed out by Lejour (1995) those countries may face an adverse selection problem. Individuals who expect to be net beneficiaries will be attracted to these countries with generous social systems, at the same time as net contributors will leave because of increasing taxes. In addition, growing competition and transparency may favor countries with less generous social protection systems if it is translated into lower labor costs. Thus countries may get into a race to the bottom on social protection expenditures. On the other hand, Rodrik (1998) shows that countries more open to trade tend to have also bigger public sectors, because their citizens demand social security and welfare expenditures to mitigate the exposure to external risk.

In the light of the forces leading to convergence, we could infer that this process may be even stronger in the case of EU Member States engaged in economic integration. Thus, the assumption of similar β_c seems more plausible for these countries as their productive structure may be more similar. Further, EU governments seem also to be committed to enhancing “growth in national incomes and to ensure that this is sustainable

over the medium term” (Commission of the European Communities 2002) after the low performance of the EU economy during the 90’s: the ratio of EU to United States GDP per capita in the late 90’s is the lowest since 1970. That is EU governments seem to be maximizing growth, which may lead to convergence in the composition of government expenditures. Moreover the Stability and Growth Pact and the Lisbon strategy aim to achieve the goal of making the EU the “most competitive and dynamic knowledge-base economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion”. In fact this process is focused on long-term economic growth through continuous progress in economic reform and safeguarding sound government finances (Presidency conclusions, Barcelona European Council).

Finally, interdependencies of economic policies have also been greater in the field of fiscal policy. In this way, EU may avoid, through co-operative harmonization, the effects on the composition of government expenditures pointed out by Keen and Marchand (1997), Tanzi (2000), Tanzi and Schuknecht (2000), Lejour (1995) and Masson (2000). European integration process may give rise to externalities and economies of scale in the provision of public goods, mainly in higher education, infrastructure of transport and communications and Research and Development (Masson, 2000). In addition, Mongelli (1997) suggests that the centralization of monetary policy in the European Central Bank (ECB) and the euro currency will strongly reduce interest rates differentials. Moreover, the Stability and Growth Pact implies the maintenance of debt-to-GDP and deficit-to-GDP ratios close to 60% and 3% respectively, and thus harmonization of interest payments.

3. Similarity among government expenditure structures in the EU and OECD.

In the rest of this paper we analyze whether OECD Members States have converged in their composition of government expenditures by functions in the period 1970-1997. We use the Classification of the Functions of Government (COFOG, United Nations, 2000): public services (including general administrative services and public order and safety), defense, health, education, housing, transport and communications, other expenditures (mainly interest payments but including also other economic services, recreational, cultural and religious affairs) and social security. We also explore whether any convergence process has been greater for the EU than for the Non-EU countries of the OECD, so that it may be partially attributed to the European integration process. Our sample include 26 countries: all

OECD members states, except the Czech Republic, Hungary, Poland and the Slovak Republic. The data source is the OECD publication *National Accounts. Volume II: Detailed Tables*. This source is chosen because as it offers information on the consolidated spending of all levels of government and, in addition, it adopts the accrual criterion.² In order to analyze the extent to which the OECD, EU and Non-EU countries of the OECD have harmonized the structure of government expenditures by functions we constructed a dissimilarity index for each function f , DIF:

$$DIF_t = \left(\frac{1}{N} \right) \sum_{i=1}^N \left| \frac{g_{fit} - \bar{g}_{fit}}{\bar{g}_{fit}} \right| \quad (2)$$

Where g_{fit} is the share devoted to function f in country i and year t , \bar{g}_{fit} the simple average share devoted to function f and year t in the OECD, EU, Non-EU countries respectively, N , twenty six when computing the total OECD Member States dissimilarity index, fifteen, when computing the dissimilarity index for the EU³, and eleven when computing it for the Non-EU countries of the OECD, and t all the years of the period 1970-1997. Thus, the expression in absolute terms measures deviations from the mean: it compares the share of a function in the total amount of public expenditure of each country with the average share for this function for the OECD, EU and Non-EU countries. Therefore, DIF_t indicates the averaged deviation for one particular function. This dissimilarity index takes a value 0 if every country devotes the same share to function f and $2(N-1)/N$ (1.92 for the total sample of 26 countries of the OECD, 1.87 for the 15 countries of the EU and 1.82 for the 11 Non-EU countries) in the case where one country devotes its full budget to this function, while the rest of the countries do not allocate any resource to this function. Thus our function dissimilarity index range depends on the number of countries, as lower numbers of countries lead to lower dissimilarity, i.e. biases Non-EU downwards relative to EU and EU relative to OECD. Therefore, we compare the harmonization of functions between areas by percentage changes and trends, taking into account that function dissimilarities are not fully comparable for different sample sizes.

Finally, we compute the total dissimilarity index for the composition of government expenditures as the sum of all these function dissimilarities dividing it by the total number of functions. Total dissimilarity takes a zero value in the case that countries have the same structure of government expenditures and a maximum level of $2(s-1)/s$ (1.75 for s , number of functions, equal to 8), when countries devote their full budget to different functions. The

maximum level of dissimilarity depends on the level of disaggregation but not on the sample size. Dissimilarity indexes with different levels of disaggregation are not comparable, since disaggregating leads to higher dissimilarity indexes and more reliable results. In this paper we consider up to eight different components of government expenditures. In addition, the way this index is computed ensures it fulfils the statistical properties requires of a dissimilarity index: it is symmetric and only takes positive values, except for the case when all countries have the same structure (when it takes the value 0). Secondly, the computation of deviations is based on the share of each function in the general government expenditure. Hence, we focus our attention on the composition rather than on the size of public spending, following the recent literature on government spending and economic growth. Thirdly, this index employs the “Manhattan” or “city block” distance, since the dispersion is measured in absolute terms, which is less sensitive to the presence of outliers than other distances using squared deviations such as the euclidean. Fourthly it allows us to compare the dissimilarities among different functions since the deviation is computed relative to the mean of each. Fifthly, the deviation is computed giving the same weight to each country, rather than allowing changes in a few large countries to affect the index.

Table 1 compares the dissimilarity index for 1970 and 1997 (column 3,4 and 5). We also use the intermediate years regressing the yearly dissimilarity indexes against a trend and an intercept in column 6, 7 and 8. Thus we are able to test the robustness of the harmonization process. Moreover we compare the speed of the trends between two different areas: EU and Non-EU. The dissimilarity among OECD countries’ public expenditure distribution has been significantly reduced in the last three decades (-12.2%). However, this process has not been homogenous for all functions and areas. Four functions: defense, education, transport and communications and social welfare show a significant harmonization trend, while the rest of the functions do not show any significant trend. By area, the dissimilarity index has been significantly reduced in the EU (-20.4%), whereas no significant approach tendency is found for the Non-EU countries. Further, column 8 shows that in five functions: public services, health, education, transport and communications and other expenditures, the convergence (divergence) trend is significantly higher (lower) in the EU than in the Non-EU area, whereas only housing shows a significantly higher approaching trend in the Non-EU area than in the EU. In the case of public services, the OECD dissimilarity index is reduced by -38.9% but do not show any significant trend. That

is, the reduction is due to particular years instead of a constant and sustainable harmonization trend. As for defense, the EU shows a slightly higher reduction in dissimilarity, whereas the Non-EU area show a greater harmonization trend, though not significantly different.

4. Convergence in the composition of government expenditure.

The analyzis of convergence in the composition of government expenditure in OECD countries during the period 1970-1997 is carried out by means of the usual approach in the literature on per capita income convergence (Barro and Sala-i-Martin, 1992) which we adapt to examine the functional distribution of public spending. Thus, we start with an examination of β -convergence, with the object of evaluating whether countries that have a higher share in one particular function increase (decrease) this percentage to a lesser (greater) extent than countries in which this function is not so important. The eight estimated equations are:

$$g_{fit} - g_{fi,t-1} = \alpha_f + \beta_f g_{fi,t-1} + \sum_{i=2}^N \alpha_{f,i} + \sum_{t=3}^T \alpha_{f,t} + \varepsilon_{fit}; \quad (3)$$

$$f = 1,..8; \quad i = 1,..15,..26 \quad t = 1970...1997 \quad \sum_{f=1}^s g_{fit} = 1$$

where β_f is the coefficient reflecting the existence and the speed of convergence for function f . If the coefficient β_f takes a negative and significant value, there is some indication of a convergence process in function f , i.e. countries with high initial shares have lower growth in subsequent years. We have also included country dummies, α_{fi} , because, as shown in the second column of Table 2, Arellano and Bover's test (1990) rejects the null hypothesis of no correlation between the unobservable effects and the explanatory variables for all the functions.⁴ Thus, not accounting for country dummies capturing preferences, institutional and historical country-specific factors would introduce a bias. Moreover, we test the hypothesis that all the individual effects are the same. If we can't reject the hypothesis of country dummies being equal countries would be converging to the same steady state. If we reject the hypothesis of all the individual effects being equal, then there is conditional convergence and each country will be approaching its own long-term share of a particular function of government expenditure. Equation (3) also allows us to estimate these equilibrium states and to evaluate the margin for further convergence. This will be done by means of a comparison of the standard deviation of the shares estimated in the

equilibrium state for every country in a particular function and the standard deviation of the real shares of this function for every country in the last year available (1997). Thus a ratio below one will indicate that according to the pattern of the last three decades there is still some margin to converge in the future, so that dispersion of shares may narrow. A ratio above one will suggest that the standard deviation of the shares devoted to this function by countries may increase in the future.

Time dummies, α_{ft} , capture time-specific effects affecting all the countries in a similar way. This estimation is a system composed of eight equations, one for every spending function. These equations are related because contemporary errors are correlated. In fact, the sum of all the right hand side variables add up to zero. Moreover common shocks could also affect to different functions of government expenditure in similar ways. We, therefore estimate by means of Seemingly Unrelated Regressions (SURE). In addition we use all the intermediate years. Otherwise, beginning at a base year and examining whether there has been convergence at the end of the period by means of single cross-section regression implies the choice of an arbitrary base year (Bernard and Durlauf, 1996).

Results given in the third column of Table 2 indicate that there has been some sort of convergence process in all the functions. All the β_f are negative and significant, in the range -0.116 to -0.143. Housing, public services and transport and communications do show a higher speed of convergence than the rest of functions. By area, convergence speed is significantly higher for the EU in defense, housing and social security.⁵ However, column six and seven show that convergence in the OECD is absolute only for public services. For all other functions, the test of equality of country dummies rejects the hypothesis that the individual effects are the same for every country; they converge to different equilibrium states with distinct distributions of public expenditure. Country effects (e.g. preferences, institutional and historical factors) impede convergence to an identical composition of public expenditure. These results are in line with Rodrik (1998) and Gemmell and Kneller (2002) who find conditional convergence for different types of government expenditures (consumption, productive and non-productive expenditures). From column 8 it can be inferred that, health, education and other expenditures may still converge in the future. On the other hand defense and housing appear to have no more margin for future convergence and these expenditures may even start to diverge, while

social security and transport and communications are close to their steady state at the end of the period. By areas, absolute convergence for EU include public services and education. Not function shows absolute convergence in the Non-EU countries. In addition, with the exception of transport and communications, functions will converge (diverge) to a higher (lower) or similar extent in the EU than in the Non-EU countries of the OECD.

However, the existence of β -convergence is a necessary but not sufficient condition for σ -convergence, since a negative value of β is compatible with an increase of dispersion of shares devoted to each function of government expenditures (De la Fuente, 2000). Random shocks may temporarily increase the dispersion of shares even in the presence of β -convergence or countries may be approaching their steady state shares (conditional convergence) with higher dispersion than at the beginning of the period. In addition, evidence of β -convergence may be reflecting Galton's fallacy, i.e. the tendency for countries to regress towards the mean (Quah, 1993). In fact, Gemmell and Kneller (2002) claim that observed β -convergence in the composition of government expenditures by its productive character primarily reflects the tendency for countries to revert to their long-term trend.

It is therefore σ -convergence that ensures there has been a convergence process overall (Barro and Sala-i-Martin, 1992). For this reason, we have computed the standard deviation of the logarithm of the shares of each function. In the context of this work, σ -convergence explores if the dispersion among shares of the functions of government expenditures among OECD countries has been reduced. Moreover, we test the hypothesis that the variance decreases over time using the Likelihood Ratio test (T_2) proposed by Carree and Klomp (1997) and the Variance Ratio test (T_3) proposed by Lichtenberg (1994), but taking into account that the variance in the first year and the variance in the last year are not independently distributed (Carree and Klomp, 1997). These two tests perform better than the original test proposed by Lichtenberg for short time periods and small samples reducing the probability of committing a type II error.

Results obtained for σ -convergence in Table 3 confirm the existence of a harmonization tendency in the functional distribution of government expenditures, since at least one of the two statistics suggests convergence for five functions (including defense at

a 10% significant level). Public services and education are pointed out as the most similar and the ones showing the fastest harmonization. By areas, both EU and Non-EU area show significant convergence for three functions. Nevertheless, the T_3 -statistic suggests that there has been divergence in other expenditures in the Non-EU area⁶. No significant trend is found for other expenditures (mainly interest payments), even in the EU, though it was expected to be one of the most converging expenditures following Maastrich criteria.

Further, in Table 4 we compare the speed of the σ -convergence between EU and Non-EU area. For this purpose we followed three different procedures. The first one is to regress the yearly standard deviation of the logarithm of the shares against a trend and an intercept (column 3, 4 and 5). The second is a non-parametric testing method like the following. In a first step, we estimate the relationship between the logarithm of the share in 1970 and 1997 as in Carree and Klomp (1997), for the EU and Non-EU areas and for each of the functions, separately. In the second step, 1000 bootstrap samples of the residuals are drawn with replacement from the observed residuals of the EU and Non-EU and each of the functions⁷. In the third step, the 1000 bootstrap samples of observations for each function and area are constructed by adding the randomly sampled residual to the original predicted value for each country. Finally we compute the number of times where the σ -convergence is stronger in the Non-EU area than in the EU area for each function (column 6). If this number is lower than 50, we conclude that the σ -convergence is stronger in the EU than in the Non-EU area at a 5% significant level. If this number is higher than 950 we conclude that convergence is significantly higher in the Non-EU area than in the EU area at a 5% significant level. The third method is equivalent to the second but drawing bootstrap samples of the residuals from a normal distribution with mean zero and the estimated standard deviation of the observed residuals (column 7).

As can be inferred in Table 4, using at least two of the methods proposed, four functions: health, education, transport and communication and other expenditures have reduced (increased) the dispersion to a significantly higher (lower) extent in the EU than in the Non-EU area. On the other hand, only housing has reduced the dispersion to a significantly higher extent in the Non-EU area than in the EU. These results match that from the dissimilarity index. In addition, as for case of the dissimilarity index, the comparison in the reduction in dispersion in defense between areas differ from the pattern

of the harmonization. Thus, the dispersion among EU has decreased to a significantly higher degree than in the Non-EU area (column 6), whereas the harmonization trend is significantly higher for the Non-EU area (column 4 and 5). This fact suggest that the harmonization trend in the Non-EU areas has been more constant while in the EU the reduction in dispersion is mainly due to particularly years. Public services and social welfare do not show different patterns between the EU and Non-EU area. This result is in line with Cornelisse and Goudswaard (2001), who find that convergence of social protection systems, measured as coefficient of variation of replacement rates and social security spending as a GDP share, has not been significantly different in the EU and OECD during the period 1960-1999.

Finally, we have calculated the Kendall index with the object of analyzing whether there are significant changes in the rankings, known as γ -convergence (Boyle and McCarthy, 1997, 1999). In our context, these rankings classify the countries of the OECD, EU and Non-EU according to the importance that each function has in total government expenditure. Thus, we explore if countries in the first rank for the share of one particular function in 1970 are in a lower position for 1997, therefore, indicating a convergence process. In the extreme case were there is a reversal of the ranking, the Kendall index will take the value zero. If, on the other hand, these countries remain on the same top positions at the end of the period, the Kendall index will take the value one implying no ranking convergence. In Table 4 we show the Kendall multiannual index, which takes into account what happens at the beginning, the final and the intermediate years. Results indicate that there has been an important movement in the rankings of the functional shares in each country (measured as shares of total public expenditure). By function, public services is again showing the greatest convergence. In contrast, the expenditure having the greatest disparities at the beginning of the period (defense) and the larger share in total public spending along with other expenditures (social welfare) reveal less mobility. These characteristics make it more difficult for countries to change positions in the ranking. By areas, four functions seem to show a significant higher ranking convergence trend in the EU (public services, defense, health and other expenditures) whereas in the other four functions is the Non-EU the area showing a significant higher speed of ranking convergence.

5. Conclusions

In this paper we have shown that globalization may cause countries to tend towards similar functional distributions of government expenditure. On the one hand, globalization will tend to increase competitiveness and hence the shares devoted to government productive expenditures, while decreasing resources allocated to non-productive expenditures. Alternatively, citizens may increase their demand for social welfare expenditure as their countries are more open to trade, because this type of expenditure reduces the exposure to external risk. In addition, following Barro's model and assuming growth-maximizing governments, countries with similar productive structures should tend to the same optimal functional distribution of government expenditure. These convergent forces may be expected to be even more intensive in the case of EU Member States. To test this, we have explored if, in the period 1970-1997, there has been a convergence process in the OECD and if this convergence has been greater in the EU than in the Non-EU countries of the OECD.

The results obtained, through the construction of a dissimilarity index and by adapting the usual indicators of convergence (β , σ and γ) to the analysis of government expenditure composition, reveal that there has been an alignment of its functional distribution among OECD countries. Nevertheless, in 1997 the margin for future convergence seems to be very small. That is, functions appear to be close to the steady state. In addition steady states are different for each country. So there are individual factors, such as preferences and historical and institutional factors, which determine that each country has its own functional distribution of public expenditure in the long term.

Still, three of the eight functions do not show σ -convergence. By areas, σ -convergence show that three functions out of eight are converging in the EU, the same number of functions as in the Non-EU countries. However, comparing the speed of the σ -convergence and the dissimilarity index reduction show that this harmonization (divergence) has been greater (lesser) in the EU than in the Non-EU countries at least for four functions: health, education, transport and communications and other expenditures, whereas only housing show a higher convergence pattern for the Non-EU area. Functions showing higher convergence in the EU accounted for 52,68% of the total government expenditure of the OECD countries in 1997, while housing only accounted for 2,78%.

Thus we may infer that the composition of government expenditures of the EU Member States are converging and faster than the Non-EU countries of the OECD. Overall, therefore, there is some indication that the European integration process is fostering convergence in the composition of government expenditures. These results corroborate the findings of Sanz and Velazquez (2001) who, using a cluster analysis for the composition of government expenditures in the OECD member states, show that most of the EU take part in the same cluster. Harmonization of the structure of public spending in EU member states could reflect the convergence in income and demographic factors which are the most important determinants of the composition of government expenditures (Sanz and Velazquez, 2002). Moreover, some endogenous growth models incorporate the composition of government spending, among other fiscal variables, which are capable of yielding steady state effects. Thus, Gemmell and Kneller (2002) and Sanz and Velazquez (2001) suggest that convergence of the functional distribution of government expenditure could give rise to convergence in long term economic growth rates which in turn may enhance further harmonization of the structure of government expenditures.

REFERENCES

Arellano, Manuel and Bover, Olympia, "La Econometría de Datos de Panel." *Investigaciones Económicas*. **14**, 1:3-45, Enero 1990.

Barro, Robert J., "Economic Growth in a Cross Section of Countries," Working Paper No. 3120. Cambridge: NBER, September 1989.

Barro, Robert J., "Government Spending in a Simple Model of Endogenous Growth." *Journal of Political Economy*. **98**, 5:S103-125, October 1990.

Barro, Robert J. and Sala-i-Martin, Xavier, "Convergence." *Journal of Political Economy*. **100**, 2:223-251, April 1992.

Bernard, Andrew B. and Durlauf, Steven N., "Interpreting tests of the convergence hypothesis." *Journal of Econometrics*. **71**, 1-2:161-173, March 1996.

Boyle, Gerry E. and McCarthy Thomas G., "A Simple Measure of β -convergence." *Oxford Bulletin of Economics and Statistics*. **59**, 2:257-264, May 1997.

Boyle, Gerry E. and McCarthy, Thomas G., "Simple Measures of Convergence in per Capital GDP: a Note on Some Further International Evidence." *Applied Economics Letters*. **6**, 6:343-347, June 1999.

Carre, Martin and Klomp, Luuk, "Testing the convergence hypothesis: a comment." *Review of Economics and Statistics*. **79**, 4:683-686, November 1997.

Commission of the European Communities, *Productivity: The Key to Competitiveness of European Economies and Enterprises*. Brussels: Commission of the European Communities, COM(2002) 262, final, 2002.

Cornelisse, Peter A. and Goudswaard Kees P., "On the Convergence of Social Protection Systems in the European Union," *The Role of Political Economy in the Theory and Practice of Public Finance*. Linz:57th Congress of the International Institute of Public Finance, August 2001.

Davison, Anthony C. and Hinkley, David V., *Bootstrap Methods and Their Application*. Cambridge: Cambridge University Press, 1997.

Davoodi, Hamid and Zou, Heng-fu, "Fiscal decentralization and economic growth: A cross country study." *Journal of Urban economics*. **43**, 2:244-257, March 1998.

De la Fuente, Ángel, "Convergence Across Countries and Regions: Theory and Empirics," Discussion Paper No. 2465. London: CEPR, May 2000.

Devarajan, Shantayanan, Swaroop, Vinaya and Zou, Heng-fu, "The Composition of Public Expenditure and Economic Growth" *Journal of Monetary Economics*, **37**, 2-3:313-344, April 1996.

Easterly, William and Rebelo, Sergio, "Fiscal Policy and Economic Growth: An empirical investigation." *Journal of Monetary Economics*, **32**, 3:417-458, December 1993.

Efron, Bradley and Tibshirani, Robert J., *An Introduction to the Bootstrap*. New York: Chapman and Hall, 1993

Gemmell, Norman and Kneller, Richard, "Fiscal Policy, Growth and Convergence in Europe," Working Paper No. 14. Madrid: European Economy Group, May 2002.

Hitiris, Theodore and Nixon, John, "Convergence of health care expenditure in the EU countries." *Applied Economic Letters*. **8**, 4:223-228, April 2001.

Keen, Michael and Marchand, Maurice, "Fiscal competition and the pattern of public spending." *Journal of Public Economics*, **66**, 1:33-53, October 1997.

Kneller, Richard, Bleaney, Michael and Gemmell, Norman, "Fiscal Policy and Growth: Evidence from OECD Countries." *Journal of Public Economics*, **74**, 2:171-190, November 1999.

Lejour, Arjan M. "Integrating or disintegrating Welfare States ? A Qualitative Study to the Consequence of Economic Integration on Social Insurance," Thesis. Tilburg: CentER, September 1995.

Lichtenberg, Frank R., "Testing the Convergence Hypothesis." *Review of Economics and Statistics*, **76**, 3:576-579, August 1994.

Masson, Paul R., "Fiscal Policy and Growth in the Context of European Integration," Working Paper No. 133. Washington: IMF, July 2000.

Mongelli, Francesco P., "Effects of the European Economic and Monetary Union (EMU) on Taxation and Interest Spending on National Governments," Working Paper No.93. Washington: IMF, July 1997.

Quah, Danny., "Galton's Fallacy and tests of the convergence hypothesis, " *Scandinavian Journal of Economics* **95**, 4:427-443, December 1993.

Rodrik, Dani, "Why do more open economies have bigger governments?." *Journal of Political Economy*, **106**, 5:997-1032, October 1998.

Sanz, Ismael and Velazquez, Francisco J., "The composition of public expenditure and growth: Different models of government expenditure distribution by functions," Discussion Paper No. 115. Dunedin: Department of Economics of the University of Otago, August 2001.

Sanz, Ismael and Velazquez, Francisco J., "Determinants of the composition of government expenditures by functions," Working Paper No. 13. Madrid: European Economy Group, April 2002.

Tanzi, Vito and Zee Howell H., "Fiscal Policy and Long-Run Growth." *IMF Staff Papers*, **44**, 2:179-209, June 1997.

Tanzi, Vito, "Globalization and the Future of Social Protection," Working Paper No. 12., Washington: IMF, January 2000.

Tanzi, Vito and Schuknecht, Ludger, *Public Spending in the 20th Century: A Global Perspective*. Cambridge: Cambridge University Press, 2000.

United Nations, *Classifications of Expenditure According to Purpose: Classification of the Functions of Government (COFOG); Classification of Individual Consumption*

According to Purpose (COICOP); Classification of the Purposes of Non-Profit Institutions Serving Households (COPNI); Classification of the Outlays of Producers According to Purpose (COPP). New York: UN, Statistics Division, M, No. 84, 2000.

Xie, Danyang, Zou, Heng-fu and Davoodi, Hamid, "Fiscal decentralization and economic growth in the United States." *Journal of Urban Economics*. **45**, 2:228-239, March 1999.

TABLE 1. Dissimilarity indexes of the functions of government expenditure in the OECD, EU and Non-EU (1970-1997).							
Functions	Area	1970	1997	Variation (%)	Intercept ^a	Trend ^a	Chow test F (1,52)
Pure Public Goods							
Public Services	OECD	0.27	0.17	-38.9	0.26 (19.79)	0.0004 (0.35)	8.53 **
	EU	0.23	0.13	-41.4	0.50 (20.49)	-0.0021 (-3.68)	
	Non-EU	0.32	0.21	-33.5	0.34 (16.71)	0.0029 (1.50)	
Defense	OECD	0.59	0.45	-23.0	0.59 (113.82)	-0.0041(-11.13)	2.03
	EU	0.49	0.36	-26.0	0.43 (34.39)	-0.0038 (-4.62)	
	Non-EU	0.68	0.54	-20.1	0.76 (38.98)	-0.0055 (-4.47)	
Merit Goods							
Health	OECD	0.28	0.28	0.5	0.26 (51.50)	0.0003 (0.78)	12.23 ***
	EU	0.23	0.17	-28.4	0.17 (16.29)	-0.0018 (-2.50)	
	Non-EU	0.42	0.42	1.3	0.43 (86.99)	0.0006 (1.81)	
Education	OECD	0.21	0.20	-5.5	0.20 (29.83)	-0.0012 (-2.21)	37.94 ***
	EU	0.23	0.13	-42.6	0.20 (18.70)	-0.0039 (-5.67)	
	Non-EU	0.12	0.15	25.3	0.12 (16.50)	0.0012 (2.38)	
Housing	OECD	0.49	0.40	-18.2	0.49 (43.72)	-0.0005 (-0.57)	3.99 **
	EU	0.42	0.39	-6.9	0.46 (30.94)	-0.0001 (-0.09)	
	Non-EU	0.58	0.38	-34.7	0.55 (30.65)	-0.0032 (-2.90)	
Services and Others							
Transport & Communications	OECD	0.37	0.38	0.8	0.37 (88.25)	-0.0006 (-2.07)	12.92 ***
	EU	0.41	0.34	-16.7	0.42 (43.27)	-0.0031 (-5.09)	
	Non-EU	0.22	0.28	28.4	0.22 (18.02)	0.0004 (0.49)	
Other	OECD	0.35	0.41	19.0	0.35 (56.19)	0.0001 (0.10)	5.72 **
	EU	0.35	0.36	3.0	0.34 (46.31)	-0.0002 (-0.43)	
	Non-EU	0.31	0.48	52.2	0.31 (27.99)	0.0023 (2.23)	
Transfers							
Social Welfare	OECD	0.35	0.27	-23.4	0.36 (124.25)	-0.0025 (-9.60)	0.98
	EU	0.24	0.18	-24.9	0.23 (43.05)	-0.0024 (-7.49)	
	Non-EU	0.34	0.29	-14.2	0.37 (47.40)	-0.0016 (-3.02)	
TOTAL	OECD	0.37	0.32	-12.2	0.36 (145.69)	-0.0010 (-6.71)	15.28 ***
	EU	0.33	0.26	-20.4	0.30 (71.22)	-0.0022 (-8.35)	
	Non-EU	0.37	0.34	-7.8	0.39 (83.93)	-0.0004 (-1.07)	

a: In parenthesis heterocedasticity consistent t-statistics.
 ***, **, * : The null hypothesis of equality of trends can be rejected at a 1%, 5% and 10% significance level, respectively .

TABLE 2. Results of the convergence estimation for each function of the government expenditures by areas (1970-1997).							
Function	Area	Arellano & Bover Test $\chi^2(1)^a$	β^b	Chow Test $\chi^2(1)^a$	Equality country-dummies $\chi^2(14)/\chi^2(10)/\chi^2(25)^a$	Type of convergence	$\sigma(\text{Steady State})/$ $\sigma(1997)$
Pure public goods							
Public Services	OECD	4.4 (0.04)	-0.134 (-14.39)		30.51(0.21)	ABS.	0
	EU		-0.129 (-4.57)	0.01 (0.93)	3.82 (0.99)	ABS.	0
	Non-EU		-0.132 (-11.15)		25.43 (0.00)	COND.	1.54
Defense	OECD	439.8 (0.00)	-0.120 (-12.09)		90.29 (0.00)	COND.	1.46
	EU		-0.152 (-9.06)	7.05 (0.01)	44.82 (0.00)	COND.	1.28
	Non-EU		-0.101 (-7.88)		77.06 (0.00)	COND.	1.53
Merit goods							
Health	OECD	667.8 (0.00)	-0.119 (-11.42)		149.04 (0.00)	COND.	0.89
	EU		-0.145 (-8.37)	4.52 (0.03)	49.46 (0.00)	COND.	0.72
	Non-EU		-0.097 (-6.34)		129.77 (0.00)	COND.	0.94
Education	OECD	352.7 (0.00)	-0.116 (-11.51)		64.94 (0.00)	COND.	0.81
	EU		-0.118 (-6.75)	0.17 (0.68)	17.82 (0.21)	ABS.	0
	Non-EU		-0.109 (-8.07)		22.32 (0.01)	COND.	0.65
Housing	OECD	738.4 (0.00)	-0.143 (-10.38)		69.41 (0.00)	COND.	1.18
	EU		-0.140 (-6.86)	0.51 (0.48)	68.90 (0.00)	COND.	1.19
	Non-EU		-0.161 (-7.11)		37.89 (0.00)	COND.	1.22
Services & others							
Transp. & Comm.	OECD	539.8 (0.00)	-0.135 (-12.17)		75.74 (0.00)	COND.	0.93
	EU		-0.144 (-8.28)	0.13 (0.71)	54.68 (0.00)	COND.	1.13
	Non-EU		-0.136 (-9.19)		25.93 (0.00)	COND.	0.69
Other	OECD	880.1 (0.00)	-0.123 (-15.55)		98.95 (0.00)	COND.	0.82
	EU		-0.132 (-10.76)	1.39 (0.24)	54.14 (0.00)	COND.	0.83
	Non-EU		-0.114 (-10.67)		59.31 (0.00)	COND.	0.79
Transfers							

	OECD	683.0 (0.00)	-0.121 (-14.39)		189.13 (0.00)	COND.	1.07
Social Security	EU		-0.136 (-10.62)	3.78 (0.05)	125.61 (0.00)	COND.	0.98
	Non-EU		-0.104 (-8.67)		125.58 (0.00)	COND.	0.95
<i>a: In parenthesis p-value. b: In parenthesis heterocedasticity consistent t-statistics.</i>							

TABLE 3. σ -convergence of the shares of each function in total government spending for EU, Non-EU and OECD (1970-1997).

Functions	Area	1970	1997	Variation (%)	T2 $\chi^2(1)$	T3 $N(0,1)$
Pure Public Goods						
Public Services	OECD	0.37	0.21	-42,0	7.09***	5.09***
	EU	0.28	0.18	-36,7	3.20*	3.05***
	Non-EU	0.47	0.26	-45.4	2.97*	3.90***
Defense	OECD	1.46	1.28	-11,9	2.76*	1.29*
	UE	0.62	0.46	-25,8	2.22	1.88**
	Non-EU	2.17	1.95	-10.2	0.51	0.68
Merit Goods						
Health	OECD	0.58	0.62	6,0	0.25	-0.59
	EU	0.28	0.23	-18,1	0.61	1.02
	Non-EU	0.82	0.93	13.3	0.44	-1.16
Education	OECD	0.37	0.24	-34,1	4.24***	3.37***
	EU	0.40	0.17	-57,4	8.56***	8.80***
	Non-EU	0.15	0.21	37.5	0.97	-0.90
Housing	OECD	1.27	0.85	-32,7	3.67*	3.09***
	EU	0.60	0.50	-16,4	0.47	0.88
	Non-EU	1.84	1.16	-37.1	1.77	2.53***
Services & Other						
Transport & Comm.	OECD	0.49	0.50	0,1	0.00	-0.05
	EU	0.48	0.46	-4,5	0.03	0.20
	Non-EU	0.29	0.41	42.2	1.11	-0.90
Other	OECD	0.41	0.50	23,8	1.32	-1.06
	EU	0.43	0.45	6,3	0.06	-0.24
	Non-EU	0.37	0.58	57.3	2.25	-1.75**
Transfers						
Social Welfare	OECD	0.59	0.38	-34,8	8.34***	3.94***
	EU	0.35	0.29	-17,9	0.69	1.05
	Non-EU	0.64	0.42	-34.5	2.54	2.46***

***, **, *: The null hypothesis of no convergence can be rejected at a 1%, 5% and 10% significance level, respectively.

TABLE 4. Speed of σ -convergence of the shares of each function for EU, Non-EU and OECD (1970-1997).						
Functions	Area	Intercept ^a	Trend ^a	Chow test F(1,52)	Bootstrap 1)	Bootstrap 2)
Pure Public Goods						
Public Services	OECD	0.37 (19.98)	-0.0004 (-0.30)	0.06	855	691
	EU	0.24 (19.22)	-0.0014 (-1.68)			
	Non-EU	0.51 (16.79)	-0.0008 (-0.37)			
Defense	OECD	1.45 (383.71)	-0.0055 (-17.99)	6.39 **	37 **	102
	UE	0.58 (56.91)	-0.0047 (-6.72)			
	Non-EU	2.16 (336.95)	-0.0069 (-13.62)			
Merit Goods						
Health	OECD	0.58 (48.62)	0.0036 (5.11)	21.95 ***	82 *	39 **
	EU	0.21 (15.62)	-0.0011 (-1.15)			
	Non-EU	0.84 (47.49)	0.0071 (6.11)			
Education	OECD	0.29 (15.82)	-0.0040 (-3.32)	40.99 ***	0 ***	100 *
	EU	0.28 (10.48)	-0.0073 (-4.49)			
	Non-EU	0.15 (17.41)	0.0019 (3.04)			
Housing	OECD	1.23 (16.91)	-0.0244 (-4.80)	15.59 ***	957 **	809
	EU	0.64 (35.96)	-0.0025 (-2.14)			
	Non-EU	1.75 (13.59)	-0.0431 (-4.51)			
Services & Other						
Transport & Comm.	OECD	0.48 (81.60)	-0.0017 (-3.01)	9.92 ***	87 *	161
	EU	0.50 (63.16)	-0.0030 (-5.21)			
	Non-EU	0.48 (19.39)	0.0012 (1.20)			
Other	OECD	0.41 (56.89)	0.0004 (0.64)	5.05 **	70 *	133
	EU	0.41 (47.58)	0.0001 (0.19)			
	Non-EU	0.38 (28.25)	0.0031 (2.33)			
Transfers						
Social Welfare	OECD	0.75 (20.73)	-0.0067 (-2.80)	1.48	880	804
	EU	0.30 (27.20)	-0.0014 (-2.15)			
	Non-EU	0.89 (15.44)	-0.0060 (-1.59)			
<i>a: In parenthesis heterocedasticity consistent t-statistics.</i>						
<i>***, **, *: The null hypothesis of equality of speed of σ-convergence can be rejected at a 1%, 5% and 10% significance level.</i>						

TABLE 5. γ -Convergence. Kendall multi-annual index of each function of government expenditure in EU and OECD countries, 1970-1997.							
Functions	Area	1970	1997	Variation (%)	Intercept ^a	Trend ^a	Chow test F (1,52)
Pure Public Goods							
Public Services	OECD	1.00	0.72	-28.2***	0.97 (126.71)	-0.0090 (-21.79)	27.58***
	EU	1.00	0.69	-31.3***	0.98 (191.15)	-0.0114 (-33.11)	
	Non-EU	1.00	0.73	-26.8***	0.96 (78.93)	-0.0079 (-12.27)	
Defense	OECD	1.00	0.92	-7.7***	0.98 (350.34)	-0.0022 (-13.29)	37.06***
	EU	1.00	0.90	-10.4***	0.97 (149.31)	-0.0032 (-8.62)	
	Non-EU	1.00	0.95	-4.8***	0.99 (408.29)	-0.0011 (-7.72)	
Merit Goods							
Health	OECD	1.00	0.78	-21.8***	0.98 (116.19)	-0.0088 (-15.16)	51.06***
	EU	1.00	0.60	-39.8***	0.98 (63.88)	-0.0168 (-15.79)	
	Non-EU	1.00	0.75	-25.0***	0.99 (191.28)	-0.0089 (-29.50)	
Education	OECD	1.00	0.77	-23.2***	0.99 (147.21)	-0.0074 (-18.44)	4.82***
	EU	1.00	0.68	-32.4***	1.03 (111.70)	-0.0110 (-14.79)	
	Non-EU	1.00	0.50	-49.7***	0.89 (42.84)	-0.0134 (-12.20)	
Housing	OECD	1.00	0.75	-24.8***	0.98 (123.40)	-0.0096 (-19.90)	22.09***
	EU	1.00	0.78	-22.4***	0.96 (68.69)	-0.0077 (-10.71)	
	Non-EU	1.00	0.69	-31.0***	1.01 (80.27)	-0.0133 (-19.79)	
Services & Other							
Transport & Comm.	OECD	1.00	0.80	-20.4***	0.95 (90.10)	-0.0056 (-10.12)	18.43***
	EU	1.00	0.71	-29.1***	0.89 (40.32)	-0.0069 (-5.93)	
	Non-EU	1.00	0.64	-36.1***	0.94 (76.68)	-0.0113 (-17.45)	
Other	OECD	1.00	0.78	-22.5***	1.00 (324.57)	-0.0076 (-30.46)	70.14***
	EU	1.00	0.76	-25.5***	1.00 (351.92)	-0.0089 (-59.52)	
	Non-EU	1.00	0.79	-21.1***	0.97 (167.03)	-0.0056 (-12.69)	
Transfers							
Social Welfare	OECD	1.00	0.88	-12.0***	0.99 (329.27)	-0.0037 (-22.09)	39.88***
	EU	1.00	0.85	-15.0***	0.99 (366.32)	-0.0050 (-33.14)	
	Non-EU	1.00	0.79	-21.5***	0.97 (114.62)	-0.0081 (-14.14)	

*a: In parenthesis heterocedasticity consistent t-statistics.
***, **, *: The null hypothesis of independence between rankings of each year or the null hypothesis of equality of trends is rejected at a 1%, 5% and 10% significance level, respectively.*

¹Government productive expenditures have a higher output elasticity than non-productive expenditures, which might have even no effect on growth. Some of these non productive expenditures might enter in individual's utility functions. For example, among productive expenditures Kneller et al., (1999) include those devoted to health, general administration services, public order, education, defense, transport and communication and housing. Therefore, non-productive expenditures would be social security, recreation, culture and religious services, and economic services other than transport and communication.

²Data from national agencies, OECD and World Bank country reports, Eurostat: *General Government Accounts and Statistics* and the IMF publication: *Government Finance Statistics*, is used on a supplementary basis so as to make use of OECD data to obtain longer statistical series and supplement the informative shortcomings of the basic sources. Although IMF data covers a longer period of time, it is not as a rule consolidated for all the Public Administrations. Therefore, this source requires the separation of transfers between different administrative levels expenditures (see Easterly and Rebelo, 1993 for a discussion on the limitations of the data of this publication). Furthermore, it uses the cash criterion.

³ We include in the EU sample to the UK, Ireland and Denmark who joined in 1973, Greece (1980), Spain and Portugal (1986) and Austria, Finland and Sweden (1995). These countries were members of the EFTA or had close economic relation with EU including free trade agreements.

⁴ This test compares the coefficients in levels and first differences, so that if these are significantly different the hypothesis of absence of correlation between unobservable effects and explanatory variables is rejected. This test is more robust than usual Hausman's test if heterocedasticity and autocorrelation are to be present.

⁵ The β_f coefficient for health expenditures in the EU is also remarkably similar that found by Hitiris and Nixon (2001). Note, however, that Hitiris and Nixon (2001) include both private and public health expenditures and express expenditures as a share of GDP.

⁶ T_2 and T_3 are in principle statistics for testing convergence. Actually T_3 cannot be computed in case of β -divergence. Therefore, the latter inference should be taken with cautious. In addition, the hypothesis of no divergence may be only rejected at a 10% significance since it would be a two-sided test.

⁷ Bootstrap is a resampling method for statistical inference (see Efron and Tibshirani, 1993, for a review on bootstrap methods). Each of the 1000 bootstrap samples are simple random samples of 15 (EU area) or 11 (Non-EU area) residuals selected with replacement from the residuals of the estimation of the first step. Some of the original

residuals are presented two or more times in each bootstrap sample, whereas other residuals are absent. Davison and Hinkley (1997) reported that 1000 replications provides robust inferences. Other possibility is to bootstrap the observations, which is asymptotically equivalent to bootstrap the residuals. However this possibility does not maintain the structure of covariates and do not assume the appropriateness of the original model.