

THE DYNAMICS OF REGIONAL GDP IN THE EURO ZONE FROM 1980 TO 2005: ECONOMIC GROWTH OR DEVELOPMENT?

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Abstract

This paper aims to determine and analyse the typology and intensity of the economic growth through an approach to the structure of the allometric models, previously developed by biologists. It could be important for political decision-takers to know the type of growth since it allows the determination of the dynamics that characterize the areas subject to the study. This study aims to examine the growth in the Euro zone considering the GDP per capita at constant prices (2000) of every single country in the period from 1980 to 2005. The model permits the estimate of the pattern intensity and typology that characterize the economic growth of every single Euro country with respect to the relevant region.

JEL classification: C20, O1, O47, O52

Key words: Allometry, Economic growth, Euro zone, GDP

1. Introduction

The region presents different features and potentialities of development, i.e. deriving from different forms of external economies (Marshall, 1920). Solow (1956), with his economic growth model, splits the determining features of the growth into input variations (work and capital) and technological progress.

The economic growth is not a linear process - according to the neoclassical theories it should spontaneously realize the coincidence of economic interest of operators with the goal of the optimal allocation of the resources, but as a process characterized by

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I thank the Editor of RSES for the comments and suggestions.

moments of discontinuity (Nelson, 1998) and by disequilibrium. Such disequilibrium process, that produces regional inequalities, has as its target the analysis of the differences in the growth levels in spatial terms.

An important study is understanding how regional sub-groups (i.e. the Euro zone countries) grow up in respect to a regional system (i.e. a region made up by the G8 countries of the Euro zone).

The GDP at constant prices is the most important indicator to study the economical growth both at short and at long term. The variable at constant prices has the advantage of eliminating the effect produced by prices in time and of evaluating the growth in terms of quantity.

This study aims to examine an indicator of the regional economic growth estimating an allometric growth ratio between the i -th country of the Euro zone and the relevant region.

Allometry is known in biology to study the differential growth rates of the parts of a living organism's body. The growth is possible when the body evolves with proportionality features among all the components of the structure and its elements are linked to interdependences that do not change the structure.

Development is possible when deep transformations intervene in the system and, inside the structure, some elements begin forms of disproportionate growth (compared to the whole) or of an allometric type (Coccia, 2006). Julian Huxley (1972) described a model in order to determine the allometric growth:

$$y = \alpha (x)^{a/c} \quad (1)$$

where a and c identify the growth of two analysed components.

This typology of approach in the economic field aims to answer to the following questions:

- What are the typologies of economic growth of the different regional systems compared to a relevant geographical region?
- Does the examined regional system follow in space a process of economic growth or development?

Since Coccia's approach (2006) a typology of economic dynamics of the single countries of the Euro zone has been examined compared to a relevant region.

2. Analysis of the economic growth in the Euro zone

The Euro zone is the region comprising all the EU Member States that have adopted Euro as the official currency. Euro was adopted on 1st January 1999 by eleven countries; Greece and Slovenia joined respectively in 2001 and 2006; Slovenia will not be taken into consideration in the following analyses.

From 1980 to 2005, Ireland, Luxembourg and Portugal registered the greatest average annual growth of GDP per capita among the 12-country Euro zone (respectively 4.2%, 3.7% and 2.5%).

Let analyse some aspects relating to the economic activities that characterise those countries. Ireland, for example, is characterised by the positive trend in exportations, feature that pull the economic growth. It is the main exporting country in terms of software and services for the advanced service industry and it distinguishes for tax exemption on copyright royalties, feature that makes Ireland the core of the international trade of material covered by copyright.

On the other hand, Luxembourg has an unstable and high-income economy characterised to be a fundamental core of the international finance.

Portugal is the third country of the Euro zone in terms of average annual economic growth of GDP per capita, in percentage but not in absolute terms, in the last 25 years. Since 1985, it has taken a modernisation process and in 1986 it joined the European Economic Community. Then, the country went through several reforms and the privatization of public services, making free some economic sectors such as finance and telecommunications. Nevertheless economic growth in Portugal, in absolute terms of increase in real GDP per capita has been one of the lowest of EU12 countries, as seen in table 2.

TABLE 1 - Dates when the Euro countries joined EU

Countries	Date of joining EU		
Belgium	23 July 1952		
France			
Germany			
Italy			
Luxembourg			
Netherlands			
Ireland	1 January 1973		
Greece	1 January 1981		
Portugal	1 January 1986		
Spain			
Austria	1 January 1995		
Finland			
Slovenia	1 May 2004		

TABLE 2 - GDP per capita in levels (€) at constant prices 2000

Euro zone countries	1980	1985	1990	1995	2000	2005
Austria	17575	18847	21299	22904	26260	27462
Belgium	16544	17379	20019	21728	24563	25803
Finland	16906	18844	21832	20513	25555	28579
France	17708	18180	20577	21260	23759	24733
Germany	17435	18644	21302	22903	25073	25806
Greece	12026	11753	12221	12396	14261	17401
Ireland	11696	12211	15036	18300	27587	32609
Italy	14233	15408	17946	19065	20880	21227
Luxembourg	22473	25578	35236	39851	50116	55961
Netherlands	17648	18230	20839	22397	26244	27147
Portugal	6438	6818	9217	10088	11960	12044
Spain	9381	9819	12189	13128	15562	17031
Region*	16548	17538	20103	21309	23478	24166
EU12	15136	15972	18474	19642	22089	23058

*made up by France, Germany, Italy (G8 countries of the Euro zone)

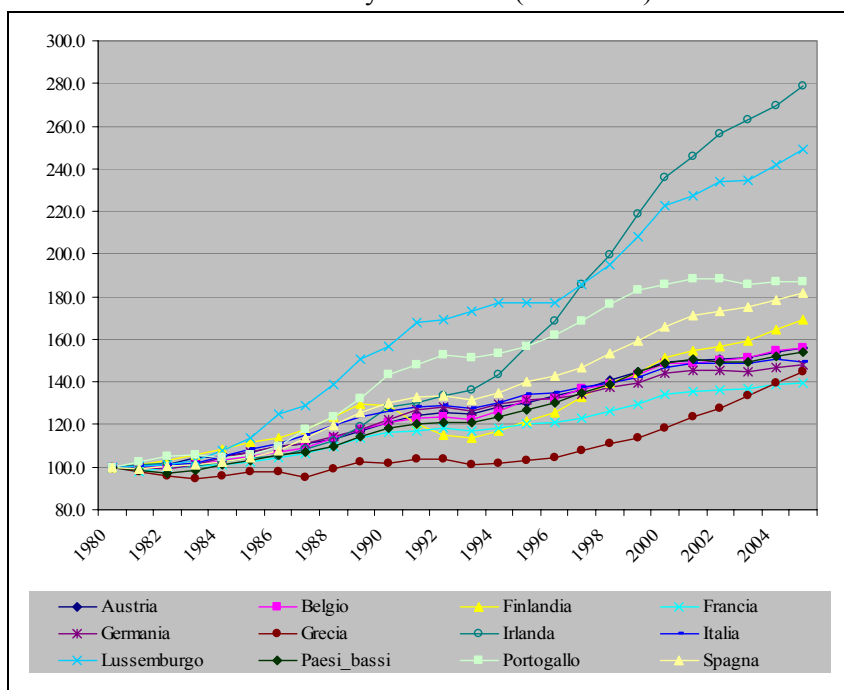
Source: data processed by the International Monetary Fund (April 2007)

Greece from 1980 to 1995 manifested a low growth of GDP per capita at long term, tendency changed only since the late nineties.

Regarding table 2, we may notice that the highest increases in real GDP per capita, among EU12 countries, in the period 1980-2005 correspond to Luxembourg (33488), Ireland (20913) and Finland (11673). These countries, in descending order of increase, are followed by a second group of five countries with increase higher than 8000 Euros: Austria (9887), Netherlands (9499), Belgium (9259) and Germany (8371). Finally a third group with the lowest increase are, in descending order: Spain (7650), France (7025), Italy (6994), Portugal (5606) and Greece (5375).

The high increases of real GDP per capita in Ireland and Luxembourg did not imply a similar increase in real wages and real family income per inhabitant, because they have been due, partly to foreign investments that share the income from the corresponding activities. The effect has been positive on real income per capita but at a more moderate level.

CHART 1 - Growth of GDP per capita (€) at constant prices 2000 in the 12-country Euro zone (1980=100)



Source: data processed by the International Monetary Fund (April 2007)

Regarding Portugal, as seen in Guisan and Aguayo (2004), the shares of real Value-Added per inhabitant are below the shares of population on EU25 countries, both at national en regional level, and have not improved during the period 1995. The country as a whole went from 1.73% of total real Value-Added of EU25 in year 1995 to

1.69% in year 2000, while population share in year 2000 was 2.26. At regional level some regions experienced a decrease in their share of European Value-Added in that period: North from 0.52 to 0.50, Centro from 0.25 to 0.23, Alentejo from 0.08 to 0.07. The other regions experienced stagnation in their shares of European Value-Added. All the regions but Lisboa e Val do Tejo had a share of real Value-Added lower than their share of population on EU25, what implies value-added per capita below European average. In the case of Lisboa the shares coincide at a percentage of 0.76 on EU total for both variables (Value-Added and Population), what implies a value-added per capita like EU25 average.

3. The model

To estimate the indicator of the regional economic growth, we usually consider the variable of GDP per capita at constant prices (2000) letting 1980=100 (chart 1). The variables considered are data processed by IMF (International Monetary Fund), World Economic Outlook, April 2007.

The function used is:

$$y_{it} = \alpha (x_t)^{a/c} \quad (2)$$

where a and c are the indexed growths of GDP per capita (1980=100) respectively of the i -th country and of the region. The equation has been transformed in logarithm in order to obtain the following linear relationship, letting $a/c = \beta$. The model has been estimated by the ordinary least squares method (Greene, 1997).

$$\log y_{it} = \alpha + \beta \log x_{jt} + \varepsilon_t \quad (3)$$

α = constant; y_{it} = indexed growth of GDP per capita of i -th country at time t ; x_{jt} = indexed growth of GDP per capita of the region j = (France, Germany, Italy) at time t ;

The following hypotheses have been considered:

If $\beta > 1$, the country (i) has a quicker growth than the region (j), positive allometric growth (*economic development*).

If $\beta < 1$, the country (i) has a lower growth than the region (j), negative allometric growth (*diverging economic growth of i-th country*).

If $\beta = 1$, country (i) and region (j) are following an isometric economic growth (*the growth follows a steady-state*).

On the value of β estimated by the model has been verified the hypothesis of equality to one through the t-student test:

$$t = \frac{\beta - 1}{\sqrt{\frac{\sum (y_i - y_i^*)^2}{(n - 2) \sum (x_j - \bar{x})^2}}} \quad (4)$$

Null hypothesis H_0 : $\beta = 1$ against the alternative hypothesis that H_1 : $\beta \neq 1$ choosing $\alpha = 0.05$ e 0.01 as the level of significance.

The value obtained has to be compared to the tabulated t value for n-2 degrees of freedom, to the level of significance of 5% and 1% .

With $\beta = 1$ identifying a pattern of economic growth of isometric type of the i-th country compared to the region j, Ireland and Luxembourg are the areas that present the higher values of the parameters estimated by the model, respectively 2.728 and 2.290.

This is a clear indication of economic development and dynamics of growth of positive allometric type compared to the region made up by Germany, France, and Italy. Finland is the only country to register a growth of isometric type with a tendency almost to the positive economic allometry, while Greece presents a growth of negative allometric type (diverging economy), on which weigh the first fifteen years of the historic series.

TABLE 3 - T-student test for the classification of the economic growth of different countries in the Euro zone (1981-2005)

Country	β	t-student (4)	Hypothesis $H_0: \beta = 1$ $\alpha = 0.05$	Hypothesis $H_0: \beta = 1$ $\alpha = 0.01$
Austria	1.1246	4.56	Allometry +	Allometry +
Belgium	1.1582	5.90	Allometry +	Allometry +
Finland	1.0937	0.91	$\cong$ Isometry/ allometry +	$\cong$ Isometry/ allometry +
Greece	0.8434	-1.50	Allometry -	Allometry -
Ireland	2.7278	9.36	Allometry +	Allometry +
Luxembourg	2.2898	39.95	Allometry +	Allometry +
Netherlands	1.2092	6.14	Allometry +	Allometry +
Portugal	1.7449	15.16	Allometry +	Allometry +
Spain	1.5497	15.43	Allometry +	Allometry +

CHART 2 - Parameter of growth

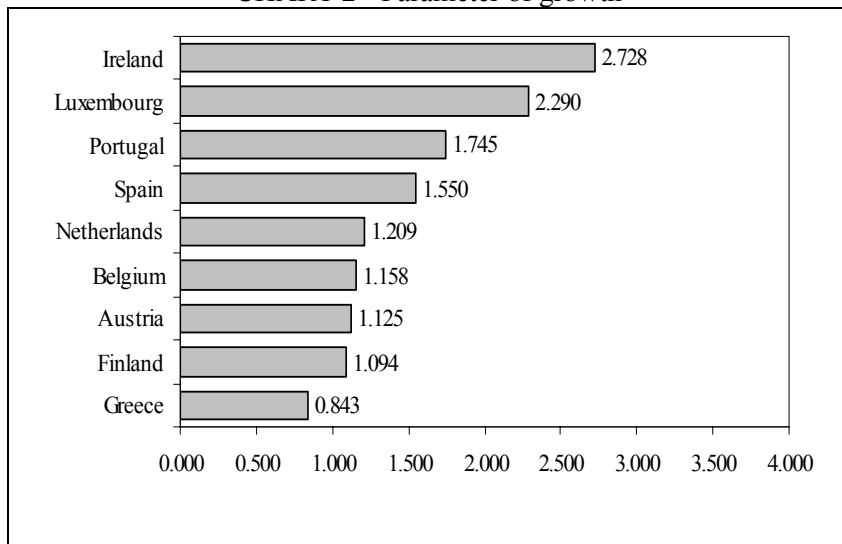


TABLE 4 - Estimates of parameters of the economic growth model for the 12 countries of the EU with the exclusion of the relevant region

Country	α	β	R ² adj.	S.E. of Regression	F-statistic
Austria	-0.00314 (0.0067) [-0.46]	1.1246 (0.0273) [41.17]	0.986	0.017124	1695.2 Prob. (0.000)
Belgium	-0.01850 (0.0065) [-2.81]	1.1582 (0.0267) [43.22]	0.987	0.016799	1868.2 Prob. (0.000)
Finland	0.01378 (0.0251) [0.54]	1.093776 (0.1024) [10.67]	0.825	0.064215	114.0 Prob. (0.000)
Greece	-0.1028 (0.0255) [-4.02]	0.8434 (0.1042) [8.08]	0.729	0.065366	65.43 Prob. (0.000)
Ireland	-0.1459 (0.0452) [-3.22]	2.7278 (0.1844) [14.78]	0.901	0.115645	218.6 Prob. (0.000)
Luxembourg	0.01198 (0.0079) [1.51]	2.2898 (0.0322) [70.93]	0.995	0.020237	5031.9 Prob. (0.000)
Netherlands	-0.04534 (0.0083) [-5.43]	1.2092 (0.0340) [35.52]	0.981	0.021339	1262.1 Prob. (0.000)
Portugal	0.00661 (0.0120) [0.54]	1.7449 (0.0491) [35.51]	0.981	0.030800	1261.4 Prob. (0.000)
Spain	-0.03071 (0.0087) [-3.51]	1.5497 (0.0356) [43.50]	0.987	0.022334	1892.2 Prob. (0.000)

Obs=25 (1981-2005);

Method of estimation = Ordinary Least Squares (OLS);

() Std. Error; [] t-Statistic;

Estimates made with the econometric software E-views;

The Euro zone in general highlights a disproportionate growth in terms of space and time with respect to the relevant region, with seven countries showing economic development with different intensities, while only a geographical area shows a divergent economic growth.

4. Conclusions

The application of allometric models in economic studies provides important information on dynamics belonging to the neoclassical theory of convergence with three typologies of growth: positive and negative allometry, and isometry.

A first consideration helps defining that the economic growth of a regional system depends on the dynamics of the growth that distinguish the different subsystems that define it. Despite France, Germany and Italy fall into the first eight more industrialized countries at world level, their dynamics of economic growth in terms of GDP per capita result to be, in the majority of cases, lower than other countries that define the whole economic system of the Euro zone.

The proposal of using in the model an indicator of growth of the GDP with base 1980=100, instead of considering an annual growth rate as in Coccia's study (2006), has permitted to obviate the problem of excluding from the estimate the periods with negative growth due to the presence of negative growth rates that in the transformation in logarithms generate some missing values.

In the future, today approach could be applied to examine the dynamics of economic growth in the enlarged Euro Europe, in order to evaluate the countries that have the greater pulling possibilities in the considered economic system.

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