CONVERGENCE IN THE INNOVATIVE PERFORMANCE OF THE EUROPEAN UNION COUNTRIES

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RESUMEN

The aim of this work is to study whether a process of convergence in innovation in the European countries has occurred or not, by analysing the relative changes in the innovative position of the European countries during period 2002-2006. A special attention is paid to the relative changes that have occurred in the recently acceded countries and to the poorest countries of the UE-15. The data used in this research come from the fourth and fifth wave of the Community Innovation Survey (CIS). The statistical technique used is the Multiple Factorial Analysis. The study has been carried out in two different sets of firms. On the one hand, it has considered all the manufacturing firms (innovative and non-innovative firms) and on the other, only the innovative manufacturing firms. The results show a moderate convergence process in innovation in the manufacturing as a whole, but not in the innovative firms.

Palabras clave: convergence, CIS, innovation

1.- INTRODUCTION

One of the aims of the European Union since the beginning of the process of economic integration has been to reach greater economic convergence between the European countries. This objective was reached until the 70s (Mud, 1991; Fagerberg and Verspagen, 1996), stopping in the 80s and, undergoing an improvement since the 90s (Iammarino and Santangelo, 2001).

The interest in understanding factors that influence the economic convergence in the European countries has given rise to two main research strands. The first one has focused on the study of the factors that affect, in general, the economic convergence. The second research strand has dealt with the analysis of the economic effects that have

occurred as a result of the last two enlargements (2004 and 2007) of the European Union.

Within the first research strand, one aspect that has recently received increased attention in academic and policy-making circles is the importance of the innovation in explaining the existing economic differences among countries (Jungmittag, 2006). The existing consensus about the relevance of technical progress and innovation for the economic growth (Aghion and Howitt, 1997) has led to many authors to suggest that the innovative dynamics of countries provide relevant inputs to understand their economic dynamics. Hence, the existence of convergence in the innovative profile of countries would lead one to believe that they advance towards convergence in terms of income.

From a theoretical standpoint, the study of technological and innovative differences across countries has gained attention since the 80s (Fagerberg and Verspagen, 1999), giving rise to the development of two main theoretical approaches. The first one assumes that technological differences across countries open the possibility for countries with low economic and technological profile to catch up the rest of the countries by means of imitating more productive technologies applied in leader countries (Fagerberg, 1987). In this strand of thought, imitation is seen as a process less expensive than innovation. Technology is not considered as a public good in the sense that it is not available for all the agents at zero cost . The adoption of new technology entails costs and requires the country to have innovation capacity. The second approach considers that the accumulation of knowledge is basically endogenous (Kaldor, 1966). More precisely, it maintains that countries follow their own growth path, generating his own technological capacities, and consequently, the existing margin for convergence is rather limited.

The second research strand as it has been stated, has dealt with the study about the economic effects of the European enlargement on the countries of the previous EU-15, in general, and on the poorest countries like Spain and Portugal,in particular (Monetary Policy and the Economy, 2008; European Commission, 2006, Kutan and Yigit, 2007, Mountain Altuzarra, and, 2008). From this perspective, one of the subjects that has

received increased attention is the empirical study of the effects of FDI on both the technological development and the real convergence of the countries. One stylized fact is the important increase of FDI flows that has taken place since the 90s, especially from the EU-15 countries towards the enlargement countries. The increase of FDI flows in the latter countries has been promoted by both the elimination of barriers to FDI inflows and the acceleration of the transition process towards market economies. There exist, however, great differences in the volume of FDI inflows that have received countries. Most of the FDI inflows have gone into Poland, the Czech Republic, Estonia and Hungary which are the largest countries of the last enlargements and that exhibited better initial economic condition (Bevan and Estrin, 2000). These countries are followed, to certain distance, by Slovakia and Slovenia that have also advanced successfully towards the single market. In Romania, the progress towards a market economy has been slower, which has made difficult the FDI inflows until recent dates. In the last years, however, this country has undergone an important increase of FDI inflows. Table 1 shows the FDI stock per capita and per GDP for years 2002, 2006 and 2007.

Table 1. FDI Stock

	Stock per capita			Stock per GDP		
	2002	2006	2007	2002	2006	2007
Czech Rep	3.790	7.836	9,923	51.40	56.50	58,40
Estonia	3.115	9.451	12,427	57.80	78.50	80,30
Hungary	3.564	8.111	9,711	54.30	72.90	71,10
Lithuania	1.148	3.226	4,33	28.20	37.60	38,90
Poland	1.260	3.265	3,732	24.40	36.60	34.00
Portugal	4.314	8.315	10,749	35.00	45.90	52.00
Romania	0.358	2.111	2,842	17.10	37.10	36,80
Slovakia	1.583	4.446	23,2	34.80	68.40	54.10
Spain	6.212	10.049	12,138	37.50	36.00	37,60

Source: UNCTAD(2008), Major indicators. Own elaboration.

The intense FDI growth in the enlargement countries could have consequences for countries such as Spain and Portugal that have been receiving important amounts of foreign capital coming from more developed European countries. Undoubtedly, the latter countries have been losing relative positions as a destination of FDI inflows in favour of the newly acceded countries, that could put in danger the advance of their innovating activity and their economic development (Redness and Damijan, 2008).

Table 2 presents the evolution of the FDI inflows as percentage of the GIP. It can be noted that FDI inflows have been greater in enlargement countries than in Spain and Portugal.

Tabla 2. FDI inflows (% GDP)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average of the period
Czech Rep	1,80	2,00	4,60	2,30	2,30	6,00	10,50	8,80	9,10	11,30	2,30	4,60	9,40	4,30	5,30	5,64
Estonia	3,90	5,10	4,50	3,20	5,30	10,20	5,30	6,90	8,80	3,90	9,60	8,30	20,90	10,40	12,00	7,89
Hungary	6,20	2,70	11,10	7,10	8,90	6,90	6,70	5,80	7,40	4,50	2,50	4,40	7,00	6,10	4,10	6,09
Lithuania	0,50	0,50	1,10	1,90	3,50	8,30	4,50	3,30	3,70	5,20	1,00	3,40	4,00	6,30	5,10	3,49
Poland	1,80	1,70	2,60	2,90	3,10	3,70	4,30	5,50	3,00	2,10	2,10	5,20	3,40	5,60	4,20	3,41
Portugal	1,70	1,30	0,60	1,10	2,10	2,50	1,00	5,90	5,40	1,40	4,60	1,10	2,10	5,90	2,60	2,62
Romania	0,40	1,10	1,20	0,70	3,40	4,80	2,90	2,90	2,90	2,50	3,70	8,50	6,60	9,30	5,90	3,79
Slovakia	1,30	1,60	13,10	1,70	1,10	3,20	2,10	9,40	7,50	16,80	6,50	7,20	4,40	7,40	4,30	5,84
Spain	1,90	1,80	1,40	1,50	1,60	2,40	3,00	6,80	4,70	5,70	2,90	2,40	2,20	2,20	3,70	2,95
UE_7	2,4	2,21	5,56	2,94	4,19	6,30	5,26	6,19	6,33	7,67	4,11	6,30	8,20	7,30	6,30	5,42
UE_2	1,8	1,55	1,00	1,30	1,85	2,45	2,00	6,35	5,05	3,55	3,75	1,75	2,15	4,05	3,15	2,78

Source: UNCTAD(2008), Major indicators. Own elaboration
UE_2 includes Portugal and Spain
UE_7 includes Czech Rep., Estonia Hungary, Lithuania, Poland Romania and Slovakia

The aim of this work is to study whether a process of convergence in innovation in the European countries has occurred or not, by analysing the relative changes in the innovative position of the European countries during period 2002-2006. Special attention is paid to the relative changes that have occurred in the recently acceded countries and to the poorest countries of the previous UE-15. Section two describes the methodology and the data used in this study. Section three contains the results and the last section contains the main conclusions drawn from the study.

2.- METHODOLOGY, DATA AND VARIABLES

2.1.- METHODOLOGY AND DATA

The statistical technique used in this study is the Multiple Factorial Analysis (Escofier and Pagès, 1994). This method is a factorial technique adapted to the treatment of data

tables where the same set of individuals (countries, in our case) is described through different groups of variables.

The AFM provides results of great interest from the interpretation standpoint. The interpretative wealth reaches its maximum on the factorial planes, where the individuals are represented and seen through each table or group of variables. These factorial planes allow one to detect the relative position of the individuals considering the whole set of variables. Also, and being this the dimension where the statistical technique offers a major interpretative wealth, the factorial planes allow one to detect the relative position of the individuals from the standpoint of each group of variables. Hence, it can be detected the group of variables that defines the tendency of each individual, as well as the differences between the individuals according to the different standpoints, that is to say, according to the different groups of variables. The statistical programme used is SPAD 6.0.

The data used in this research come from the fourth and fifth wave of the Community Innovation Survey (CIS), elaborated by EUROSTAT and gathered in different European states.

The CIS is a survey on innovation activity in firms of the EU states, candidate countries, Iceland and Norway. Data were collected every four years since 1996. However, since 2004 a reduced version is presented every two years. The observation period for the CIS-4 was from 2002 to 2004 (excluding the Czech Republic, where the observation period was from 2003 to 2005). The CIS-5 is the last survey whose observation period was from 2004 to 2006. In the Survey the reference population is firms with 10 or more employees and it is based on a sample stratified by size and sector.

The CIS-5 largely follows the structure of the CIS-4, with minor modifications. This makes it feasible to make comparisons between the two waves. The comparison with other editions of the CIS is complicated from a technical perspective given that some editions have introduced changes in the definition of innovation, in the wording of certain questions of the questionnaire and in the number of participating countries. The

difficulty in establishing comparisons over time is also conditioned by the quality of the data provided. It is a necessary condition for the correct application of certain statistical techniques that the selected variables contain data for each individual participating in the sample. The lack of data may invalidate the conclusions reached. Therefore, in this investigation we have decided to make a comparison of the waves that have a high degree of harmonization

The processing of the information provided by Eurostat for the countries participating in the survey is at industry level. However, for the aim of this research, an aggregated treat of data at manufacturing level has been made. On the other hand, the absence of data for some variables in some countries has meant that the study covers a total of eighteen European countries: Belgium, Czech Republic, Denmark, Estonia, Ireland, France, Italy, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia and Sweden.

2.2.- SELECTION OF VARIABLES

The selection of variables has been made taking into account the availability of information and the different dimensions that, according to the theory, affect the innovative activity. Of all the information contained in the CIS, firstly, a set of variables has been selected and then, variables have been grouped into two groups for each wave of information. The groups of variables refer, on the one hand, to manufacturing as a whole including both innovative and non-innovative firms. And, on the other, to the subset of innovative manufacturing firms[1]

The information provided by each of subsets is different. Innovative activity across the manufacturing provides an idea of the diffusion of the forms of innovation in all firms, but does not capture the intensity with which the innovation takes place in innovative companies. The study of innovation in the innovative firms allows to know the

[1] The definition of innovation that is used in the two waves of the CIS is harmonized. It is considered that a firm is innovative when the firm has introduced new or improved products on the market or it has implemented new or improved processes. The term includes all types of innovation: product innovation and process innovation.

concentration of forms of innovation in such firms, acting as an indicator of innovation intensity. The distinction between the innovative profile of the whole manufacturing and of the innovative firms allows to detect whether there exist countries with a scarce (intense) diffusion of innovation across manufacturing, but where innovative firms perform an intense innovative activity by combining several (few) types of innovation.

By Proceeding in this way, we can carry out two types of analysis. Firstly, considering the information from all groups of variables, the innovative profile of the European countries can be studied. And secondly, the change in the innovative profile that has occurred in manufacturing and in the innovative firms of countries during the two waves of information can be analyzed. Table 3 presents the variables included in each group of variables. All variables are continuous.[2].

Table 3: Variables included in the analysis

GROUP	VARIABLE	LABEL
GROUP 1 Innovation in manufacturing (CIS 5)	Percentage of innovative firms	C5_MANUF_Inno
	Percentage of firms that perform R & D	C5_MANUF_I+D
	Percentage of firms that innovate in product	C5_MANUF_Pd
	Percentage of firms that innovate in process	C5_MANUF_Pc
	Percentage of expenditure in innovation/total income	C5_MANUF_Ginno
	Percentage of expenditure in R&D/total income	C5_MANUF_GI+D
	Percentage of expenditure in machinery/total income	C5_MANUF_Gmaq
GROUP 2 Innovación en la manufactura (CIS 4)	Percentage of innovative firms	C4_MANUF_Inno
	Percentage of firms that perform R & D	C4_MANUF_I+D
	Percentage of firms that innovate in product	C4_MANUF_Pd
	Percentage of firms that innovate in process	C4_MANUF_Pc
	Percentage of expenditure in innovation/total income	C4_MANUF_Ginno
	Percentage of expenditure in R&D/total income	C4_MANUF_GI+D
	Percentage of expenditure in machinery/total income	C4_MANUF_Gmaq
GROUP 3 Innovación en tejido innovador (CIS 5)	Percentage of firms that perform R & D	C5_INNOV_I+D
	Percentage of firms that innovate in product	C5_INNOV_Pd
	Percentage of firms that innovate in process	C5_INNOV_Pc
	Percentage of expenditure in innovation/total income	C5_INNOV_Ginno
	Percentage of expenditure in R&D/total income	C5_INNOV_GI+D
	Percentage of expenditure in machinery/total income	C5_INNOV_Gmaq
GROUP 4 Innovación en tejido innovador (CIS 4)	Percentage of firms that perform R & D	C4_INNOV_I+D
	Percentage of firms that innovate in product	C4_INNOV_Pd
	Percentage of firms that innovate in process	C4_INNOV_Pc
	Percentage of expenditure in innovation/total income	C4_INNOV_Ginno
	Percentage of expenditure in R&D/total income	C4_INNOV_GI+D
	Percentage of expenditure in machinery/total income	C4_CINNOV_Gmaq

[2] Note that for continuous variables AFM behaves as an ACP (weighted variables) and for nominal variables behaves like an ACM (weighted modalities).

We have, therefore, a matrix of 18 individuals (countries) and 26 variables, classified into four groups or tables (two for each round). Table 4 presents a descriptive analysis of the variables included in the study.

Table 4: Description of variables

	CIS 5				CIS 4			
	Mean	S.D.	Max	Min	Mean	S.D.	Max	Min
MANUF_Inno	43.31	14.86	21.21	71.16	42.46	14.29	21.19	73.99
MANUF_I+D	14.44	9.37	2.68	36.53	13.91	8.03	2.11	29.19
MANUF_Pd	22.41	8.54	10.60	36.61	21.87	8.69	10.52	42.46
MANUF_Pc	17.80	6.53	6.26	30.61	18.00	6.64	6.41	35.52
MANUF_GInno	2.71	1.35	0.98	6.19	2.83	1.24	1.37	5.86
MANUF_GI+D	1.20	1.10	0.21	3.95	1.41	1.18	0.22	3.89
MANUF_Gmaq	1.18	0.73	0.36	3.38	1.19	0.57	0.35	2.57
INNOV_I+D	31.24	14.02	11.29	61.71	30.56	11.72	8.06	52.00
INNOV_Pd	51.79	8.01	36.17	68.46	51.26	7.44	36.17	69.11
INNOV_Pc	41.92	10.80	23.13	71.97	43.18	10.76	25.93	65.34
INNOV_GInno	3.63	1.49	1.38	7.73	3.74	1.34	2.03	7.16
INNOV_GI+D	1.81	1.44	0.31	4.93	1.81	1.39	0.30	4.75
INNOV_GMaq	1.57	0.97	0.45	4.29	1.66	0.88	0.45	3.59

3.- RESULTS

3.1. RESULTS OF THE AFM

This section contains the presentation and interpretation of the most outstanding results of the analysis of the tables above mentioned. Table 5 shows the histogram of the first five eigenvalues of the global analysis of all the juxtaposed tables. The table reveals the existence of a dominant first global axis, in that it incorporates a significant percentage of inertia, 46.08% versus 17.57% and 15.52% of variability that is projected onto the second and third global factor, respectively. In this work the first two axes will be considered, as they summarize properly the major features of the countries, ie, the main differences and similarities in terms of innovative behaviour.

Table 5 Histogram

Number	Eigenvalue	Percentage	Accumulated Percentage
1	3.5848	46.08	46.08
2	1.3670	17.57	63.65
3	1.2071	15.52	79.17
4	0.6570	8.44	87.61
5	0.3832	4.93	92.54

Tables 6 and 7 show the Lg coefficients matrix and the RV coefficients matrix, respectively. These matrices provide us information regarding the relationship between the groups of variables analyzed. The Lg coefficients matrix shows a great similarity between the elements of the main diagonal, which means that the groups have a similar dimensionality, ie, have a similar number of factors with considerable inertia. The RV coefficients matrix provides additional information. In this matrix, coefficients can take values between 0 and 1, and has the advantage that groups are directly comparable. In our case, by using these coefficients, it is found that the groups are closely related in time, ie, the group that expresses the innovative activity in manufacturing in 2006 is highly correlated (0.858) with the same group in 2002. This indicates that there have been some changes, but that these changes have been modest. In the case of the innovative firms, the over time correlation is even higher (0,879) which means that changes have been smaller than in the whole manufacturing. The correlation between the innovative profile of the whole manufacturing and the innovative profile of the subset of innovative firms is similar for the two waves under study (0,681 in 2006 and 0,675 in 2002). This correlation, which is not very high, permits us to work with the hypothesis that there exist differences between the relative innovative position of each country in the manufacturing as a whole and their relative innovative position in the subset of innovative firms.

Table 6. Lg coefficients matrix

	1	2	3	4	AFM
1	1.158				
2	0.986	1.140			
3	0.913	0.766	1.550		
4	0.900	0.874	1.327	1.470	
AFM	1.104	10.050	1.271	1.275	1.311
	1	2	3	4	AFM

Table 7. RV coefficients matrix

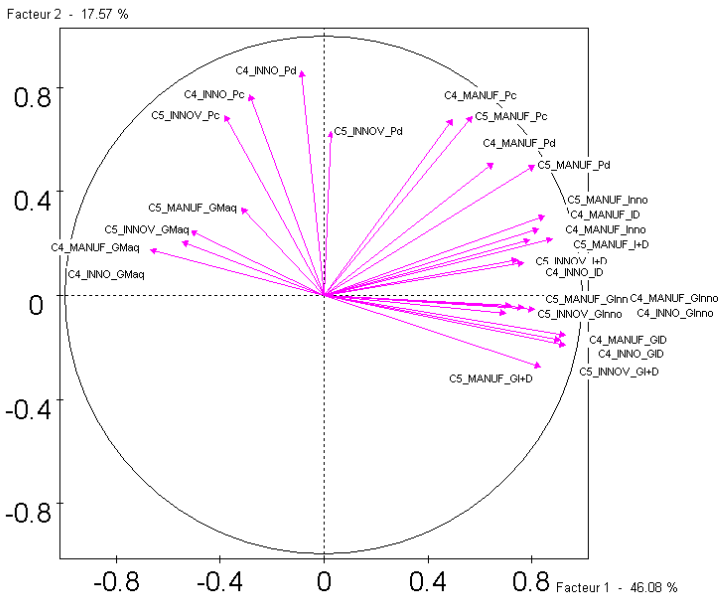
	1	2	3	4	AFM
1	1.000				
2	0.858	1.000			
3	0.681	0.576	1.000		
4	0.690	0.675	0.879	1.000	
AFM	0.896	0.859	0.891	0.918	1.000
	1	2	3	4	AFM

3.2. ANALYSIS OF FACTORS AND RELATIVE POSITION OF THE COUNTRIES

The variables that most contribute to the formation of the axes are represented in Figure 1.

The first factor provides information about the behaviour of variables related to R&D activities and expenditure in innovation in both manufacturing and the innovative firms. The main difference among European countries regarding these variables will be reflected through a ranking where countries situated in the right semiplane will be characterized by a high innovative profile in both the whole manufacturing and the subset of innovative firms as well as in the two waves. By contrast, countries situated in the left semiplane will be characterized by a lower innovative profile, in both manufacturing and the set of innovative firms.

Figure 1. First factorial plane of variables and partial axes

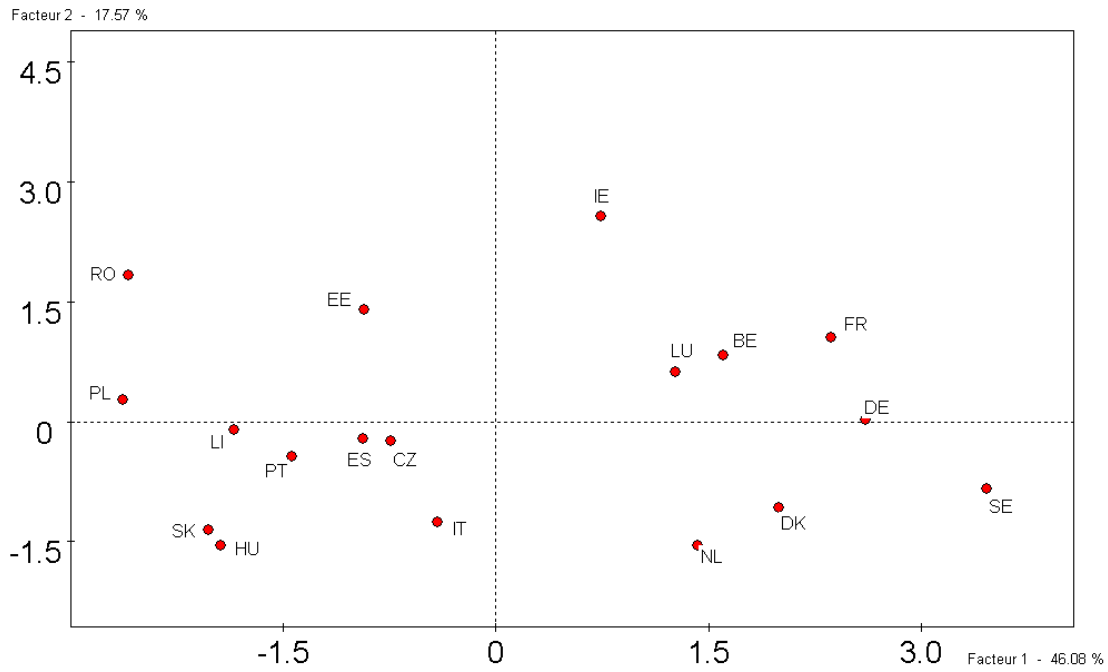


The second axis is a factor that reflects process and product innovation. These variables will be projected on the upper semiplane, for both manufacturing and the set of innovative firms as well as for the two waves of information. Therefore, countries that are characterized by these forms of innovation will be projected in this semiplane.

However, it must be noted that in the first quadrant will be projected those countries where these forms of innovation are complementary to R & D and expenditure in innovation, while, in the second quadrant will be screened those countries where these forms of innovation are substitute of R & D and expenditure in innovation.

Based on the distribution of the variables, Figure 2 shows the representation of the mean individuals on the first factorial plane, ie the representation of the countries mean position, taking into account all the views or groups of variables considered. Therefore, this factorial plane provides a very general view through the relative positions of European countries in the first two factors.

Figure 2: Representation of the *mean countries* on the first factorial plane



The horizontal axis (factor 1) can produce an initial ranking of countries as regards the R&D and the expenditure on innovation. Countries that have the most important positions from highest to lowest are: Sweden, Germany, France, Denmark, Belgium, Netherlands and Luxembourg. Ireland and Italy occupy intermediate positions. In the last positions are: the Czech Republic, Estonia, Portugal, Lithuania, Hungary, Lithuania, Slovakia, Romania and Poland.

This classification should be qualified by the information of the second factor. In the positive semiplane of the vertical axis (factor 2) countries with greater process and product innovation are projected. Under this new characterization, a ranking headed by Ireland, Romania, Estonia, France, Belgium and Luxembourg is obtained. In positions close to average are: Germany, Lithuania, Poland, Spain, Czech Republic and Portugal. The countries that occupy less prominent positions are Sweden, Denmark, Netherlands, Italy, Slovakia and Hungary.

By quadrants, in the first one we find countries that are characterized by performing R&D, introducing process and product innovations and spending a large income share in innovation activities. These countries exhibit the highest innovative profile of the European Union. The fourth quadrant represents countries characterized by performing R&D activities and spending a large income share in innovation, but not so much by introducing process and product innovations. In the second quadrant appear countries characterized by innovating in product and process and by spending resources in acquisition of machinery. In the third quadrant are located the least innovative countries of the European Union. These results are consistent with those obtained in other studies (Altuzarra, Puerta, Serrano, 2007; Altuzarra, Serrano, 2008).

3.3. ANALYSIS OF CONVERGENCE IN INNOVATION

In the previous section, we have represented the relative mean position for each country on the first factorial plane, taking into account all the information. However, it may happen that the relative position that corresponds to a country in one or more of the viewpoints is significantly far from that mean position. One of the advantages of the statistical technique we use is that it allows us to project each country on the factorial plane, from all the viewpoints that we have been considered. Thus, each country could be represented on the factorial plane through five points: one of them reflects the mean position of the country and the rest, the relative partial position of each country in each of the four viewpoints.

This section seeks to identify changes that have occurred in the period analyzed as regards innovative activity in the manufacturing and in the set of innovative firms. To carry out this analysis, initially, we have tested whether countries have different relative positions in manufacturing and in the subset of innovative firms. Only if it is, it would be convenient to treat manufacturing as a whole and the set of innovative firms separately to study the changes in the relative positions of countries over time.

Figures 3a and 3b show the representation of the relative partial position of countries in both manufacturing and the set of innovative firms. To ease interpretation, only countries of the last wave (CIS 5) have been represented. Also, for clarity, figures have been divided vertically into two semiplanes, one, with the most innovative countries and the other one, with the least innovative ones.

Figure 3 (a). Relative position of countries in the manufacturing and in the set of innovative firms (right semiplane)

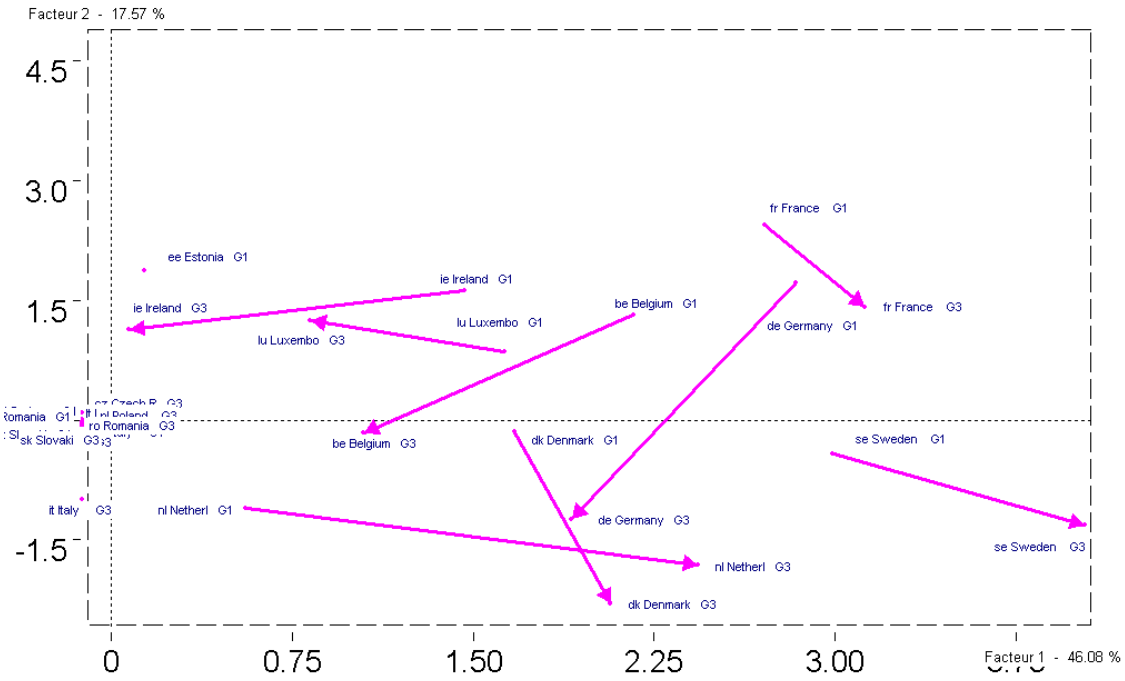
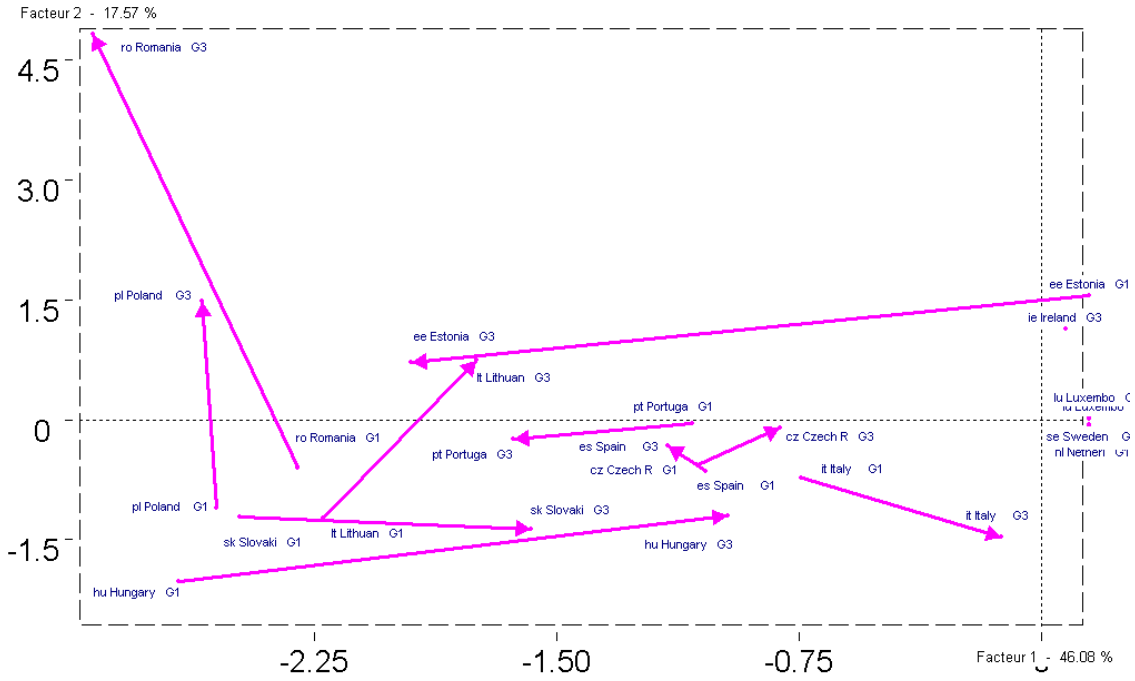


Figure 3 (b). Relative position of countries in the manufacturing and in the set of innovative firms (left semiplane)



Figures show that the relative position of countries in the whole manufacturing differs from the countries relative position in the set of innovative firms. That is, the relative innovative profile for the whole manufacturing in many countries does not match the relative innovative profile of the set of innovative firms in such countries. The innovative profile of manufacturing, as already mentioned, is related mainly to the diffusion of forms of innovation across manufacturing, while the profile of the set of innovative firms is associated with the concentration of forms of innovation in innovative firms.

The differences in the relative position of the whole manufacturing and the innovative firms have been represented by trajectories. The displacement of the trajectories towards the left means that the country relative position in manufacturing is better than the country relative position in the set of innovative firms. The opposite is true when the trajectories move towards the right.

The results show that countries that exhibit a better relative position in the whole manufacturing than in the set of innovative firms are: Ireland, Belgium, Luxembourg, Germany (right semiplane), Romania, Estonia and Portugal (left semiplane). By contrast, France, Sweden, Netherlands, Denmark (right semiplane), Hungary, Italy, Lithuania and Slovakia (left semiplane) show a better relative position in the set of innovative firms than in the whole manufacturing. Spain, Czech Republic and Poland have no significant deviations between the two sets analysed.

The existing asymmetry in most countries between the innovative profile of the whole manufacturing and of the set of innovative firms makes it interesting to analyse the innovative dynamics of countries in each set separately.

The following figures show the changes in the relative innovative position of European states in the whole manufacturing and in the set of innovative firms. The arrows represent the over time trajectories of the innovative profile of the countries. The displacement of the trajectories towards the right expresses an improvement of the relative position of countries and the opposite happens when the trajectory moves towards the right[3].

The results regarding the whole manufacturing show that, countries that have improved their relative innovative position are: France, Luxembourg, Estonia and Portugal. Ireland, Denmark, Germany, Lithuania, Spain and the Czech Republic have experienced a relative decline. Netherlands, Belgium, Sweden, Poland, Slovakia, Hungary, Italy and Romania have not shown significant changes. The relative decline in the whole manufacturing of some countries with high innovative profile along with the relative improvement observed in manufacturing of countries with low innovative profile suggests that convergence in innovation of European countries has been moderate. Besides, this convergence has not been evenly distributed across European countries. For example, manufacturing in France, despite having a high innovative profile has

[3] Intra inertia provides an indicator of the variation that a country shows with respect to its centre of gravity. Countries with the strongest within inertia in the first factor are: Ireland (20.27), Netherlands (16,02), Estonia (13,75), France (10,09), Hungary (10,06), Germany (6,21), Belgium (4,59), Sweden (4,55). Countries with weaker intra inertia in the first factor are: Spain (0,58), Denmark (0,67), Poland (0,80), Czech Republic (0,88), Lithuania (0,88), Portugal (1,04) and Romania (1,28).

continued to experience an improvement and, the opposite happens in Spain and the Czech Republic.

Regarding the set of innovative firms, countries that present advances in the relative position are: France, Ireland, Netherlands and Hungary, while Luxembourg, Belgium, Italy, Germany, Estonia, Romania, Spain and the Czech Republic have fallen in its relative position. Sweden, Denmark, Portugal and Lithuania have hardly change. In the case of the set of innovative firms has not been observed a convergence process in innovation. A nunber of high innovative profile countries such as Sweden, France, the Netherlands have shown progress in their relative position, while some lower innovative profile countries such as Netherlands or Estonia have experienced setbacks. This has meant that countries exhibit a greater dispersion in the factorial plane and a reduction of the convergence in innovation.

Figure 4a. Over time changes in the relative position of countries in the whole manufacturing (right semiplane)

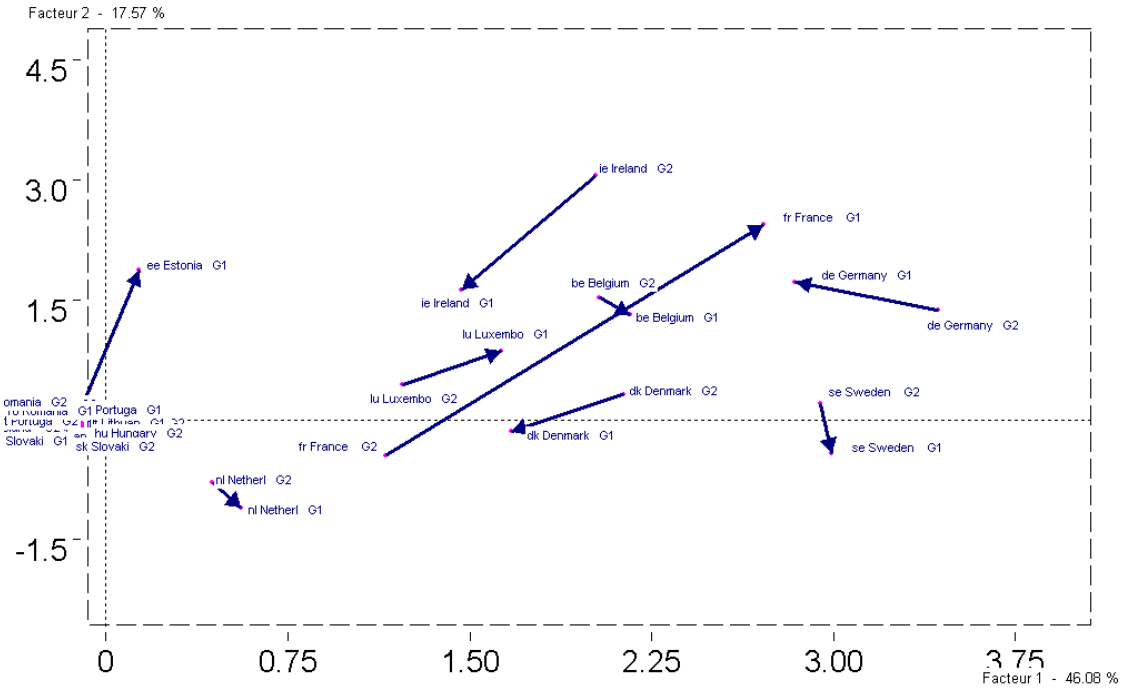


Figure 4b. Over time changes in the relative position of countries in the whole manufacturing (left semiplane)

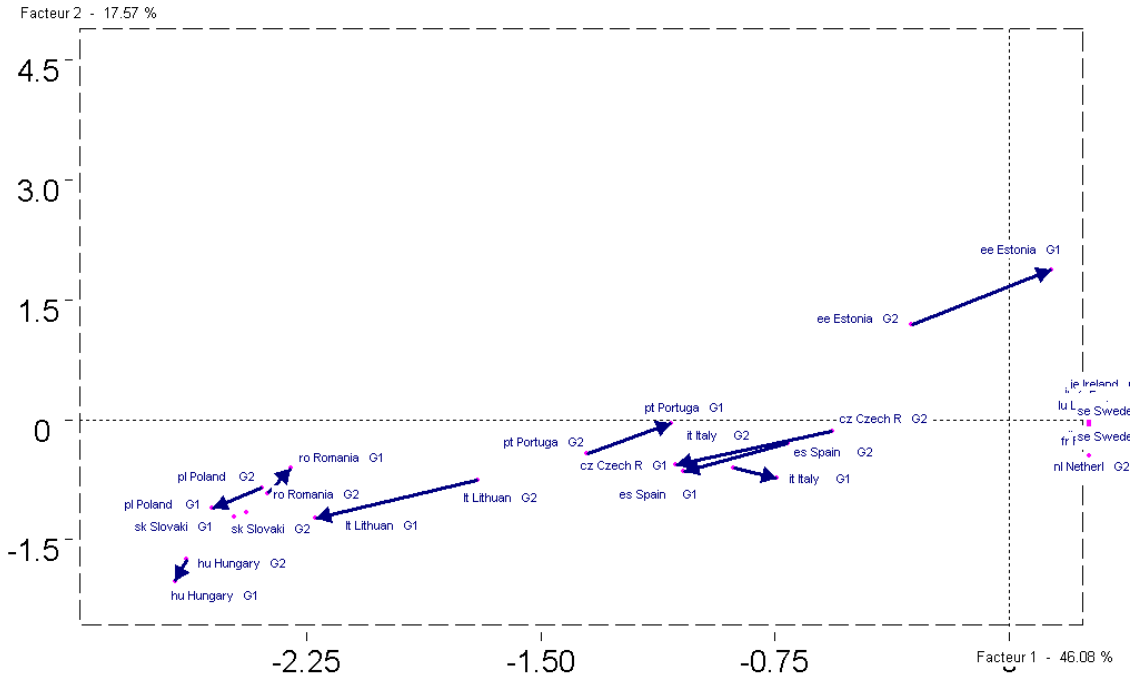


Figure 5a. Over time changes in the relative position of countries in the set of innovative firms (right semiplane)

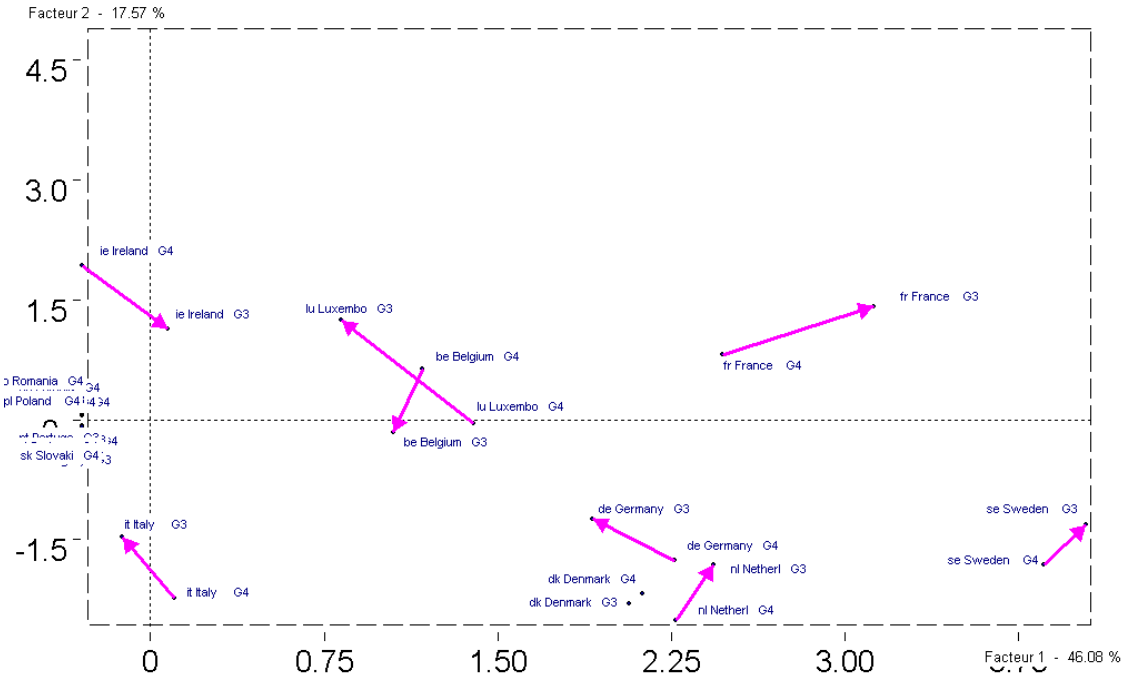
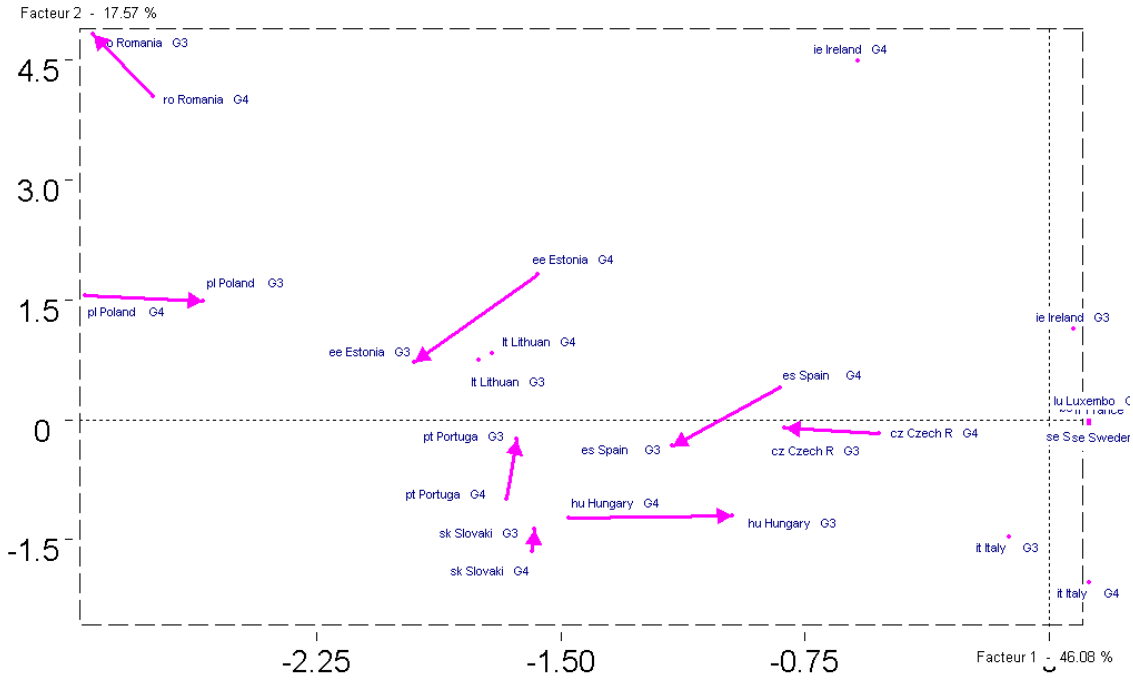


Figure 5b. Over time changes in the relative position of countries in the set of innovative firms (left semiplane)



The results show that some countries as Poland and Hungary have advanced significantly in the relative position of their set of innovative firms despite their non-improvements in manufacturing. Both countries have experienced the largest increase in the stock of direct investment relative to GDP. The Czech Republic, though still has some advantage over other recent acceding countries, this advantage begins to shorten in both manufacturing and the innovative sector. Estonia has experienced a strong relative improvement in manufacturing, but a relative decline in the innovative sector. The innovative strategy in this country seems to have been aimed at the diffusion of innovation among firms, being one of the countries that have had a major relative breakthrough in the European Union. Slovakia, Lithuania and Romania have not had significant improvements in either the manufacture or the set of innovative firms. The latter two countries are those that have the least FID (as percentage of GDP) of the countries of last European enlargements. Spain has lost relative positions in both manufacturing and innovation sector. This fact would support the hypothesis that EU enlargement has had negative consequences for this country. Portugal, meanwhile, has shortened distance with Spain in manufacturing and in the set of innovative firms.

4.- CONCLUSIONS

In this paper we have presented the changes in the innovative position of eighteen EU countries over the period 2002-2006 using the technique of Multiple Factor Analysis. The study has been carried out in two different sets of firms. On the one hand, it has considered all the manufacturing firms (innovative and non-innovative firms) and on the other, only the innovative manufacturing firms.

In terms of convergence in innovation it should be noted that there is a moderate advance in the whole manufacturing in the European countries over the period considered. However, it is not possible to say the same for the set of innovative firms. The results, as regards the innovative profile of manufacturing, show that countries that have improved the relative position are: France, Luxembourg, Estonia and Portugal. Countries that have worsened their relative position are: Ireland, Denmark, Germany, Lithuania, Spain and the Republic Czech. Netherlands, Belgium, Sweden, Poland, Slovakia, Hungary, Italy and Romania have not shown significant changes.

Regarding the set of innovative firms, countries that present advances in the relative position are: France, Ireland, Holland and Hungary, while those who have fallen in their relative position are: Luxembourg, Belgium, Italy, Germany, Estonia, Romania, Spain and the Czech Republic. Sweden, Denmark, Portugal and Lithuania have hardly changed. In the case of the innovative sector one can not assert that there has been a convergence process in innovation. A number of high innovative profile countries such as Sweden, France and Netherlands have shown progress in their relative position, while other low-profile innovative countries such as Romania or Estonia have experienced setbacks.

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