EU-MEMBERSHIP IMPACTS IN THE SPANISH PROVINCE INCOME CONVERGENCE: A SPATIAL AUTOCORRELATION PERSPECTIVE

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RESUMEN

In this empirical work, we aim to reconsider the question of Spanish regional economic income convergence from a spatial econometric perspective. In this sense, Spanish National and Regional Governments as well as other institutions have boosted studies at a regional scale considering each spatial unit as an isolated economy, without any links among others. Further research is needed to find spatial patterns in disposable income not only in a regional global perspective but also at a provincial scale. This paper proposes the use of some spatial association tests in order to shed light on the consequences of the EU integration process in provincial income convergence overcoming the limitations of some recent research.

We will analyse the behaviour of some spatial association statistics for the spatial distribution of disposable real income per capita in the Spanish provinces during 1986-1998, with the help of GIS. Strong patterns of both global and local spatial autocorrelation are found throughout the study period, and the magnitude of global spatial autocorrelation is also found to exhibit an important temporal co-movement with provincial income dispersion. Our goal here can be summarised by the following questions: What kind of advantages have Spanish provinces obtained, in terms of disposable income, of the new common market area introduced by EU-membership? How is this process affecting the rigid structure of richness, measured by income per capita, over the Spanish Northeast regions? Is EU-membership creating convergence and growth in Spain?

1. __INTRODUCTION__

Income and productivity convergence has been one of the most recently debated economic issues. Economic convergence has important theoretical implications as several distinct types of convergence have been suggested in the literature, each being analysed by distinct groups of researchers employing different methods. Convergence implies a long-run tendency towards the equalisation of per capita income or product levels (Rey and Montouri 1999).

Knowledge of whether poorer countries/regions display faster growth rates in per capita income than richer ones can be of assistance in planning and evaluating national/ regional policy measures. Consequently, a rejection of the hypothesis of convergence could call public investment policies into question, as they would not be achieving a re-balancing of the distribution of the national/regional per capita income. This will be particularly negative inside the European Union (EU) as with the EU Treaty and the Structural Funds rules revision, in July 1993, a cohesion policy was designed with the basic objectives of promoting the development and structural adjustment of regions whose development is lagging behind.

This interest has led to numerous studies of inter-national income convergence in the late 80's. Recently, convergence studies have derived to intra-national scale generating a great deal of literature focused on the American states and EU regions. In particular, Spanish regional income convergence has been exhaustively explored, as measured by gross value added or productivity (Cuadrado et al. 1998 and 1999) rather than by per capita disposable income[1], as it is proposed in this paper.

In this empirical work, we aim to reconsider the question of Spanish regional economic income convergence from both a spatial econometric perspective and on a provincial scale (NUTS III, in Eurostat terminology). Spanish National and Regional Governments as well as other institutions have boosted studies at a regional scale considering each spatial unit as an isolated economy without any links among others. Further research is needed to find spatial patterns in disposable income not only in a regional global perspective[2] but also at a provincial scale. This paper proposes the use of some spatial association tests in order to shed light on the consequences of the EU integration process in provincial income convergence overcoming the limitations of some recent research.

We will analyse the behaviour of some spatial association statistics for the spatial distribution of disposable real income per capita in the Spanish provinces during 1986-1998, with the help of GIS. Strong patterns of both global and local spatial autocorrelation are found throughout the study period, and the magnitude of global spatial autocorrelation is also found to exhibit an important temporal co-movement with provincial income dispersion.

Our goal here can be summarised by the following questions: What kind of advantages have Spanish provinces obtained, in terms of disposable income, of the new common market area introduced by EU-membership? How is this process affecting the rigid structure of richness, measured by income per capita, over the Spanish Northeast regions? Is EU-membership creating convergence and growth in Spain?

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[1] See in Pons-Novell (1999) a study for the 153 Catalan most populous towns.
[2] Some examples of this spatial view firstly applied to the Spanish regional GDP convergence are Vayá (1998) and López-Bazo (1998).

2. **NON-SPATIAL ANALYSIS OF σ-CONVERGENCE**

Convergence is seen as an outcome of the neo-classical growth theory. According to this theory, cross-sectional economic growth cannot carry on indefinitely, but will eventually decline (i.e. growth rates of different economies converge towards a certain steady state). Traditional studies of convergence are based on the concepts of σ-convergence and β-convergence proposed in Barro and Sala-i-Martín (1992 and 1995) and Sala-i-Martín (1996), among others. These authors say that β-convergence occurs when poor regions grow faster than rich ones, resulting in the former eventually catching up to the latter in per capita income levels.

On the other hand, σ-convergence exists if dispersion of income per capita between different economies tends to reduce in time. Quah (1993) demonstrated that it is possible for a negative relationship between initial income and growth to coexist with a stable cross-section variance in income levels. Possibly, that is why this form of convergence has attracted much attention in the regional science and economic geography literature[3].

σ-convergence is a measure only concerned with spread-dispersion (2nd moment) of the income distribution. This concept checks the dynamics of approximation between per capita income in a certain period. Several different dispersion methods have been employed to examine this form of convergence, as the standard deviation or the coefficient of variation of the log of per capita income. Figure 1 displays the pattern of declining per capita income dispersion in Spain, as measured by the coefficient of variation for the natural log of province real per capita incomes:

$$s_t = \sqrt{\frac{\sum \left(\ln x_{it} - \ln \overline{x}_t \right)}{n}} \qquad \text{(Eq. 1)}$$

with σ_t: σ-convergence in year t

       x_{it}:   province real per capita income in province i in year t[4]

       $\overline{x}_t$:   national real per capita income –equivalent to a weighted average of

                province real per capita income.

       n=50:   total number of Spanish provinces[5].

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[3] The aim of this paper is neither to enter in a detailed analysis of these well-known techniques nor to show the main limitations resulting from its use, but to demonstrate the necessity of complementary spatial models for a better knowing of the reality. Indeed, as stated by Rodríguez-Posé (in Cuadrado et al. 1998), the majority of convergence models are more or less affected by spatial autocorrelation problems related to political intervention over national/regional economies.

[4] Province disposable income comes from Spanish Regional Accounts (Spanish Institute for Statistics, INE) for 1986-95. Lawrence R. Klein Institute has estimated provincial disposable income over the 1996-98 period (for further information, see Chasco and Vicéns 1999). Population data proceed from Census 'de iure' population and estimations based on official annual Census actualisation. Finally, data have been deflated with the index of retail prices, IPC, as it is disposable desaggregated at the provincial level (this is not the case of a better deflator, the private consumption index, only available at the national level).

[5] Ceuta and Melilla will be excluded from all computations as they clearly distort some results.

Fig. 1: Spanish province income convergence, 1986-98
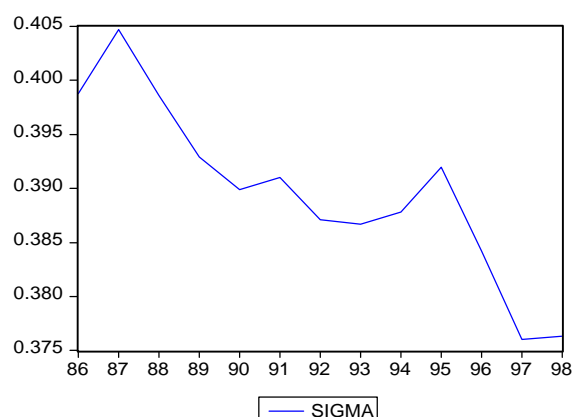
The long-term trend appears to have been towards convergence with a few exceptions, most notably in the depression years (1993-95) and the slight increase in dispersion over 1986-87 and 1990-91. The most rapid period of convergence was both in late 80's and 90's, coinciding with periods of economic recovery mainly due to the integration of Spanish economy into the EU and EMU (Economic Monetary Union), respectively.

A more specific analysis would take into account the individual behaviour of Spanish provinces inside the overall pattern of income convergence (Table 1). Tendency results have been calculated by the deviation of the natural log of each province income from the national average (see Cuadrado et al. 1998).

Table 1: Contribution of Spanish provinces to the measure of σ-convergence

| rage													
Diver.				HUES	SEG	BAR	GIR	LLE	MAD	NAV			
Conv.		ZAR	AST	BAL	BUR	PALE	VALL	TAR	CAS	ALA	VIZ	RIO	
Conv.	ALM	CORD	GRA	JAE	AVI	SAL	ZAM	ALB	CIU	CUE	BAD	CAC	LUG	OUR
Diver.				CAD	HUEL	GUA	TOL	CORU	PON	MUR			

We can distinguish into three groups of provinces according to their trend behaviour:

- Divergent behaviour: this category includes 14 provinces with a significant divergent trend from the average. On the one hand, Huesca, Segovia, Barcelona, Girona, Lleida, Madrid and Navarra diverge with an improvement of their per capita income levels. On the other hand, Cádiz, Huelva, Guadalajara, Toledo, A Coruña, Pontevedra and Murcia have experienced a progressive deterioration of their standard of living.

- Convergent behaviour: this group includes 25 provinces with per capita income levels approximating to the national average. Eleven of them are over the average (Saragossa, Asturias, the Balearic Islands, Burgos, Palencia, Valladolid, Tarragona, Castellón de la Plana, Álava, Biscay and La Rioja) and the other 14 provinces stay under the average (Almería, Córdoba, Granada, Jaén, Ávila, Salamanca, Zamora, Albacete, Ciudad Real, Cuenca, Badajoz, Cáceres, Lugo and Ourense).

- Neutral behaviour: eleven provinces have not significantly contributed to the Spanish province income convergence/divergence during 1986-98. They are Teruel, Santa Cruz de Tenerife, Cantabria, Soria, Valencia, Guipúzcoa (over the national average), and Málaga, Seville, Las Palmas, León and Alicante (under the average).

It is important to highlight that one half of Spanish provinces have shown convergence movements, though a relatively high number of provinces have experienced divergence. It is especially worrying Cadiz downward trend and the deterioration of Guadalajara income levels (Fig. 2).

**Fig. 2: Under-averaged provinces with divergent behaviour**
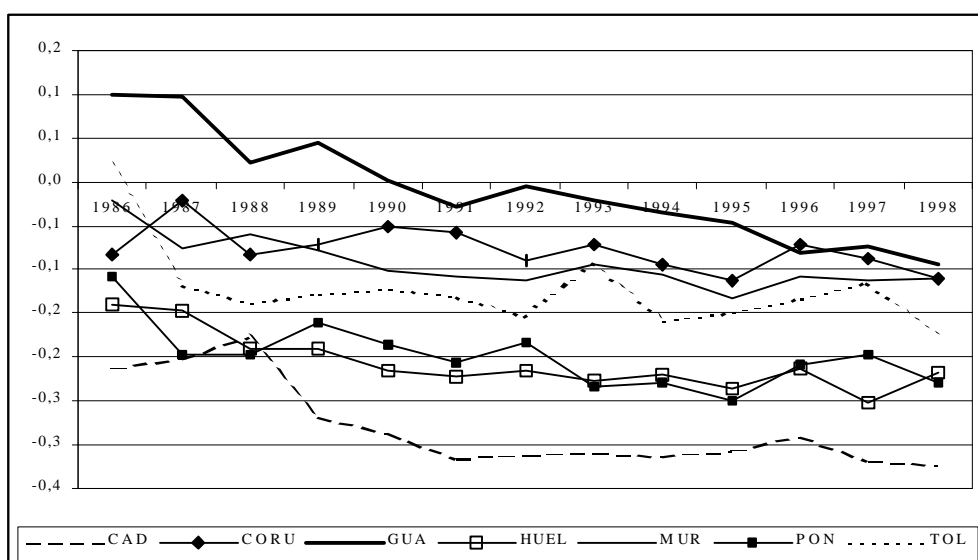
Source: Self-elaboration.

We can conclude that Spanish province income appears to be towards convergence in the long-term (1986-98), with some exceptions, but it can be appreciated fourteen provinces with a divergent trend, from which seven follows a worsen path: Cádiz, Huelva, Guadalajara, Toledo, A Coruña, Pontevedra and Murcia. On the other hand, there are seven provinces (Huesca, Segovia, Barcelona, Girona, Lleida, Madrid and Navarra), with initial high levels of per capita income, which diverge improving increasingly their per capita income levels.

From a non-spatial view, these last results can be completed and clarified making clusters of provinces with similar per capita income levels in the initial period (1986). Therefore, the lack of an absolute global convergence has led to the analysis of 'local' convergence for a group of states/regions, the so-called 'convergence clubs' (Pulido, 1999). As stated in Cuadrado et al. (1998), we can demonstrate the existence of convergence clubs in Spain by the decomposition of σ-convergence in two components: intra-group convergence (e.g. convergence inside a certain group) and inter-group convergence (e.g. an approximation tendency between provinces belonging to different groups). For example, we can establish three groups of provinces (Fig. 3):

Fig. 3: σ-convergence evolution for groups of Spanish provinces

Source: Self-elaboration.
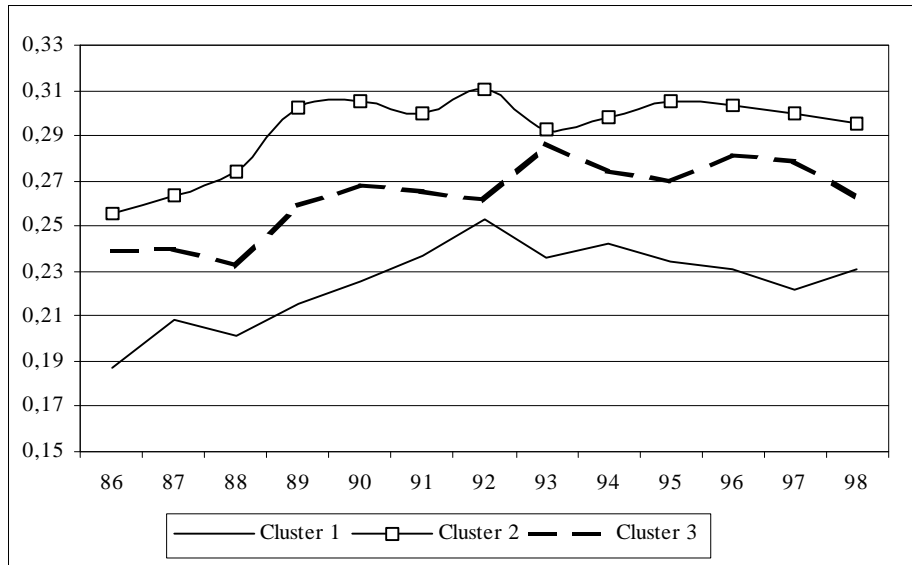
- Cluster 1: Higher-income provinces with per capita income levels more than 10% over the 1986 Spanish average. This group includes Catalonia provinces (Barcelona, Girona, Lleida and Tarragona), the Balearic Islands, Madrid, Navarra, La Rioja, the Basque Country (Álava, Guipúzcoa and Biscay), Huesca, Teruel, Burgos and Castellón de la Plana.

- Cluster 2: Medium-income provinces with per capita income levels less than 10% under and over the 1986 national average. This group includes the Canary Islands (Las Palmas and Santa Cruz de Tenerife), Asturias, Cantabria, León, Palencia, Salamanca, Segovia, Soria, Guadalajara, Toledo, Valencia, Alicante, A Coruña and Murcia.

- Cluster 3: Lower-income provinces with per capita income levels less than 10% under the 1986 national average. This group includes Andalusia provinces (Almería, Cádiz, Córdoba, Granada, Huelva, Jaén, Málaga and Seville), Extremadura provinces (Badajoz and Cáceres), Ávila, Zamora, Albacete, Ciudad Real, Cuenca, Lugo, Ourense and Pontevedra.

As it can be seen in Fig. 3, dispersion is higher in medium-income provinces and lower in provinces with upper standard of living in 1986. Thus, all clusters present divergent trends, although Cluster 3 show slightly better patterns as since 1992, they walk slowly towards convergence.

At this moment, we can question ourselves about the origin of total σ-convergence shown in Fig. 1, inter-group or intra-group dispersion? Intra-group convergence could be obtained as the simple average of the three clusters σ-convergence values and inter-group convergence would be the difference between total and intra-group ones.

In Fig. 4 (left side), it can be appreciated that total σ-convergence takes place in inter-group convergence, while intra-group follows a certain increasing trend, as also shown in Fig. 3. These results allow us to conclude that, the approximation process of per capita disposable income have been produced more intensively between provinces with dissimilar standard of living.

Nevertheless, the existence of certain convergence clusters or 'clubs' seems a real fact in Spain over the period of 1986-98. Indeed, the three clusters evolve jointly, as also shown in Fig. 4 (right side), with the same income gap between each of them over the whole period. The existence of a certain polarisation in the per capita income distribution ('twin peaks' model[6]) can coexists with a global convergence process assuming a simultaneous mobility of the different values of the distribution (e.g. if the first provinces in the income ranking go to farther positions and vice versa). Results for inter-group convergence (Fig. 4, left side) let us conclude that these changes are taking place slowly.

Fig. 4: Intra-group and inter-group σ-convergence (left). Evolution of the natural log of real per capita incomes for groups of provinces (right).

Source: Self-elaboration.
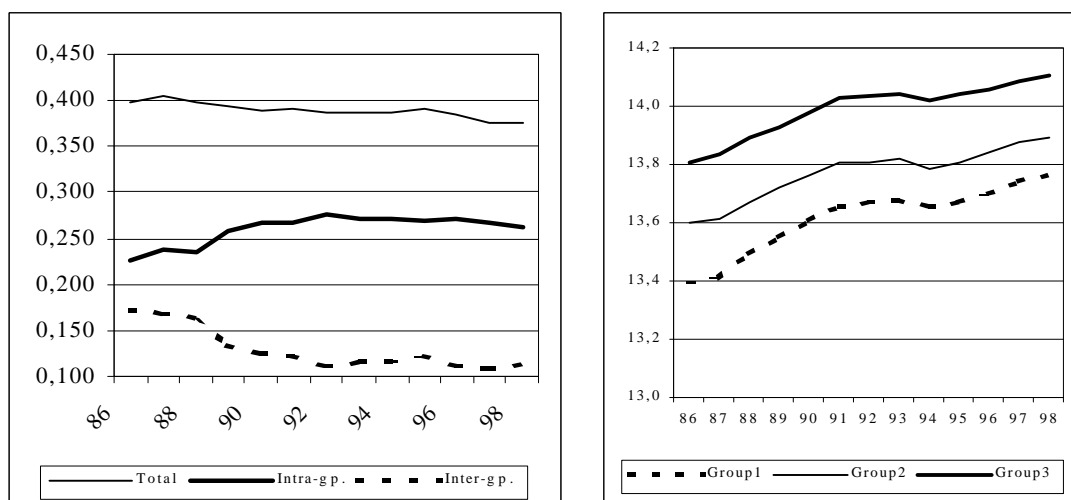
Rey and Montouri (1999) argue that the current focus on the dispersion of regional income distributions may mask nontrivial geographical patterns that may also fluctuate over time. Therefore, in addition to analysing the dynamic behaviour of income dispersion for the 50 Spanish provinces over time, the geographic dimensions of these distributions will also be explored.

3. σ-CONVERGENCE AND SPATIAL AUTOCORRELATION EFFECTS

Location, spatial interaction, spatial structure and spatial processes lie at the heart of research in regional science and urban economics. In contrast, many of the theoretical findings obtained in this field, particularly related to the role of 'space', ignore spatial statistic and econometric effects. Despite the fact that theoretical mechanisms of technology diffusion, factor mobility and transfer payments that are argued to drive the regional convergence phenomenon have explicit geographical components, the role of spatial effects in the regional studies has been virtually ignored (with some exceptions, as stated in Rey and Montouri 1999).

Spatial econometric research has been surrounded by important obstacles related with several difficulties in collecting, processing and analysing spatial data. In the 70's, micro-econometrics arises as an alternative of time series analysis thanks to new software packages capable of processing and analysing great amounts of cross-sectional data with an adequate

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[6] 'Twin peaks' models consist of a lost of probability of the intermediate values of a distribution to collapse itself towards the extreme values (see Quah 1966).

methodology (Vicéns, 1992). This impulse helped theoretical and applied spatial statistics to develop in economic contexts during the 80's and, over all, the 90's.

This study reconsiders the question of regional economic income convergence from a spatial econometric perspective. So, it will be possible to provide new insights into geographical dynamics of Spanish province income growth patterns using methods of Exploratory Spatial Data Analysis (ESDA), mentioned by Anselin and Rey (1991) as a special case of Exploratory Data Analysis (EDA). As they say, in spite of the seeming attractiveness of such a notion, very few of the standard exploratory data analysis techniques are equipped to deal with the distinguishing characteristics of spatial data, specifically to spatial dependence. We present an ESDA of Spanish province income dynamics over the period 1986-98 to contrast different patterns of spatial convergence.

In all notions of convergence, the unit of analysis has been an individual geographical unit (mainly states or regions) observed as part of a cross section. Each region has been viewed as an independent entity and the potential for observational interactions across space has gone largely ignored. While technology spill-overs have been identified as key mechanisms that may lead to convergence[7], geographical dimensions of these externalities crossing the barriers of regional economies must be explored. Externalities do not spread out in space without bounds, but diffusion of innovations will be easier within groups (clubs) of closed economies (López-Bazo et al. 1998).

Our empirical analysis focuses on the case of Spain during the period of 1986-98 to analyse EU-membership impacts in terms of disposable income convergence, at the provincial level. Now we will reconsider σ-convergence over this period to investigate the spatial dimensions of Spanish income dynamics using ESDA instruments of spatial autocorrelation[8].

In the last decades, a number of instruments for testing for and measuring spatial autocorrelation have appeared: Moran's I and, to a lesser extent, Geary's c (Cliff and Ord 1973 and 1981) are very well-known, specially for geographers. These procedures are applied globally to the complete region under study. As it is often desirable to examine local 'pockets' of dependence, we will apply new complementary measures of spatial association, as Anselin's I_i (Anselin 1995)[9].

3.1. σ-CONVERGENCE AND GLOBAL SPATIAL AUTOCORRELATION

As seen in last chapter, the current focus on the dispersion of the province income distributions may mask nontrivial geographical patterns that may also fluctuate over time. Therefore, we will also explore the geographic dimensions of these distributions through measures of global spatial association. Particularly, we will use the Moran's I statistic expressed as:

$$I_t = \frac{n}{S_0} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\left(y_{it} - \bar{y}_t\right)\left(y_{jt} - \bar{y}_t\right)}{\sum_{i=1}^{n}\left(y_{it} - \bar{y}_t\right)^2}$$

(Eq. 2)

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[7] See Pulido (1999) for a further analysis of sources of growing and convergence between nations and regions.
[8] Spatial autocorrelation or spatial dependence takes places if the presence of some quality in a region makes its presence in neighbouring regions more or less likely (Cliff and Ord 1973). Spatial dependence can be considered to be the existence of a functional relationship between what happens at one point in space and what happens elsewhere (Anselin 1988).
[9] See also Getis and Ord's family of statistics G(d), G_i(d), G_i*(d) (Getis and Ord 1992 and 1995).

where w_{ij}:   is an element of a spatial weights matrix W[10] such that each element, w_{ij}, is set equal to the inverse of the squared distance between provinces i and j.

   y_{it}:   natural log of real per capita income in province i in year t

   $\overline{y}_t$:   average value of variable 'y' in year t.

   S_0:   scaling factor equal to the sum of all elements of W.

We have based the significance of the Moran'I statistics on the randomisation assumption, which assumes that each observed value could equally likely have occurred at all locations (provinces). Based on this assumption, different theoretical mean and standard deviation for Moran's I are obtained to yield to a z-value, which follows a standard normal distribution (Cliff and Ord 1973 and 1981). The analysis of the natural logarithms of the per capita income values revealed no evidence of departures from normality, as it is revealed by Jarque-Bera tests in Table 2[11].

Table 2: Jarque-Bera normality test

| Year	Jarque-Bera	P-value	Year	Jarque-Bera	P-value	Year	Jarque-Bera	P-value
1986	2.394	0.302	1991	2.800	0.247	1995	2.681	0.262
1987	3.201	0.202	1992	2.843	0.241	1996	2.929	0.231
1988	3.379	0.185	1993	2.427	0.297	1997	2.335	0.311
1989	3.351	0.187	1994	2.256	0.324	1998	1.818	0.403
1990	3.079	0.215						

Source: Self-elaboration.

Fig. 5 portrays not only the pattern of declining per capita income dispersion in Spain (as measured by the coefficient of variation for the natural log of province real per capita incomes, in Fig. 1), but also the path of spatial autocorrelation for the province incomes over the same period[12].

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[10] The role of the spatial weight matrix is to introduce the notion of a neighbourhood set for each province. It has been also utilised several alternative weight matrices, which generated very similar results to those based on the inverse of the squared distance. These include a simple contiguity matrix and three other matrices obtained from using a distance threshold to define a state's neighbourhood set (see Rey and Montouri 1999, pp. 155). As stated in Anselin (1988), pp. 24, the inverse distance matrix has not been standardised, 'as scaling the rows so that the weights sum to one may result in a loss of a meaningful economic interpretation'.

[11] Under the null hypothesis of normality, the Jarque-Bera (JB) statistic distributes as a chi-square, with two degrees of freedom, whose critical value is approximately six (with a 5% statistical significance). 'P-values' are related to the probability of statistic JB exceeding –in absolute value- the critical value. Therefore, the null hypothesis of normality will be rejected with a JB value lower than six and non-zero p-values. For further information, see Pérez and López (1997), pp. 413-414, and Pulido and López (1999), pp. 413, 481.

[12] All computations were carried out using the SpaceStat, SPSS, Eviews and MapInfo software packages (for SpaceStat, see Anselin 1995).

Fig. 5: Spanish province income convergence and spatial autocorrelation, 1986-98
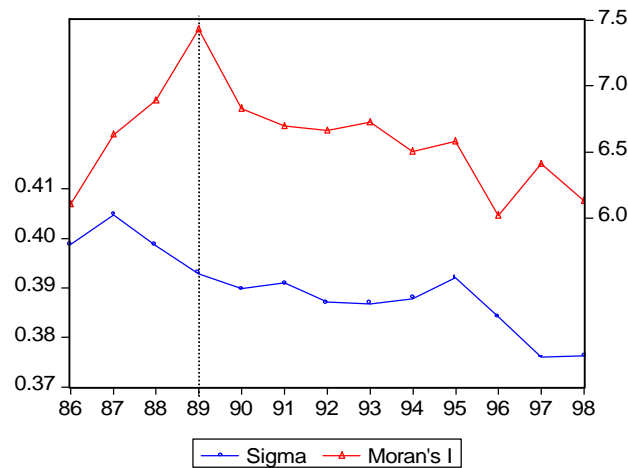
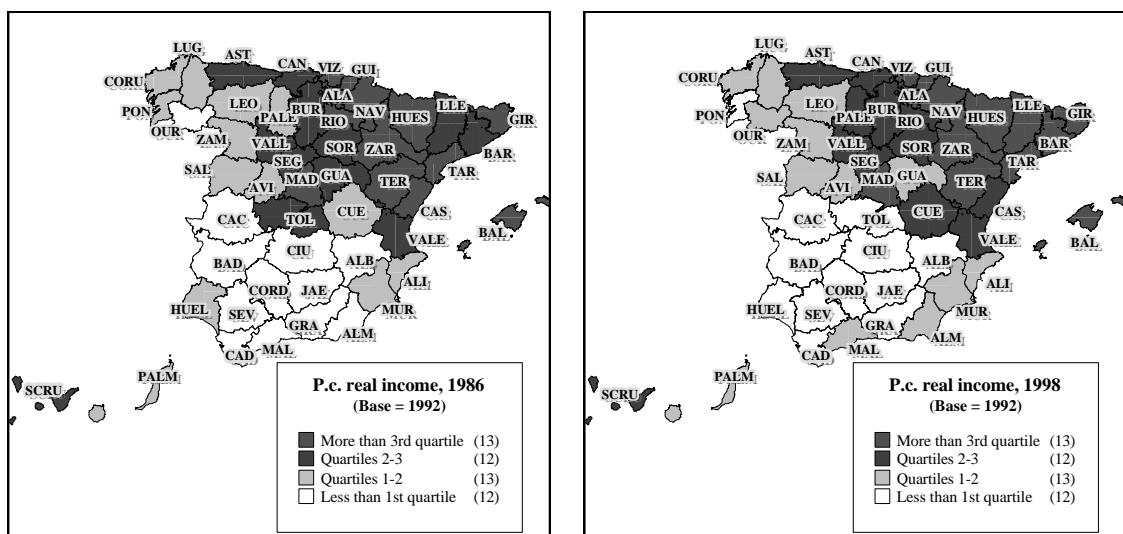
Source: Self-elaboration.

There is a very strong evidence of spatial dependence as the statistics are significant at p = 0.01 for all years. The measure of spatial autocorrelation presents a certain decreasing co-movement with the measure of σ-convergence, specially from 1989.

In any given year, the province income distribution displays a high degree of spatial autocorrelation. Although the magnitude of the dependence seems to weaken –from 1989- as the income dispersion lessens, the dependence is always very significant. This suggests that the evolution of the province income distribution, though tending to convergence, appears to be clustered in nature. That is, provinces with very relatively high (low) income level tend to be located nearby other provinces with high (low) income more often than would be expected due to random chance. If this is the case, then each province should not be viewed as an independent observation, as has been implicitly assumed in previous studies of regional income convergence. In Fig. 6, little differences can be observed between 1986-1998 per capita income spatial distribution: lower income levels concentrate in the mid-South provinces, though higher ones can be found in the North-Northeast of the Iberian Peninsula.

**Fig. 6: Spanish province per capita income, 1986-98**

Source: Self-elaboration.

Notes: <u>P.c. real income, 1986</u>: 1st quartile, 680,226 PTA per inhabitant; 2nd quartile, 810,674 PTA p.inhab.; 3rd quartile, 959,461 PTA p.inhab. <u>P.c. real income, 1998</u>: 1st quartile, 973,422 PTA p.inhab.; 2nd quartile, 1,070,319 PTA p.inhab.; 3rd quartile, 1,294,723 PTA p.inhab.

It is also possible to notice that the individual behaviour of Spanish provinces inside the overall pattern of income convergence follows a spatial pattern. In Fig. 7, we have mapped the results obtained in Table 1. As stated before, there are some provinces with divergent trends, seven of them, scatterly located through the Spanish geography, are following a worsen path: Cádiz and Huelva (in Andalusia), A Coruña and Pontevedra (in Galicia), Toledo and Guadalajara (in Castile-La Mancha), and Murcia. The other seven diverging provinces are improving increasingly their standard of living, most of them located in the Northeast of Spain: Barcelona, Girona and Lleida (in Catalonia), Huesca (in Aragón) and Navarra; the other ones are central provinces (Madrid and Segovia), and also Santa Cruz de Tenerife, in the Canary Islands.

Fig. 7: Contribution of Spanish provinces to σ-convergence (left) and convergence clubs (right)
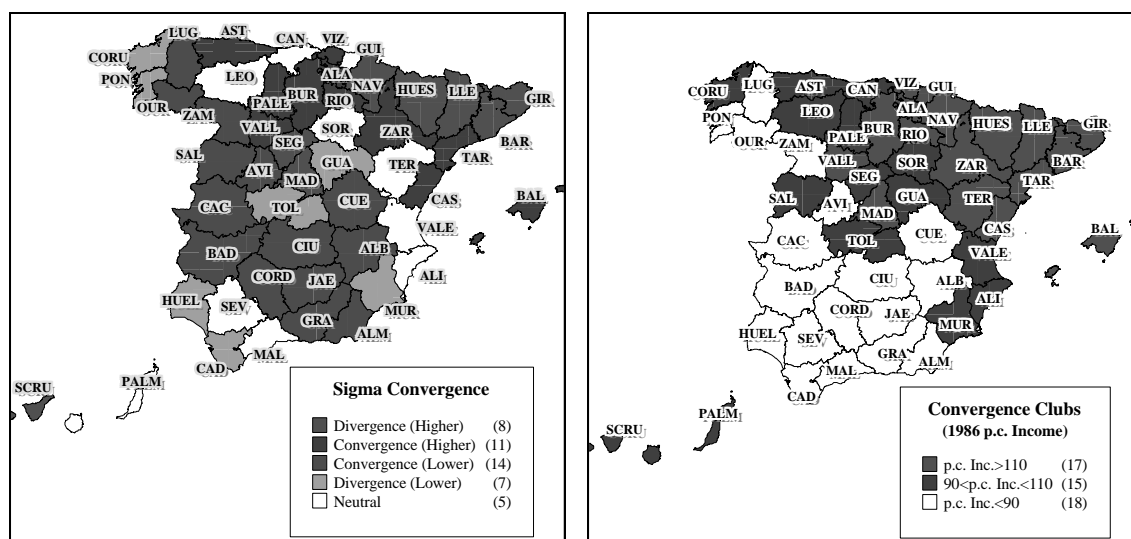
Source: Self-elaboration.

The co-movement between income dispersion and spatial dependence (Fig. 5) may reflect a dynamic characteristic of the regional clustering. Two possibilities can be identified for the weakening of the regional clustering in times of income convergence: more dissimilarity in income levels of provinces in each cluster ('convergence club') or the disappearance of existent groups during a period of increased income concentration. The former seems to be more plausible than the latter, as shown in Figs. 3 and 4.

Unfortunately, Moran's I statistic, which is a global measure of spatial dependence, does not detect some kind of pockets of non-stationarity ('hot-spots') that deviate from the overall pattern. For that there is a more disaggregate view of the structure of spatial dependence in Spanish provincial incomes.

3.2. σ-CONVERGENCE AND LOCAL SPATIAL AUTOCORRELATION[13]

In Fig. 8, the local Moran statistics (Anselin 1995) are mapped for each province at the initial and terminal years of our sample. The local Moran for province i takes the following form:

$$I_{i,t} = \frac{z_i}{m_2} \sum_{j=1}^{n} w_{ij} z_{j,t} \qquad \text{(Eq. 3)}$$

with $m_2 = \sum_{i=1}^{n} x_{i,t}^2$

- $z_{j,t}$: natural log of real per capita income in province i in year t (measured as a deviation from the mean value for that year)
- w_{ij}: is equal to the inverse of the squared distance between province i and provinces $j \in J_i$ located (from i) at a distance threshold of the first quartile of all province-to-province distances.

Fig. 8: Local Moran statistics significant at p = 0.01
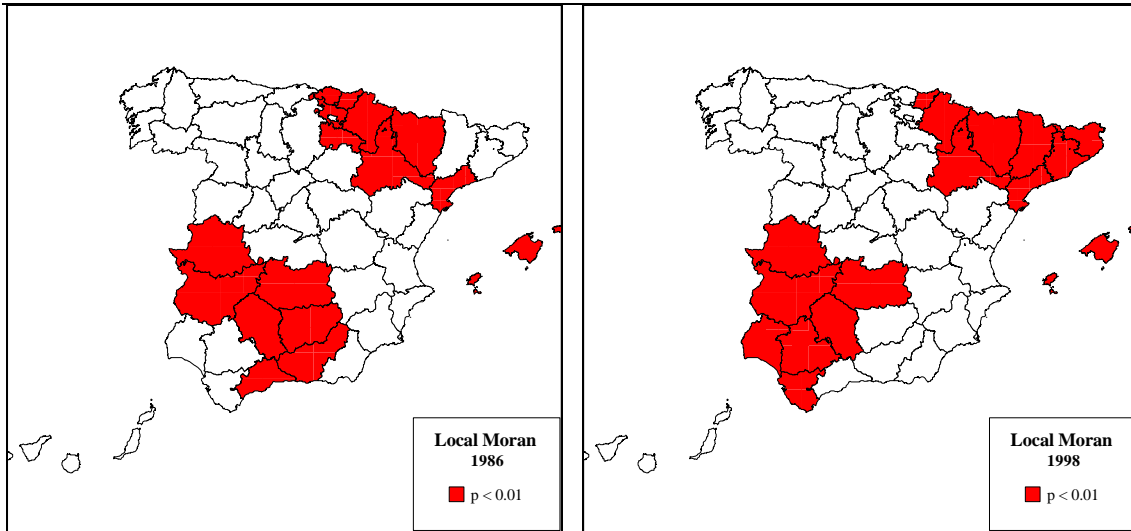
Source: Self-elaboration.

The local Moran statistics give an indication of the extent of significant spatial clustering of similar values around an observation. This Figure suggests that there are two big 'hot spots' in per capita income distribution located in the Spanish South (low-income values) and North (high-income values), either in 1986 or 1998. These provinces are the most important contributors to the global Moran's I statistic *(Eq. 2)*.

However, it can be appreciated a polarisation shift to the Southwest (low incomes) and Northeast (high incomes) during the period. Indeed, in 1986, the Basque Country, the Ebro Valley and the Balearic Islands were the main contributors to global spatial autocorrelation, just as the Guadiana Valley and part of Eastern Andalusia. Thirteen years later, 'hot spots' of high per capita incomes have moved from the Basque Country (except Guipúzcoa) and La Rioja provinces to the rest of Catalonia. In the other pole, lower incomes are now most concentrated

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[13] Local spatial autocorrelation produces in spatial nonstationary processes when local spatial clusters, sometimes referred to as 'hot spots', may be identified. Local patterns of spatial association may be produced with a global autocorrelation, although this is not necessary the case. In fact, it is quite possible that the local pattern is an aberration that the global indicator would not pick up, or it may be that a few local patterns run in the opposite direction of the global spatial trend (Anselin 1995).

in Extremadura, Ciudad Real and the Southwest of Andalusia, including Seville, Cádiz and Huelva.

4. CONCLUSIONS

In this paper, we have provided new insights as to the nature of disposable income convergence patterns in Spanish provinces over the post EU-membership era (1986-98). Our empirical strategy was based in both traditional non-spatial (σ-convergence) and explicit exploratory spatial data analysis (spatial association and GIS), as the majority of convergence models are more or less affected by spatial autocorrelation problems related to political intervention over national/regional economies.

Our goal here was initially summarised by the following questions: What kind of advantages have Spanish provinces obtained, in terms of disposable income, of the new common market area introduced by EU-membership? How is this process affecting the rigid structure of richness, measured by income per capita, over the Spanish Northeast regions? Is EU-membership creating convergence and growth in Spain?

Next, we will try to answer all these questions with some conclusions extracted from the previous analysis:

1. **EU-membership has produced in Spain a global convergence trend in per capita disposable income.** This course is in line with EU cohesion policies (structural funds), especially during the 90's.

2. Per capita disposable income displays a high degree of spatial autocorrelation. This suggests that the evolution of the province income distribution, though tending to convergence, appears to be clustered in nature. That is, provinces with very relatively high (low) income level tend to be located nearby other provinces with high (low) income more often than would be expected due to random chance. **Therefore, a rigid structure of richness prevails in Spain as higher income levels continue concentrated in the North provinces whereas lower incomes are in the South.**

3. Although in general terms Spanish province income appears to be towards convergence in the long-term, **it can be appreciated a relatively high number of provinces that have experienced divergence**. On the one hand, we can point out the Cadiz downward trend and the deterioration of Guadalajara income levels. On the other hand, some of the richest Spanish provinces go farther than the rest (Navarra, Huesca, Lleida, Girona Barcelona and Madrid) what makes specially difficult a 'caching-up' process.

4. The existence of convergence clubs in Spanish provinces let us conclude that total σ-convergence takes place in inter-group convergence, while intra-group follows a certain increasing trend. Therefore, **the approximation process of per capita disposable income has been produced more intensively between provinces with dissimilar standard of living** (inter-group convergence), what produces a slight reduction, though still significant, of spatial autocorrelation in provincial per capita income.

5. The main reason of a persistent significant spatial autocorrelation in per capita disposable income can be found in two local pockets of dependence located in the North and South of the Iberian Peninsula. Nevertheless, it can be appreciate a polarisation shift to the Southwest (low incomes) and Northeast (high incomes)

during the period. **'Hot spots' of high per capita incomes have moved from the Basque Country (except Guipúzcoa) and La Rioja provinces to the rest of Catalonia. In the other pole, lower incomes are now most concentrated in Extremadura, Ciudad Real and the Southwest of Andalusia, including Seville, Cádiz and Huelva.**

Finally, we must conclude that EU-membership is creating convergence and growth in Spain. However, this process has not been able to abolish the rigid structure of richness yet. Indeed, thirteen years seems not to be enough time for poorest provinces to catch up richest ones (35 years is more or less the time is needed to reduce one half a gap of per capita income between countries, as stated in Pulido 1999). Recently, EMU is benefiting some provinces in the Mediterranean Arch and the Canary Islands, which are growing in disposable income much more than others located in the Spanish Meseta or in the Southwest. This process can threaten the desirable global convergence trend in Spain.

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