

Cuadrado-Roura, Juan R.; Mancha Navarro, Tomas; Garrido Yserte, Ruben

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Real growth *versus* virtual growth: An analysis of regional dynamics

Juan R. Cuadrado-Roura
Tomás Mancha Navarro
Rubén Garrido Yserte

Department of Applied Economics. University of Alcalá
Alcalá-Madrid, Spain
Fax : 34-91-885 42 19
cuadrado@lander.es
tomas.mancha@alcala.es
ruben.garrido@alcala.es

ABSTRACT:

The main objective of this paper is to study the growth dynamics of Spanish provinces over the 1955-1993 period. In particular, it analyses production, employment and productivity growth and underlines the importance of provincial productive specialisation, the structural changes associated with it, and other factors influencing regional/provincial dynamics. The method used is based on a dynamic adaptation of *shift-share* analysis which enables, on one hand, to evaluate each factor's contribution to growth and, on the other, to carry out a simulation exercise in order to analyse the real evolution of the variables considered and the one which would have been obtained by taking each of these factors separately (virtual growth). The data base used is the series on the Spanish National Income and its distribution by provinces, elaborated by the Foundation BBV, which presents a sectoral disaggregation of 24 activity branches.

KEY WORDS: Regional growth, convergence, productive specialisation, *shift-share*..

1. Introduction¹

The maintenance of a balanced, stable and sustained growth rate over time is one of the essential objectives pursued by economic policy and also by regional development policy. On the other hand, the reduction of regional disparities, in terms of per capita income, has been the fundamental objective of regional policy where productivity plays a key role in reaching higher income levels.

However, the determinants of the productivity level of an economy and of its growth rate are not easy to analyse, especially if we take into account the different means by which productivity gains can be made. The introduction of new technologies, generally linked to capitalisation processes, the abandonment of specific activities yielding low productivity for more productive ones, or the strong restructuring processes in employment observed in some regions, are only but a few examples underlying, at least from a regional point of view, the heterogeneous character of productivity changes.

One of the key factors explaining the evolution of this variable is, from a static point of view, the regional productive structure and, from a dynamic one, the structural changes associated with it. The specialisation of an economy in activities presenting high or above average productivity is an element which empirical evidence has demonstrated as important in explaining regional growth and convergence (or the lack of it) in productivity.

The fundamental objective of this paper is the quantitative evaluation of the above mentioned factors through the study of the growth dynamics of the Spanish provinces taking into account three main variables: production (Gross Value Added), employment and labour productivity.

A detailed analysis of productivity evolution requires having both a data base offering an adequate temporal coverage, in order to better appreciate the long term growth trend, and an adequate sectoral/territorial disaggregation, in order to show the

¹The authors are grateful to Sonia Gallardo González for her excellent assistance in the treatment of data. Obviously, any existing mistake is the responsibility for the authors.

heterogeneous behaviour of the variables studied here. All these requirements are fulfilled when using the recently revised series of the Foundation BBV (FBBV). This data base permits the dynamic adaptation of the analysis known as *shift-share* both in a more classic, deterministic formulation and in a complementary stochastic version. This was done in order to adjust series on employment, production and productivity for the effects of productive specialisation or by other factors which would indicate a region's unique dynamism. These *virtual* series are especially useful when analysing the evolution of provincial productivity and, more particularly, provincial convergence in productivity. In addition, it has help to underline the contribution of the different sectors to global convergence and the existence of provincial groups or *clubs* presenting persisting differences between them.

According to this approach, the paper is organised as follows. As a framework, section 2 presents the general evolution of the Spanish economy over the period analysed (1955-93) as well as the main regional trends. Section 3 describes the methodology and the data base applied to the analysis and gives the main results thereby obtained. The analysis of productivity convergence is carried out in section 4 while the fifth underlines the main conclusions *reached*.

2. Evolution of the Spanish economy over the 1955-1993 period: an overview

The period chosen for the analysis is shaped by years of deep economic transformations and important cyclical movements of the Spanish economy. The annual average rate of growth for the whole period is around 3.90 percent, but the rate of employment creation has been very low, reaching only 0.30 percent (see table 1). But two relevant characteristics of the Spanish economy must also be taken into account:

1.- A strongly marked cyclical behaviour, encompassing years which, taken as a whole, could be qualified as expansive (1955-1975)², years of deep economic crisis (1975-1985) and a recovering period (1985-1991) followed by a short recession (1991-93), rather negative in terms of employment creation.

² Some relevant cyclical fluctuations can be found over the 1955-1975 period. Growth rates observed over the 1955-1962 period are not comparable with subsequent years. However, taken as a whole, the

Table 1.- GVA, employment and provincial productivity growth

| | 1955-1993 | 1955-1975 | 1975-1985 | 1985-1993 |
|----------------------------------|-----------|-----------|-----------|-----------|
| GVA growth rates | | | | |
| Average | 3,90 | 5,45 | 1,39 | 3,16 |
| Minimum | 2,31 | 2,53 | -1,10 | 1,11 |
| Maximum | 5,16 | 7,74 | 3,36 | 4,65 |
| Max - Min | 2,85 | 5,21 | 4,46 | 3,54 |
| Employment growth rates | | | | |
| Average | 0,28 | 0,65 | -0,59 | 0,42 |
| Minimum | -1,88 | -2,23 | -3,46 | -2,99 |
| Maximum | 1,92 | 3,08 | 1,32 | 1,88 |
| Max - Min | 3,80 | 5,31 | 4,77 | 4,87 |
| Labour productivity growth rates | | | | |
| Average | 3,62 | 4,80 | 1,97 | 2,74 |
| Minimum | 1,76 | 2,71 | 0,46 | 0,96 |
| Maximum | 5,05 | 6,17 | 4,47 | 6,33 |
| Max - Min | 3,28 | 3,46 | 4,01 | 5,37 |
| Labour productivity levels | | | | |
| | 1955 | 1975 | 1985 | 1993 |
| Average | 100 | 100 | 100 | 100 |
| Minimum | 46 | 43 | 47 | 56 |
| Maximum | 194 | 134 | 122 | 119 |
| Max / Min | 4,20 | 3,11 | 2,58 | 2,11 |

Source: FBBV Series. Own elaboration.

2.- From a spatial point of view, the main characteristic to be underlined could be summarised as follows:

- ◆ In the 60's and the first half of the 70's, a transformative process of economic growth in all regions can be observed, with strong migratory movements from less developed areas (with high agrarian specialisation) towards more industrialised zones (Basque Country, Madrid and the Eastern Mediterranean Arc, in particular Catalonia).
- ◆ As a consequence, a strong process of production and employment concentration took place during that period as well as important structural changes, with a clear orientation towards, on one hand, the tertiary sector and, on the other, the heavy and basic industry, particularly in the North of the country.

Spanish economy experienced a strong growth over those years.

- ◆ The 1975-1985 crisis led to the consolidation of the Mediterranean axis as well as the two archipelagos as growth centres and to the deep recession of the Spanish Atlantic Arc. On the other hand, interregional migration almost stopped completely.
- ◆ Finally, the new period of economic recovery (1985-91) and the integration of the Spanish economy into the EU contributed the spatial trends previously described. That is, the consolidation of the two big axes of development, namely: the Mediterranean Axis (specially dynamic in the provinces of Catalonia and Valencia) and the Ebro Valley axis (made up by the provinces of Alava, Navarra, Saragossa and Tarragona).

Together with these two main axes, some other areas show also a significant economic development: 1) the two archipelagos (Balears and the Canary Islands.) and the Malaga-Cadiz provinces, all of them particularly linked to tourism activities; 2) Madrid and its area of influence (Toledo and Guadalajara) mainly due to their proximity to State capital; and 3) Valladolid, Pontevedra and La Coruña provinces, very much influenced by the localisation of specific industries (i.e. Automobile) and by the great dynamism of non-market services, a result of the configuration and extension of the Spanish peripheral administration from the beginning of the 80's (see map 1).

In global terms, production and employment evolution along the whole period has led to gains in labour productivity, which also shows a strongly defined spatial behaviour, although a progressive reduction of regional disparities can also be observed (see Cuadrado, García and Raymond, 1999), as will be analysed below.³

3. Estimation of production, employment and productivity growth components

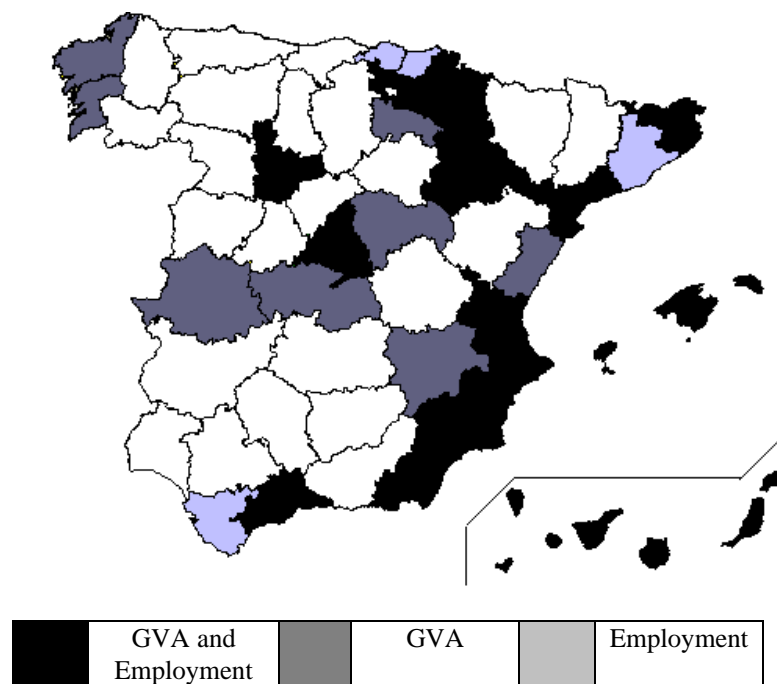
3.1. The method

Shift –share is one of the most widely techniques used in the analysis of regional growth. Essentially, it consists in breaking down the variation of a selected variable into various

³ As shown by a simple indicator as the relation between the provincial maximum and minimum value which went from 4.2 in 1955 to 2.1 in 1993.

components, normally of an additive nature, which explain the “contribution” of each one of them to the observed growth. Generally, three components are analysed: first, the influence of the growth of the national economy chosen as reference; second, the influence of sectoral specialisation; and, finally, a residual, regional or competitive component which indicates the existence of regional competitive advantages or disadvantages.

Map 1.- Regional dynamism in production (GVA) and employment 1955-1993. (Average growth rates above national average at the Spanish provincial level)



Source: Own elaboration

The aim of this paper is neither to enter into a detailed analysis of this wellknown technique nor to show the main limitations resulting from its use. It should only be mentioned that, as these limitations became recognized, some modifications were made, thus improving the analysis, or its use was relegated to that of an excellent analysis and description tool as opposed to forecasting⁴.

⁴ In Cuadrado, Mancha and Garrido (1998) a detailed analysis of these limitations is carried out and some modifications are suggested. In Keil (1992) some contributions are discussed which make up an excellent survey on the topic.

The method carried out in this paper is based on the dynamic application of Barff and Knight III (1988) to more accurately calculate the effects of each component, controlling structural changes over the whole period, together with the approach of Arcelus (1984). Combining these two approaches allows for a shift-share analysis with six effects which, in turn, can be divided into three categories: the *national growth effect* (ECN), the *industry mix or proportional effect* (EE) and, finally, the *regional or competitive effect* (R+RI). Each one of these three elements can be divided into two components: the *homothetic* component and the *residual* one. The homothetic component (followed by an asterisk in equation [1]) implies calculating each of the considered effects, according to the sectoral shares found in the Spanish economy. That is to say that changes observed in the period analysed only depend on the different regional growth rates and not on differences in sectoral specialisation. The residual component shows the variations derived from the different regional/national productive structure.

Under this approach, the shift of a specific variable - employment or production - in a region j and in a sector i ($\Delta\phi_{ij}$) between two time periods⁵ can be broken down according to the following expression:

$$\Delta \mathbf{j}_{it} = ECN_{ij}^* + ECN_{ij} + EE_{ij}^* + EE_{ij} + R_{ij} + RI_{ij} \quad [1]$$

being:

$$ECN_{ij}^* = \mathbf{j}_{ij}^* r_{00}$$

$$ECN_{ij} = (\mathbf{j}_{ij} - \mathbf{j}_{ij}^*) r_{00}$$

$$EE_{ij}^* = \mathbf{j}_{ij}^* (r_{i0} - r_{00})$$

$$EE_{ij} = (\mathbf{j}_{ij} - \mathbf{j}_{ij}^*) (r_{i0} - r_{00})$$

$$R_{ij} = \mathbf{j}_{ij}^* (r_{0j} - r_{00}) + (\mathbf{j}_{ij} - \mathbf{j}_{ij}^*) (r_{0j} - r_{00})$$

$$RI_{ij} = \mathbf{j}_{ij}^* [(r_{ij}^* - r_{0j}) - (r_{i0} - r_{00})] + (\mathbf{j}_{ij} - \mathbf{j}_{ij}^*) [(r_{ij} - r_{0j}) - (r_{i0} - r_{00})]$$

$$\mathbf{j}_{ij}^* = \mathbf{j}_{i0} \frac{\mathbf{j}_{0j}}{\mathbf{j}_{00}}$$

ϕ is the variable under study (production and employment); i is the sector or industry and

⁵ In order to facilitate the reading, time references have been left out.

j the province or region. On the other hand, r represents growth rate between t and $t+2$ ⁶, using the subindex 0 to refer to the chosen economy (that is to say the Spanish economy). With this dynamic approach, the analysis by periods is built as the sum of each of the estimated effects between the pairs of years which make up that period.

The ECN components show the shift derived from the national growth. The EE components estimate the shift due to productive structure - for the different industry mix specialisation as well as for the differences in sectoral growth rates -. The rest (R+RI) makes up the regional effect which would indicate the dynamism particular to a region, that is to say that it could represent the quantification of regional comparative advantages/disadvantages.

At an aggregated level, the Arcelus (1984) approach is equivalent to the traditional one. On the contrary, when the aim of the analysis is to study the advantages and disadvantages of a specific region in a group of sectors, the distinction made between R and RI within the regional effect is very useful, since it distinguishes a regional effect derived from regional growth (R) from growth due to the presence of regional competitive advantages or disadvantages (RI). This distinction is not a trivial one since service sectors with high income elasticity would present important regional effects in those regions with an above average growth, although they would not show competitive advantages in these activities⁷.

One of the most important constraints of *shift-share* technique is its determinist character, which makes it impossible to test the contribution of the factors previously described to growth. However, this problem can be overcome, according to Knudsen and Barff (1991), by estimating and testing a linear model of dummy variables (by industries and by regions) or, what is the same, by adapting the previous dynamic analysis to an equation like the following one:

⁶ The data base used offers biennial registers for odd years from 1955 to 1993.

⁷ One of the main advantages of this type of disaggregation is that it enables to estimate, in a more precise way, the sectors in which regional competitive advantage is to be found and its nature, although a more detailed analysis by sector is beyond the objectives of this paper.

$$r_{ij} = a + S_i + R_j + e_{ij} \quad [2]$$

where r_{ij} is the average rate of growth of region i in sector j for the period analysed; "a", a constant which approximates the national growth contribution; S_i is a matrix of dummies industries variables which captures the industry mix effect, and R_i a matrix of dummies variables used to estimate the regional effect.

The results thus obtained are not equivalent to those of the traditional analysis⁸ since estimations are carried out on growth rates. Additionally, the error term (e_{ij}) of equation 2 is not constant in variance; then, the estimation can be made using Weighted Least Squares as done in Knudsen and Barff (1991)⁹.

3.2. Data base

The data base used has been the new series of the Foundation BBV which offers data on Gross Value Added (GVA) and on the number of jobs at a provincial level (NUT III, in Eurostat terminology), with a broad temporal coverage from 1955 to 1993 for odd years and for 24 activity branches.

As series on regional or provincial prices for each productive sector were not available, current values were transformed in constant 1986 values using sectoral deflators offered by that same publication.

The combination of industries (24), provinces (52), periods (19) and the variables under study (production and employment) has implied the use of 47,424 data points and the elaboration of two parallel analyses - one for production and one for employment. This enables the analysis of labour productivity change and underlines the regional similarities and differences observed in the evolution of production, employment and

⁸ For reasons of space, results of the determinist shift-share analysis are not presented in detail.

⁹ Weights (w_{ij}) are built according to the following expression:

$$w_{ij} = \mathbf{j}_{ij} / \mathbf{j}_{00}$$

On the other hand, in order to estimate the relation's parameters, it is necessary to omit two of them (a regional one and a sectoral one) or to carry out an estimation with two restrictions on the parameters' value. We have chosen here to carry out the estimation leaving out two variables so that the estimated

labour productivity. Nevertheless, only the most relevant results are presented here.

Three main reasons justify the choice of this data base:

1st.) Its temporal coverage. Regional growth phenomena, productivity evolution and sectoral changes require a wide temporal perspective in order to minimise the influence of the economic cycle in the results.

2nd.) Its sectoral disaggregation. The availability of 24 activity branches enables us to carry out more detailed studies on the sectoral growth component, thus underlining the wide heterogeneity existing amongst the different industries.

3rd.) Its regional division. The possibility of using provinces as units of analysis also enables to capture the existing regional differences which, in many occasions, are hidden when the analysis is made through regional data (Autonomous Communities)¹⁰.

3.3 Main results

Results obtained by the estimation of equation [2] are presented in table 2 and in map 2. The first point to be emphasized is the ability of the productive structure to explain the different behaviour of each province's growth rate in each sector. Results in table 2 reveal also the different dynamism of productive sectors, both in terms of production and employment.

Industries which have not contributed to GVA growth at a provincial level have been primary activities, textile, private education and health care and the residual activity of other market services. On the contrary, chemicals, metal products and machinery, paper, products and rubber, plastics and other manufactures are the industrial activities which have contributed most to provincial growth. This fact shows a strong provincial specialisation process in industries which experienced an important impulse in the so-called "development period" of the Spanish economy, during the 60's (Mancha, 1984).

value of the parameters shows the *differential* contribution with respect to the omitted variables.

¹⁰ The division of the Spanish State into 17 Autonomous Communities does not enable to adequately underline the heterogeneity existing in some of them, as for instance Castile-León or Andalusia.

Table 2.- Results of the 1955-1993 stochastic shift-share analysis
 Estimation: Weighted least square method

| | | GVA growth (Probability) | Employment growth (Probability) |
|-----------|--|-----------------------------|------------------------------------|
| | Regressors: | | |
| | Constant | 0,088401 (0,0000) | 0,027659 (0,0002) |
| | Industries: | | |
| 1 | Agriculture | -0,028901(0,0005) | -0,102573 (0,0000) |
| 2 | Fisheries | -0,060392 (0,0000) | -0,045437 (0,0000) |
| 3 | Electricity, gas and water | 0,029723 (0,0197) | -0,062624 (0,0000) |
| 4 | Basic metal industries | 0,046962 (0,0029) | -0,043663 (0,0021) |
| 5 | Non-metallic mineral products | 0,024346 (0,0467) | -0,029905 (0,0032) |
| 6 | Chemicals | 0,058959 (0,0000) | <i>0,005292 (0,5480)</i> |
| 7 | Fabricated metal products and machinery | 0,064384 (0,0000) | 0,038957 (0,0000) |
| 8 | Transport equipment | <i>0,322505 (0,0669)</i> | <i>0,246299 (0,1044)</i> |
| 9 | Food, beverages and tobacco | 0,035910 (0,0002) | -0,017035 (0,0984) |
| 10 | Textiles, wearing apparel and leather industries | -0,039709 (0,0000) | -0,055373 (0,0000) |
| 11 | Paper products and printing | 0,058213 (0,0000) | <i>0,014488 (0,0955)</i> |
| 12 | Wood, wood products, incl. Furniture | <i>-0,001552 (0,8794)</i> | <i>-0,010859 (0,3096)</i> |
| 13 | Rubber, plastic products and other manufactures. | 0,057253 (0,0000) | 0,049881 (0,0000) |
| 14 | Construction (omitted) | 0,000000 | 0,000000 |
| 15 | Recoveries and repairs | <i>-0,002305 (0,7677)</i> | <i>0,000863 (0,9185)</i> |
| 16 | Wholesale and retail trade | 0,019817 (0,0163) | 0,026487 (0,0005) |
| 17 | Hotels and restaurants | <i>0,026569 (0,0637)</i> | <i>0,020132 (0,1560)</i> |
| 18 | Transport and communication services | 0,063247 (0,0000) | <i>0,009418 (0,2202)</i> |
| 19 | Credit and insurance services | <i>0,010099 (0,1942)</i> | 0,035041 (0,0000) |
| 20 | Rents | 0,016220 (0,0398) | -0,100956 (0,0000) |
| 21 | Private teaching and health care services | -0,046379 (0,0000) | 0,026784 (0,0007) |
| 22 | Others market services | -0,018890 (0,0248) | 0,038569 (0,0000) |
| 23 | Community, social and personal services | 0,230088 (0,0000) | -0,020711 (0,0064) |
| 24 | Non-market services | <i>-0,003371 (0,6616)</i> | 0,056172 (0,0000) |
| | Redundant variables tests: | | |
| | LR Test - Industries | 1403,790 (0,0000) | 2148,541 (0,0000) |
| | LR Test - Provinces | 127,346 (0,0000) | 219,792 (0,0000) |
| | F-Test | 172,63 (0,0000) | 140,32 (0,0000) |
| | Adjusted R-square | 0,910598 | 0,892098 |
| | No. Observations | 1248 | 1248 |

Italic values are non-significant at 95% confidence level.

Heteroskedasticity- Consistent Covariance Estimator.

Source: Own elaboration

Amongst service activities, those which stand out most are transport and communication and personal services. This last includes the estimated value added of non-market service activities, developed by entities other than public administrations, such as social work, civic, religious, cultural associations, trade union organisations, etc.¹¹

The sectoral behaviour of employment has maintained a rather different course. Two reasons must be considered in understanding the strong process of labour force restructuring which happened from the second half of the 70's: first, the growth model of the 60's was fundamentally based on activities linked to the domestic market and in some cases, oriented to imports substitution, which were strongly capital intensive and very dependent on external inputs, in particular on the use of petroleum. As a consequence of this, and in the second place, the growing integration of the Spanish economy into the international economy has had a fundamental impact on industrial and primary activities, which have experienced strong restructuring processes.

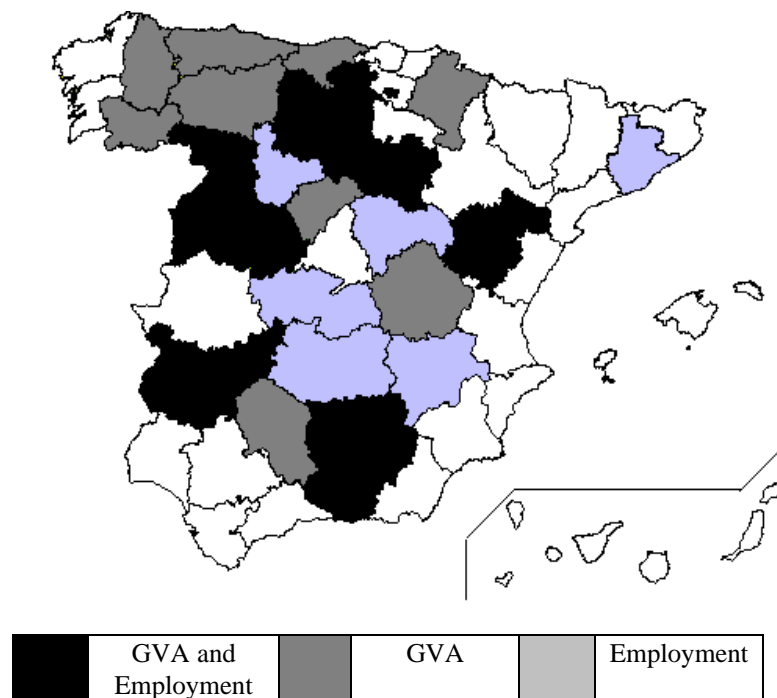
This process has been characterised by intense structural changes involving employment growth tertiarisation. Agriculture, energy, textile and mining industries are all activities which have shed large numbers of workers who were not absorbed by other sectors. On the contrary, tertiary industries have been the driving force in employment creation over this period. Credit and insurance, other market services, private education and health care and non-market services particularly show gains above all at the end of the 80's¹².

One result which can be observed following estimation of regional variables: the importance of the regional component when explaining growth rates below the Spanish average (map 2). Almost all of the regions which have grown below the Spanish average, in production as well as in employment, represent regional disadvantages for these variables. These results draw a Spanish regional map characterised by two facts:

¹¹ Domestic service corresponds to sector 93 in the NACE-CLIO R.44 classification or to sector 57 of the Spanish economy's Input-Output Tables.

¹² Employment growth in the public sector is specially concentrated between 1982 and 1989.

Map 2. Provinces with negative regional effects¹³
Representation of R_{ij} results



Source: Own elaboration

1.- Regional productive specialisation is an important determining factor of provincial dynamism, at least, in the sense in which it is analysed here: the progressive specialisation of sectors with above average growth rates or which generate more employment than the average. Thus, the structural changes which favour the specialisation of these sectors can be one of the factors contributing to the existence of a higher level of regional equality or inequality.

¹³ The selected provinces are the ones presenting 90% differences with Madrid, the province taken as reference.

2.- However, the sectoral heterogeneity existing in both GVA and employment growth shows a certain level of homogeneity in the localisation of regional effects. This result suggests the need to take into account other variables in addition to productive structure, which would explain, amongst others, the lack of provincial dynamism both in employment and production¹⁴.

As a rule, regional specialisation processes are more profound than national ones. In Spain, this has led to an important production and employment concentration process which is even greater at the provincial level¹⁵. Spanish regional growth trajectories have been strongly influenced by structural changes and, concretely, by tertiarisation. The relation between GVA and industrial growth presents a 50% correlation for the 1955-1993 period, while in the case of market service activities, this figure is above 90%¹⁶.

On the other hand, this dynamic *shift-share* analysis enables the identification of areas characterised by a constant losses both in production and employment. These losses are linked to the productive structure - specialisation in activities with lower relative growth – and to the presence of considerable regional disadvantages (map 3). The provinces which have been qualified as declining are concentrated in the inland of the country, particularly in Castile-Leon and Andalusia regions, although provinces like Teruel and Huesca (Aragón), Cuenca and Ciudad Real (Castile-La Mancha) and Badajoz (Extremadura) also present a lagging dynamism.

This lack of economic dynamism is also reflected by demographic figures¹⁷. Population ageing and depopulation are also concentrated in the inland, thus consigning these areas to a certain stagnation, which seems to perpetuate itself over time. The spatial structure of population settlements has strong implications on the performance of the economic policy's objectives. Maintaining the rural space, providing and managing public services, offering quality of life or equality of opportunities to the population,

¹⁴ A comparison of the results represented on map 1 with those on map 2 shows great similarity, indicating the relative concentration of negative effects in some provinces but not in others.

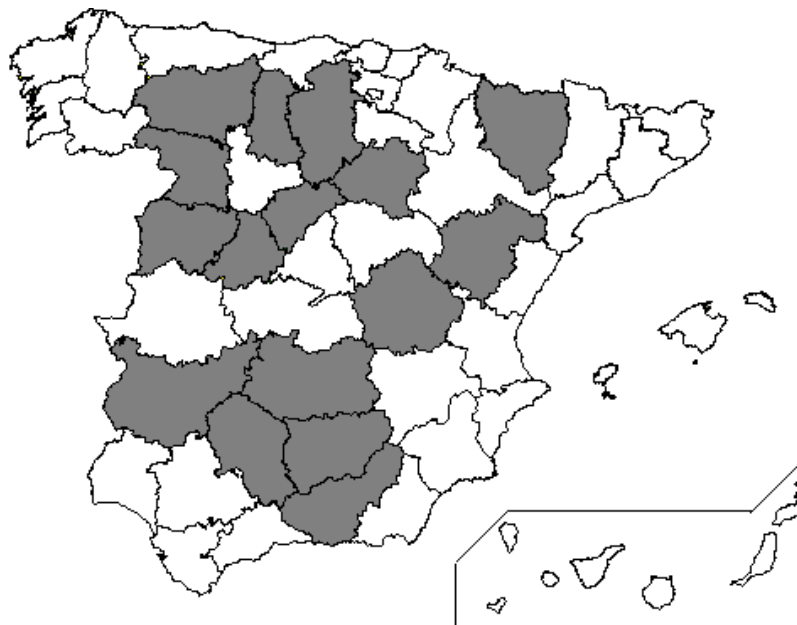
¹⁵ This is particularly important in terms of employment. The 15 provinces with higher employment in absolute terms in 1955 represented almost 55% of total employment. This figure almost reached 61% in 1993.

¹⁶ More detailed results of this analysis are not presented here.

¹⁷ We will not take into consideration the order of causality. The fact is that both magnitudes are related

independently from its geographic situation, are all objectives whose success is determined by the territorial configuration of the country¹⁸. On the other hand, congestion, the worsening of the environment, the relative lack of public and social capital, translated into an increase of private costs, social exclusion, etc. are the reflection of opposite processes experienced by other areas.

Map 3.- Declining provinces, 1955-1993.



Source: Own elaboration.

The triangular causal relationships defined by *economic growth* ↔ *presence of specific activities* ↔ *population* is particularly obvious when service activities are analysed. Given these relationships, these results are quite worrying because of the implications they have for unequal territorial development. Without taking into account the autonomous cities of Ceuta and Melilla, out of the 50 Spanish provinces, 19 presented an average density lower than the national average in 1955 and a population growth rate also below average between 1955 and 1993. If these trends are consolidated, and there are no signs leading us to think otherwise, almost 50% of the

and tend to be reinforced.

¹⁸ This type of statements is clearly reflected by the Ministry of Economic Affairs and Finance (1993).

territory would be characterised by a scarce economic and social dynamism, thus reinforcing the activity concentration around the axes previously referred to and feeding a cumulative process.

These results do not necessarily imply that a convergence process in per capita income or productivity levels is not taking place (see Cuadrado, Mancha and Garrido, 1998 and Cuadrado, García and Raymond, 1999). Leaving aside the important redistributive function of the tax system at a regional scale¹⁹, the reduction of disparities, observed between 1955 and 1993, in terms of income per capita and labour productivity, are due to population and employment losses more than to a progressive equalisation of activity levels. The strong migratory processes during the 60's and the intra-regional concentration during the following years shaped regions with some high population densities and urban centres of intermediate or low development serving as attraction poles for the population of the province or of the bordering provinces²⁰. As for the differences in activity and provincial employment rates, they also make up an element which has contributed to the reduction of disparities in terms of productivity.

Figures shown in table 2 and reflected in map 2 point to the heterogeneity of the behaviour of productive activities and regions in relation to their production and employment growth. The results show a panorama of diversity which also affects productivity dynamics. Table 3 presents the results for this variable.

Despite the fact that productive sectors' employment and GVA behave differently at a national scale, these can be classified into two broad groups according to the productivity variable:

1.- Sectors which contribute to regional productivity growth. They are mainly industrial sectors linked to primary activities. In most of the cases, important productivity increases are due to strong processes of employment destruction in these

¹⁹ That is to say not taking into account variables like family income available per habitant but using indicators such as per capita GVA or GVA by employment.

²⁰ These changes in migratory patterns have indeed slowed down the process of inequality reduction in the 80's. According to the data offered by the population censuses on total migrants, between 1981 and 1991, 51.3% moved and went to municipalities within the same province.

activities. Some service industries (Transport and Communication, Renting and Social and Personal services) have also positively contributed to the growth of regional productivity.

2.- **Activities which have a negative effect on growth** are fundamentally service activities although some industrial activities, either *traditional* or with a low technological content, like Wood, Wood products and Furniture, also present a similar behaviour. Activities standing out for their scarce increase in productivity are Wholesale and retail service, Hotels and Restaurants, the Finance Sector (Credit and Insurance), private Education and Health and Public Administrations' services. The unique character of some of these activities as well as the market structures of some of them (regulated and/or linked to the public sector) can partly explain these results.

Table 3.- Stochastic shift-share analysis for apparent labour productivity 1955-1993

Estimation: Weighted least square method

| | Productivity growth | Probability |
|--|---------------------|-------------|
|--|---------------------|-------------|

| | | |
|---|--|-----------------|
| Regressors: | | |
| Constant | | 0,076647 |
| Industries: | | |
| Agriculture | | 0,050757 |
| Fisheries | | -0,037822 |
| Electricity, gas and water | | 0,031657 |
| Basic metal industries | | 0,059369 |
| Non-metallic mineral products | | 0,035779 |
| Chemicals | | 0,036030 |
| Fabricated metal prod. and machinery | | 0,008753 |
| Transport equipment | | 0,041755 |
| Food, beverages and tobacco | | 0,030019 |
| Textiles, wearing apparel and leather industries (omitted) | | 0,000000 |
| Paper products and printing | | 0,027319 |
| Wood, wood prods., inc. Furniture | | -0,007581 |
| Rubber, plastic products and other manufactures | | -0,010187 |
| Construction | | -0,018207 |
| Recoveries and repairs | | -0,023236 |
| Wholesale and retail services | | -0,023024 |
| Hotels and restaurants | | -0,007900 |
| Transport and communication services | | 0,036751 |
| Credit and insurance services | | -0,041172 |
| Rents | | 0,091195 |
| Private teaching and health care services | | -0,089994 |
| Others market services | | -0,073673 |
| Community, social and personal services | | 0,230500 |
| Non-market services | | -0,076899 |

| | | | |
|-----------|----------------------|----------|--------|
| | | | 0,0000 |
| 1 | | | 0,0000 |
| 2 | | | 0,0000 |
| 3 | | | 0,0000 |
| 4 | | | 0,0000 |
| 5 | | | 0,0000 |
| 6 | | | 0,0000 |
| 7 | | | 0,0000 |
| 8 | | | 0,0157 |
| 9 | | | 0,0000 |
| 10 | | | |
| 11 | | | 0,0000 |
| 12 | | | 0,0001 |
| 13 | | | 0,0000 |
| 14 | | | 0,0000 |
| 15 | | | 0,0000 |
| 16 | | | 0,0000 |
| 17 | | | 0,0000 |
| 18 | | | 0,0000 |
| 19 | | | 0,0000 |
| 20 | | | 0,0000 |
| 21 | | | 0,0000 |
| 22 | | | 0,0000 |
| 23 | | | 0,0000 |
| 24 | | | 0,0000 |
| | Redundant variables: | | |
| | LR Test - Industries | 4468,291 | 0,0000 |
| | LR Test - Provinces | 697,1277 | 0,0000 |
| | F-test | 1150,874 | 0,0000 |
| | Ajusted R-square | 0,985557 | |
| | No. observations | 1248 | |

Heteroskedasticity- Consistent Covariance Estimator.

To carry out the estimation, sector 10 and the province of Madrid have been omitted.

Source: Own elaboration

The comparison of results, in terms of employment, GVA, and productivity, reinforces the thesis of the Spanish provinces' heterogeneous behaviour. Figure 1 shows a regional typology which enables us to characterise the same productivity evolution as a result of clearly different adjustment processes in production and employment. By simultaneously applying a cluster analysis²¹, the overall consideration of these three

²¹ A detailed analysis of this methodology can be found in Cuadrado, Mancha and Garrido (1997) and (1998). The utility of this technique is linked to the possibility of establishing groups of regions/provinces internally homogeneous but different from one another, according to a series of

variables results in a regional typology which is not going to be analysed here but which enables to distinguish, at least, four broad groups of provinces. Their results are summarised in table 4.

The **first cluster** is formed by seven provinces²² with above average production and employment growth rates but with below average productivity rates. The progressive tertiarisation of productive structures helps to understand this employment-productivity relation. All them are provinces with high productivity levels where dynamics of change help to reduce inequalities.

The **second** and **fourth clusters**²³ point to one of the main characteristics of productivity growth between 1955-1993. Increases in productivity have come from strong employment reductions, as shows the large number of provinces located in these clusters (55% of Spanish provinces). On the contrary, provinces which have generated employment above average have simultaneously registered productivity increases slightly below average, as the values of the centres of **clusters 1 and 3** show²⁴.

**Figure 1.- Provincial evolution of productivity, production and employment.
1955-1993**

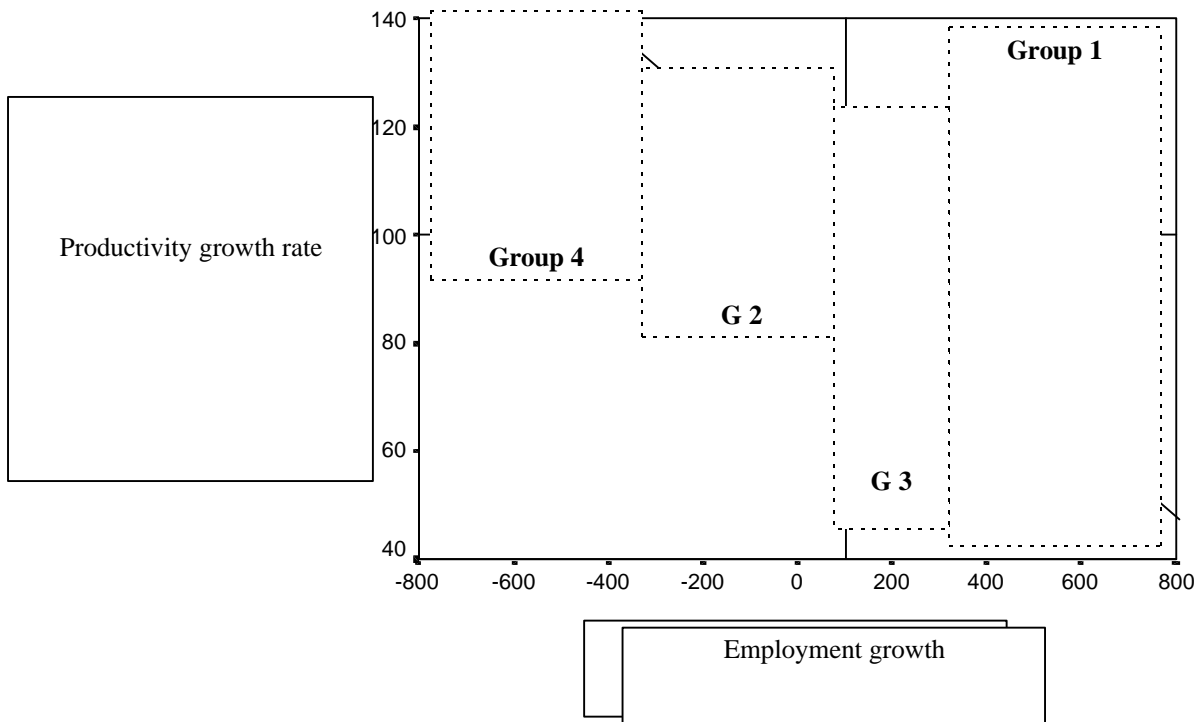
Annual cumulative average rates. Spain=100

grouping variables (GVA, employment and productivity) using distance measures. See Hair *et al.* (1995).

²² Alava, Alicante, Baleares, Barcelona, Madrid, Las Palmas and Ceuta are part of this group.

²³ Second cluster: Albacete, Asturias, Burgos, Cantabria, Castellón, La Coruña, Granada, Huelva, Huesca, Lleida, Lugo, La Rioja, Salamanca, Segovia and Toledo. Cluster number 4: Avila, Badajoz, Cáceres, Ciudad Real, Córdoba, Cuenca, Guadalajara, Jaén, León, Orense, Palencia, Soria, Teruel and Zamora.

²⁴ The third cluster is made up by the following provinces: Almería, Cádiz, Girona, Guipúzcoa, Málaga, Murcia, Navarra, Pontevedra, Sta. Cruz de Tenerife, Sevilla, Tarragona, Valencia, Valladolid, Vizcaya, Zaragoza and Melilla.



Diagonal: Regional GVA growth = National GVA growth

Source: Own elaboration

Specialisation among Spanish provinces greatly explains this productivity evolution, although there are regions with advantages or disadvantages in relation with this variable (as happens when production and employment are analysed separately) which coincide with the grouping resulting from the cluster analysis. Provinces with regional productivity disadvantages belong to groups 2 and 4, while those presenting advantages are not clearly integrated into one group: they mostly belong to groups 1 and 3.

Table 4. Results of the cluster analysis

| | Cluster centres Spain=100 | | | |
|--------------|------------------------------|---------|---------|---------|
| Variables | 1 | 2 | 3 | 4 |
| Production | 114,35 | 89,95 | 102,61 | 79,40 |
| Employment | 505,26 | -152,99 | 150,49 | -474,36 |
| Productivity | 85,10 | 108,12 | 99,03 | 120,83 |
| Case numbers | 7 | 15 | 16 | 14 |
| | Cluster centres distances | | | |
| | 1 | 2 | 3 | 4 |
| 1 | -- | 659,100 | 355,237 | 980,893 |
| 2 | 659,100 | -- | 303,876 | 321,798 |
| 3 | 355,237 | 303,876 | -- | 625,660 |
| 4 | 980,893 | 321,798 | 625,660 | -- |

Source: Own elaboration.

4.- Productivity dynamics in terms of convergence: comparison between real and *virtual* results

As was shown in section 2, a reduction of disparities in terms of labour productivity took place between 1955 and 1993²⁵. However, the evolution of productivity dispersion (known as *sigma convergence*) enables to underline two important characteristics (figure 2) which nuance the previous information:

1.- The dispersion reduction was particularly intense during the first 20 years, where over 70% of the total decrease is achieved mainly thanks to the fact that provinces with a higher level of income lost relative positions. (Indeed, in 1955, Madrid was the most productive province with a 194 index - Spain = 100 -, while, in 1993, it was Vizcaya with a 119 index).

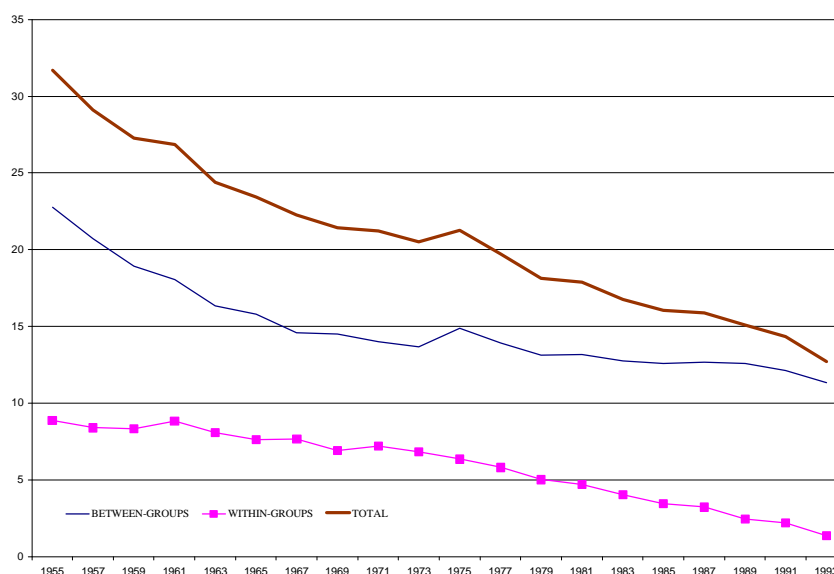
2.- The analysis of sigma convergence by groups of provinces, according to the results obtained from the previous cluster analysis, shows that the disparity reduction is greater amongst the regions being part of the same group than amongst the different groups. Indeed, from 1979, convergence between groups has practically come to a halt. The convergence observed between 1979 and 1993 is basically due to a disparity reduction *within* each group. This evolution implies that, in 1993, the differences

²⁵ The difference between the maximum and minimum level of productivity has gone from 4.2 to 2.1 in 38 years.

existing between the various groups of regions explain nearly 90% of the observed dispersion.

Figure 2.- Sigma convergence in provincial labour productivity

1955-1993



Source: Own elaboration

A complementary analysis can be done through *beta convergence*, that tries to test if a situation of relative backwardness takes as starting point can be eliminated over time by higher growth rates. That is, if there is some mechanism which would led to reduce the previous productivity gap²⁶. This empirical testing can be carried out through the estimation of the following equation:

²⁶ Behind this, can be found numerous explanations, mostly related to neo-classic growth models. The “advantage of being poor” is translated into lower costs, higher capitalisation or employment possibilities and processes of innovation adoption which would enable these areas to benefit from productivity growth rates higher than those present in areas with more important productivity levels. If the model’s assumptions are fulfilled, productivity converge would take place in each of the productive sectors and in the overall economy.

$$(1/T)\ln(y_{it+T}/y_{it}) = \mathbf{a} + \mathbf{b}_1 \ln y_{it} + e_i \quad [3]^{27}$$

Results proceeding from *shift-share* analysis, carried out for production and employment variables, make it possible to obtain *virtual* series and growth rates, which enable to study the contribution of both productive structure and evolution of regional competitive advantages to productivity convergence.

On the other hand, the estimation of structural and regional effects in the *dynamic shift-share* analysis is carried out in such a way that structural changes are not specifically contemplated, since the provincial productive structure changes every two years. Then, effects can be calculated in a more precise way but with the constraint that a factor favourable to convergence is not taking into account.

In order to avoid this problem, a static *shift-share* analysis has been carried out, where structural changes are explicitly valued. Additionally, the equation [3] has been transformed, controlling the productive structure in the initial reference year, by the means to introduce a new parameter ρ_{it} , which represents the percentage of non-agrarian employment over total employment:

$$(1/T)\ln(y_{it+T}/y_{it}) = \mathbf{a} + \mathbf{b}_1 \ln y_{it} + \mathbf{b}_2 \mathbf{r}_{it} + e_i \quad [4]$$

Estimations carried out are summarised in table 5 and the results enable to make the following remarks:

1.- A convergence process over the whole period can be observed. Nevertheless, this process of disparity reduction is quite slow since the speed of convergence is only

²⁷ The variable y_t is, in this case, the apparent work productivity. Regressions with panel data have also been carried out, adjusting an expression equivalent to number [3], which enable to test the presence of different stationary states. The adjusted equation has been the following one:

$$\Delta \ln \prod_{it} - \Delta \ln \prod_t = \mathbf{a}_i + \mathbf{b}(\ln \prod_{t-1} - \ln \prod_{it-1}) + v_{it}$$

For reasons of space, results are not detailed.

1.44% annually, then the stationary state would be reached in approximately 48 years.

2.- The contribution of regional specialisation explains this result. If *virtual* series are built without taking into account regional productive structure to growth, convergence would not have taken place, as shows regression 2.

Table 5. Results of β convergence in productivity. 1955-1993

| Regression (Equation 3) | | α (S.E.) | β (S.E.) | Annual Growth | R ² | F-test (Prob.) |
|----------------------------|---|--------------------------|-------------------------|------------------|----------------|-------------------|
| 1 | Real series | 0,295 (0,018) | -0,019 (0,001) | 1,44 | 0,7976 | 202,05 (0,000) |
| 2 | Virtual series. Without proportional shift | <i>-0,001</i> (0,028) | <i>0,002</i> (0,002) | --- | 0,015 | 1,793 (0,186) |
| 3 | Virtual series. Without regional shift | 0,299 (0,028) | -0,019 (0,002) | 1,45 | 0,626 | 86,55 (0,000) |
| Equation 4 | | | | | | |
| 4 | Real series | ,1690 (0,052) | -0,009 (0,004) | 0,78 | 0,8180 | 115,61 (0,000) |
| | ρ_{55} -estimation | -0,018 (0,007) | | | | |

In italic, values not significant at 95%
Standard errors in brackets.

Source: *Own elaboration*

3.- Regional effects have not a contributed to convergence either (regression 3). Their influence on results comes from two factors: their converging or non-converging evolution and their quantitative importance when evaluating employment and production growth. *Shift-share* analysis enables to conclude that regional factors are becoming more and more important to explain the *differential* behaviour of the Spanish provinces. Nevertheless, for the whole period, the estimation without regional shift implies that the convergence speed hardly changes (1.45 %).

4.- Results of equation 4 add a new perspective to the convergence analysis. Traditional analysis do not take into account the importance of structural changes. As shown in this paper, the sectors behaviour is significantly different, both in terms of production and employment. Therefore, provinces' productivity gains can not only be due to an increase in *intra-sectoral* productivity but also to changes in productive structure, from low to highly productive activities.

Processes of intra-sectoral convergence have not been considered in this paper but according to our analysis, controlling them through the structural changes of the Spanish provinces, results would have changed radically. For the whole period, convergence speed is reduced (practically by half, thereby falling from 1.44% to 0.78%). This fact implies that provincial economies would be reach the stationary state around 88 years. Moreover, for specific sub-periods²⁸, the fact that the initial productivity level is not significant suggests that the observed convergence is not so much due to an improvement derived from a backwardness situation (the “advantage of being poor”) but to important structural changes experienced by the different provinces.

Regional (provincial) economic development from the second half of the 70’s has mainly been based on services’ growth. Its has been more important in provinces with average to high productivity levels and has led to a *quasi-automatic* convergence process, also helped by a gradual divergence observed in variables relative to labour market, such as activity or employment rates. Additionally, these facts enable to explain the existence of regional convergence from a general perspective but not at sectoral level.

5. Final remarks

Results obtained through the analysis of growth dynamics of Spanish provinces enable to underline the following remarks:

First, the heterogeneity of the behaviours, both at a sectoral and regional level. As it could be expected not all sectors have equally grown or generate the same employment. This fact reflects the development, consolidation and decline of specific activities at a national and also at a provincial level.

Secondly, some provinces show a dynamism, or lack of it, independently from their productive specialisation. In our opinion, this result opens a new perspective for the analysis, particularly for the last years of the period (i.e.: 1980-93) when structural changes seem to have come to a halt. In the past, interregional migration flows, as a

²⁸ Due to a lack of space, regressions results are not shown here..

result of agrarian activities declining, helped to convergence in productivity and per capita income levels. But at the same time, these processes have reinforced regional unbalances in other aspects, such as population, and total production, and seems to have sunk some specific areas in a permanent low productive dynamics. These unbalances can determine the maximum levels of income generation and enable to forecast a halt in the closeness of average levels, that is to say, the exhaustion of convergence possibilities²⁹.

A third clear remark to be done is that regional productive structure and the associated structural changes, which have been fundamental to explain the convergence process between 1955 and 1993, seem to be factors whose contribution have tended to run out over the last few years. The first reason behind this behaviour concerns in the fact that the current margin to carry out structural changes, similar to those in the past, is nowadays very narrow. A second reason seems to be the fact that over the last few years regions with slower productivity growth have been able to increase them, as a result of the higher requirement which an integrated market has for its productive activities. Mainly in manufacturing industries, but also in some private service activities.

Fourth. From a territorial planning perspective, an economic convergence process such as the past one does not seem now desirable, since it would further reinforce the processes of demographic desertification, which some of the Spanish inland provinces already suffer. For this reason, regional development seems to be linked to favouring a process of *intra-regional* structural changes which, in turn, implies carrying out an analysis of the factors explaining regional dynamism (and/or the lack of it) the entrepreneurship capacity of an area.

These phenomena require a deeper analysis although current trends appear to reinforce regional disparities. European integration seems to better favour the most advanced regions, without any element enabling to state that a certain spreading effect, towards less favoured provinces, is taking place. The consequence can be a paradox with respect to Europe: the closeness of national figures together with a stagnation of regional / provincial values.

²⁹ Cuadrado, García and Raymond (1999) have also set up this important remark but using much more aggregate sectoral data and at a regional level

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