Economic convergence: a regional and sub-regional approach

De Souza Rech, G.C.(*), Pérez Montiel, M. (*) and Sanson de Bem, J. (**)

Abtract

The study of economic convergence among nations and regions is, from the initial work of Barro and Sala-i-Martin (1991), a topic of spatial economic analysis. Recently, research on economic convergence has been aimed at smaller spatial fields: a) regions within a country and, b) urban regions, micro-regions and urban areas within a region. This topic has been analyzed from different theoretical approaches and, as economic convergence is a structural economic process, which occurs in the long run, it study requires long time series data. This paper argues that the processes of economic convergence, regional and sub-regional, occur simultaneously following different models or patterns within the same country. Thus, a sub-area whose long term population declines, keep its GDP, shows a convergence process or model different from other sub-area whose population and GDP grow simultaneously. This paper attempts to identify these different patterns of economic convergence within a nation or a region. We present a model aimed at identifying the various typologies that can occur simultaneously in the process of economic convergence of regions within a country or sub-areas of a region. We study the dynamics of population and GDP of each sub-area members of the nation or the region and shows how this process occurs according to different patterns. The model presented in this paper is tested by applying the process of long-term economic convergence in Spain, on the study period 1955 - 2010 and as spatial units, the provinces. Have been selected for this work two main variables: Population and provincial GDP for the years studied. For the period 1955 to 1985 we used the publications of the Research Department of Banco de Bilbao on Spain's national income and its distribution by province and for the period 1985-2010, the statistical series of the National Institute of Statistics. The results show that economic convergence has occurred in Spain following several qualitatively different and changing patterns over time.

Keywords: Economic Convergence, Regional and Sub-regional Scales.

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1.- Introduction

Economic convergence topic has received attention in the economic literature over the past 30 years. Its interest exceeds the strictly economic sphere to be an element of national economic policies: governments consider an objective of his economic policies that his spatial growth is produced by reducing differences or disparities between "poor" and "rich" subareas. This coincidence has produced an interaction between the two fields - political and scientific-about economic convergence.

In the scientific field, many authors from different countries have focused their research on the processes of economic convergence in national and sub-national scales, USA, Rey Sergio J., Montouri Brett D. (1999), Finland, Kangasharju A. (1999), Canada, Coulombe S. (2000) , Austria, Hofer, H. and Wögöter A. (1997), Spain, Goerlich, F., Más M. y Pérez F.(2002), Villaverde J. (2004), Cuadrado-Roura J.R. (Ed.) (2009), Greece, Siriopoulos C. and Asteriou D. (1998), Colombia, Cardenas M. and Ponton A. (1995), Brazil, Magalhaes, A. Hewings G. y Azzoni C. (2005) and other countries have been investigated.

From the standpoint of economic policies actions, which objectives were the reduction of regional disparities, have been designed. The Organization for Economic Cooperation and Development -OECD- has suggested to its members the desirability of implementing policies conducive to reducing regional economic disparities space. The European Union implements and develops specific economic policies aimed at reducing the gaps between European Union countries and within each EU member state.

The coincidence of political and academic interests has allowed the work done by different authors have been able to be used in the design and implementation of these economic policies and be compared with real situations.

Research on economic convergence have been developed from different theoretical perspectives (endogenous growth models against neoclassical models) and with different empirical approaches. Different theoretical and methodological approaches based on the assumption that convergence would decrease the dispersion of income per capita. The analysis of the "standard deviation" (Carlino and Mills, 1996) or the coefficient of variation (Bernard and Jones, 1996) has been defined as "convergence **σ**". A second form of convergence occurs when poor regions or sub-areas grow faster than rich. This process is measured by **α** and **β** parameters convergence (Barro and Sala-i-Martin, 1991.1992) indicating that the growth rate of per capita income over a long period is negatively correlated with initial income levels. Finally, the study of time series (Bernard and Durlauf, 1995) suggests that long-term expectations of income differences tend to zero. These approaches are aimed to determine whether, in the long term there is or not, a sub-economic convergence between subareas, leaving the background patterns that follow each subarea in this process.

2.- Focus of this communication.

The hypothesis raised in this paper is that the long-term evolution of the different subareas of a region or a country, take place according to distinct patterns. The hypothesis is specified by proposing that subareas evolution occur according to the sub-types of different evolution, evolution that is not always regular. This work seeks to establish a methodology to identify the different types of evolution of the subareas of a nation

A complementary hypothesis of this paper is that economic developments in sub-areas is subject to external economic events which occur in the long term and are outside the scope of economic analysis: changes of political regime, different economic "shocks", technological changes, the emergence of global processes that modify the relative position of nations and regions within those specific changes and in some sub-areas of a country that significantly altered its secular evolution. This suggest that these processes are not deterministic, nor uniform.

We propose a model for structuring the available information and identify different patterns of evolution that may exist. The main feature of the model is that it doesn't propose a priori closed and predetermined types, but shows the differences between them and highlights the need for order to identify possible underlyingtypes in the information that are relevant to explain the convergence process and its characteristics. From this methodological approach, the choice of variables on which to apply the model is a critical decision, since the use of different variables can lead to different results. It is also important to have statistical information for a very long period of time.

The application and contrast of this methodological approach is carried out by developing several examples "ad hoc" and comparing the types found in each example. These applications highlight the existence of different patterns and appear to be common to several subareas. The applications of the model suggest that a generalized treatment of the available information allows the identification of standard guidelines in the process of economic convergence between subareas of a nation and, in some cases, the persistence of divergent processes, also at national level.

The application of the model series is done over two statistics series: **Population** and **GDP** of the 50 provinces into which is administratively divided the Spanish state, and for the period 1955 to 2010, in periods of 4 to 6 years depending on the availability of sources.

3.- The model.

The aim of the model is to identify patterns of economic and demographic developments of the sub-areas (departments, provinces, etc.) of a country and also within a region, between different regions or urban areas that integrate it. These patterns of evolution are obtained by comparing the evolution of individual sub-area, with the overall development of the country or region, which is taken as a reference. This allows distinguishing subareas whose evolution is similar to the whole, from those which do differently. Among these, at the same time, is expected several significantly different types of evolution. The model seeks to identify the different types of patterns or "routes" which follow subareas over time, without prejudging if the joint evolution of all leads some of them to some kind of convergence.

To identify patterns or types of evolution of subareas that comprise a country or region some variables are defined and calculated, these are called "Relative Rates of Change", **IVR**. These indexes measure the rate of variation of a particular variable in a subarea, respect to the variation of the same variable at the national level for a specific period of time. Rates of change of each chosen variable are presented as a time series for each subarea.

3.1.- Model Structure

We started as empirical material from the tables of data for each selected variable, tables showing time series of the values of each variable for each subarea and for the whole country. These tables form a matrix with **i** rows: **i = 1 to i = N.** The first **N-1** rows correspond to each of subareas, and the line **N** shows the sum of the same, namely, the national total of the variable. The M columns show the values of the variable for each year for which data are available. Thus, the matrix for the **Population** variable, **POB** is:

$$\mathbf{POB = POB_{(i,j)}}$$

$$\mathbf{i=1 \text{ to } i= N;; \ j= 1 \text{ to } j=M}$$

From this matrix produces a second array called matrix of rates of change is elaborated. Each element of which is defined as the ratio of:

$$\mathbf{IV_{i,j} = POB_{i,j}/POB_{i,1}*100}$$

$$\mathbf{i=1 \text{ to } i=N;; \ j=1 \text{ to } j=M}$$

These rates of change show for each subarea, the evolution of the selected variable taking as 100 the first year of the series. The matrix $\mathbf{IV_{i,j}}$ shows how each subarea has evolved for itself, regardless of the evolution of the remaining. These rates of change do not consider the actual values of the variable, only its relative temporal dynamics.

The calculation of the matrix of indexes of relative variation, **IVR**, is done by dividing the rate of change of each sub-area, between the general variation index, which indicates the rate of the overall economy.

$$\mathbf{IVR_{i,j} = IV_{ij}/IV_{N,j}*100}$$

$$\mathbf{i=1 \text{ to } i=N;; \ j=1 \text{ to } j=M}$$

The **IVR** measure deviation of the variation of a subarea respect to the variation of the overall national economy. IVR series of subarea possibility to compare the pattern of evolution of the whole country and analyze similarities and differences between the characteristics of each subarea and the nation as a whole. It also allows comparison of the evolution of different subareas. The process of calculating the matrix **IVR** is shown by applying it to Population data from two Spanish provinces - Barcelona and Madrid- for the period 1955 to 2010.

Miles HB.	1955	1960	1964	1971	1975	1981	1985	1991	1995	2000	2005	2010
08	2.506	2.842	3.221	3.987	4.380	4.634	4.614	4.738	4.748	4.736	5.226	5.511

Barcelona												
28 Madrid	2.210	2.568	2.983	3.861	4.344	4.702	4.781	5.028	5.182	5.205	5.964	6.459
ESPAÑA	29.105	30.302	31.552	33.948	35.701	37.697	38.356	39.756	40.322	40.358	43.968	46.864
	Índice de Variación 1955 = 100											
08 Barcelona	100	113	129	159	175	185	184	189	189	189	209	220
28 Madrid	100	116	135	175	197	213	216	228	234	236	270	292
ESPAÑA	100	104	108	117	123	130	132	137	139	139	151	161
	Índice de Variación Relativo. España = 100											
08 Barcelona	100	109	119	136	142	143	140	138	137	136	138	137
28 Madrid	100	112	125	150	160	164	164	167	169	170	179	181
ESPAÑA	100	100	100	100	100	100	100	100	100	100	100	100

Table 1. - Example of calculating indexes of relative variation, **IVR POB**. Population of Barcelona and Madrid, 1955-2010.

The first three rows of data in the table, extracted from the matrix **POB** show the population, in thousands of inhabitants of two Spanish provinces and of Spain's total. From these data we calculate the rate of change of the three sets of population, taking the year 1955 as a baseline: 100. It notes that the population of the whole country has multiplied by a factor 1.61, while Barcelona made it by a factor of 2.2 and Madrid by a factor 2.92.

The **IVR** are calculated by dividing the rate of change of each subarea - Barcelona and Madrid, in this case- between the rate of change of the whole country. The **IVR** calculated mean that between 1955 and 2010 the population of Barcelona grew by 37% above the Spanish average growth in this period, while Madrid population did so by 81% over the same average. Because we have a long time series of population, the analysis can focus on the periods of time deemed appropriate. In this application the model is taken as a starting point 1955, for which data are available on **POB** and **GDP**.

The model has the following limitations: firstly due to its own construction, it doesn't take into account the initial values in each subarea of the variable used. Secondly the **IVR** measure the behavior of a variable in relation to the national assembly, regardless of the values of other subareas.

The **IVR** has an advantage in analyzing economic long time series because as conscious of two rates of change, the distortions arising from changes in current values of economic variables are reduced, basically, the effects of inflation. To assess these effects in reading and interpreting information and the difficulty in making year comparisons, the evolution of the **GDP** of the two provinces is shown. While the rates of change grow in extremely high values, of the order of 320 and 550 times the initial value, the **IVR** show values that allow a more accurate study and legible make legible intertemporal comparisons.

	Índices de Variación del GDP		
	1955	1985	2010
08 Barcelona	100	6.310	32.476
28 Madrid	100	9.547	55.971
ESPAÑA	100	6.615	35.734
	Índices de Variación Relativos del GDP		
08 Barcelona	100	95	91
28 Madrid	100	144	157
ESPAÑA	100	100	100

Table 2.- Cálculo **IVR** del **GDP** de Barcelona y Madrid. Resumen.

From this information structure, which specifies in the **IVR** matrices for each used variable, types of changes can be identified that take into account both the degree of dynamics associated with the variable, the absolute values of departure, trend changes that can occur long-term or set location in the regional or national of each of the subareas. If you have very long series, as is the case studied in this communication it is foreseeable that different patterns of evolution observed allow to establish hypotheses about the origins of these patterns, and possibly, provide information for developing possible economic policies.

4.- Model Application and Contrast

4.1.- These applications are made using **IVR** matrices of **POB** and **GDP** of the 50 Spanish provinces during the period 1955 to 2010, which have been previously prepared. The purpose of this communication is to show the diversity of patterns of sub-areas of a nation. This will develop by several tests in order to detect different real patterns on which to base the construction of typologies of them. To this end we present four different applications that show the coexistence of various types in the process of economic development in a country or region.

These tests are:

1.- The comparison between **IVR** of the **GDP** evolution in three provinces: Alicante, A Coruña and Asturias.

2.- The identification of four possible typologies for the whole of the 50 Spanish provinces and for two **IVR: POB** and **GDP**.

3.- Application of **IVR's** to two regions: Cataluña and Galicia.

4.- Comparative analysis of four provinces whose population in 1955 was less than 400,000 inhabitants.

These four applications are intended to show, designed from different approaches, the existence of various guidelines and highlight the difficulty to find directly, the typologies that are unable to be present in the evolution of the Spanish economy in the 55 years studied. The identification and classification of them, up to propose a general typology requires further work on other nations and with the use of other variables.

4.2.- Evolution of the IVR of GDP de Alicante, A Coruña and Asturias.

First of all, we develop a comparison of the evolution of the **GDP's IVR** for four provinces whose **GDP** in 1955 involved in each, between 2% and 4% of Spanish **GDP**. Both the current values of **GDP**, as the rates of change thereof, are compared with difficulty due to differences in magnitude and change of values over time. In contrast, the **IVR** allow a first directly analysis and make comparisons between them.

	GDP in Milions of Ptas Currents											
	1955	1960	1964	1971	1975	1981	1985	1991	1995	2000	2005	2010
03 Alicante	8.965	15214	26.342	72.222	157.963	509.039	924.367	1.721.474	2.217.981	3.294.552	3.300.702	5.138.279
15 Coruña (A)	10.027	15495	25.008	62.797	134.810	415.340	691.241	1.306.651	1.806.336	2.275.698	2.478.468	3.323.179
33 Asturias	16.268	25563	38.857	91.838	181.853	498.417	777.861	1.349.306	1.803.939	2.315.890	2.432.790	3.261.246
ESPAÑA	422.357	668846	1.154.546	2.759.820	5.623.211	16.718.773	27.938.625	54.653.409	74.240.357	104.647.800	108.874.755	150.926.847
	Indices de Variación 1955 = 100											
03 Alicante	100	170	294	806	1.762	5.678	10.311	19.202	24.740	36.749	36.818	57.315
15 Coruña (A)	100	155	249	626	1.344	4.142	6.894	13.031	18.015	22.696	24.718	33.142
33 Asturias	100	157	239	565	1.118	3.064	4.782	8.294	11.089	14.236	14.954	20.047
ESPAÑA	100	158	273	653	1.331	3.958	6.615	12.940	17.578	24.777	25.778	35.734
	Indices de Variación Relativos España = 100											
03 Alicante	100	107	107	123	132	143	156	148	141	148	143	160
15 Coruña (A)	100	98	91	96	101	105	104	101	102	92	96	93
33 Asturias	100	99	87	86	84	77	72	64	63	57	58	56
ESPAÑA	100	100	100	100	100	100	100	100	100	100	100	100

Table 3.- Indices of relative change in the **GDP** of Alicante, A Coruña and Asturias.1955-2010

The graphical representation of the **IVR** allows viewing the pattern in each sub-area that as can be imagined, need not be scheduled or similar to the national average. At the same time, you can compare the evolution of different provinces for the variable being analyzed. The three selected provinces show three different patterns. Alicante is growing high above the Spanish average. Reading the **IVR** values show two stages of development. The first between 1955 and 1985, in which the **GDP** of Alicante steadily grows at rates higher than the national average and between 1985 and 2010, grows close to the rest of the country. On the contrary, Asturias shows a continuing decline in its growth in relation to the Spanish average. Finally, A Coruña, follows an oscillating very close to the Spanish average.

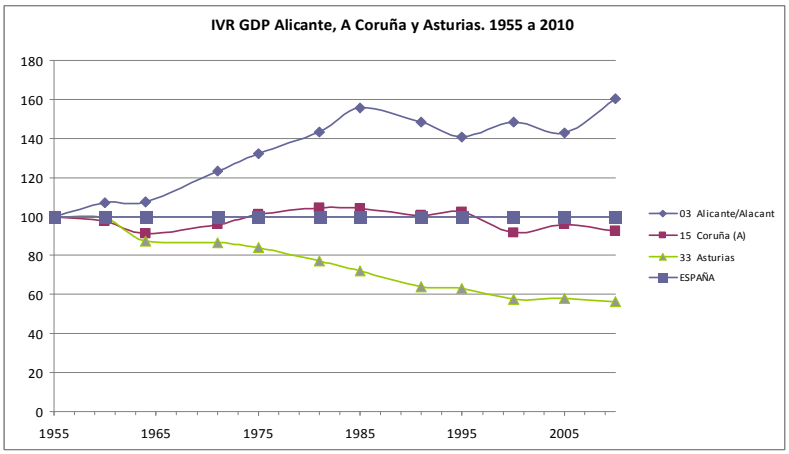

Figure 1.- Relative rates of change, **IVR**, of **GDP** in Alicante, Baleares, La Coruna and Asturias. 1955-2010.

4.3.- Evolution of the IVR of the Population and GDP of Spain.

The generalization of the analytical scheme which is presented is done by analyzing jointly the two variables **POB** and **GDP**, and for the whole of the Spanish economy. Since the "neutral" value of an is 100,-when it coincides with the evolution of the national set- we have taken the initial decision to to group the data from the two matrices **POB** and **GDP** by a double standard, according to the final value (for 2010) of the two **IVR** each sub-area is higher or lower than 100. This is a clearly methodological decision and aims to show that the search for typologies is developed initially by trial and error.

This approach generates a quadruple initial typology whose meaning is clear. If the values of the two **IVR** each sub-area are over 100 in 2010, we can say that these provinces are more dynamic than the rest and exceed the average growth of the country both in **POB** and **GDP**. Conversely, if both are less than 100, it may be suggested that these provinces have a slower and regressive evolution than the rest. If the **IVR** of the **POB** is higher than 100while the **IVR** of the **GDP** is less than 100, we can say that these provinces are being delayed from the rest, in economic terms. Finally, if the **IVR** of **GDP** is higher than 100, while the **IVR** of the **POB** is less than 100, these provinces can show significant economic dynamics. Using this criterion, the 50 Spanish provinces can be grouped on four "type areas". Table 4 shows the population, the total **GDP** and **GDP per capita** in current peseta search of the four type areas and the whole of Spain.

	AREAS TIPO B		AREAS TIPO A		AREAS TIPO C		AREAS TIPO D		ESPAÑA	
	1.955	2.010	1.955	2.010	1.955	2.010	1.955	2.010	1.955	2.010
GDP Mill. Ptas	5.443	2.078.996	137.105	70.991.849	134.888	41.588.534	141.371	35.753.007	418.807	150.412.386
POB Miles Hbs.	778	918	9.400	21.230	5.780	10.911	13.147	13.806	29.105	46.864
GDP PC Miles current Pesetas	7	2.265	15	3.344	23	3.812	11	2.590	14	3.210

Tabla 4.- **GDP, POB y POB PC**, of the four type areas and the whole of Spain. 1955 y 2010. Values in current pesetas.

Direct comparison of data of 1955 and 2010 show the difficulty of making comparisons between the monetary values of these two years. In current pesetas, **GDP per capita** in 2010 is 230 times higher than in 1955. Comparisons between thePIB of each of the 4 Area types does not directly provide relevant information. In contrast, **GDP per capita** allow to point to a certain convergence. In 1955, the richest type area was 3,5 times more than the poorest. In 2010 this ratio had fallen to 1.6. These observations underscore the desirability of seeking a complementary procedure for comparisons between variables. Table 5 shows the series of the **IVR** in each Type Area.

	Indices de Variación Relativos del **GDP** y de la **POB**.											
ÁREA TIPO A	1955	1960	1964	1971	1975	1981	1985	1991	1995	2000	2005	2010
IVR GDP A	100	103	111	121	124	132	134	136	137	144	142	147
IVR POB A	100	103	107	114	119	122	124	127	129	132	137	140
ÁREA TIPO B												
IVR GDP B	100	100	103	99	100	108	103	107	107	103	107	103
IVR POB B	100	95	90	81	77	75	76	77	78	75	73	73
ÁREA TIPO C												
IVR GDP C	100	100	92	84	79	77	78	75	77	72	73	70
IVR POB C	100	97	92	83	79	76	75	74	72	70	67	65
ÁREA TIPO D												
IVR PIB D	100	97	97	97	99	93	89	90	88	87	87	86
IVR GDP D	100	104	109	119	121	122	120	120	119	119	118	117

Table 5.- **IVR** of **GDP** and of **POB** for the four defined Type Areas.

The A area's **GDP IVR** indicates that between 1955 and 2010, the **GDP** of the area has increased by 47 percent more than the average growth of Spanish GDP in the period. In the same way, the **IVR GDP** of Area C assumes that this group of provinces has grown less than the Spanish GDP, namely 14%. This does not mean that this type area has been lowering its **GDP**. As noted above, the **IVR** does not take into account the absolute values of each sub-area or group of the same. Specifically, the Type C Area, which has grown below the Spanish average, shows the highest **GDP per capita** highest rate of the four areas in both 1955 and 2010. Its **GDP per capita** has grown more slowly than the Spanish side, but since their initial **GDP per capita** was very high in 2010 still shows the highest **GDP** in the country.

The **IVR** in Table 5 are shown in Figure 2. It is observed that the patterns of evolution of each type areas are clearly distinct. A Area Type evolves on a regular and growing both in **POB** and **GDP**. The population is 9.4 million inhabitants. in 1955 to 21,200 in 2010. PIB grows by 47% above the Spanish average. In the opposite direction, the D type area Population grows only absolute and relative terms, that is according to the **IVR**, the trend is 14% lower than the Spanish average.

B type areas include only three provinces with limited economic and demographic weight. But its existence suggests the variety of possible patterns that can exist in an economy, by contrast, C type area Area, finally, its PIB increases more relatively than its population.

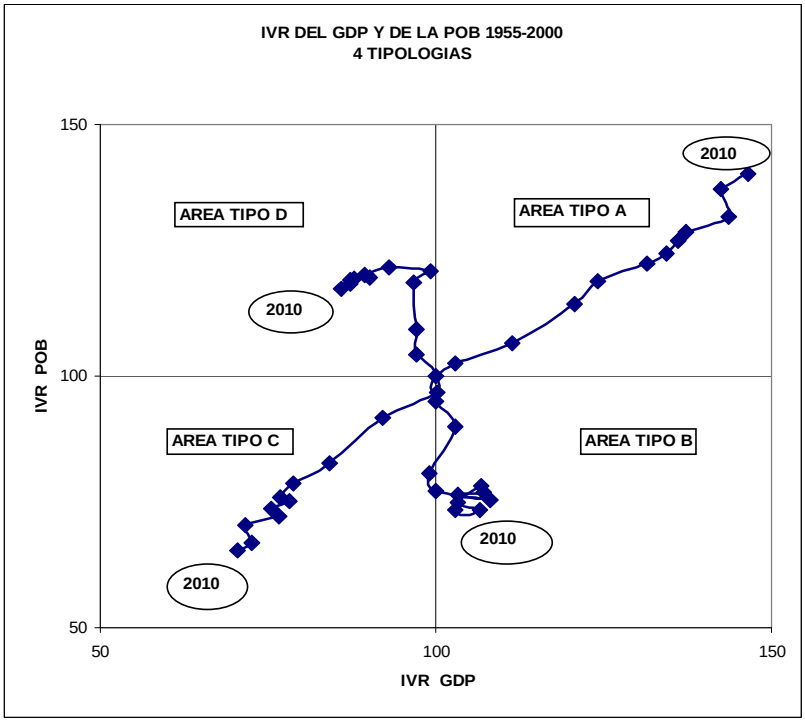

Figure 2.- Temporal evolution of the **GDP's IVR** and the **POB** in the Four Type Areas.

Figure 2 shows that the temporal evolution of the four **IVR** type areas seems to be due to some regular patterns. Because the study period is very long, 55 years, you can set the hypothesis that the co-evolution of **GDP** and **POB** in each Type Area (which involves the aggregation of many sub) occurs with some regularity. Direct examination of Figure 2 shows that the A Type Area provinces which could be described as the most prosperous and dynamic areas of the country, throughout the period grew faster than the rest, high above the national average. The other three Type Areas seem to follow a double pattern: until 1980-85 follow a regular path away from the national average. From those years, the pace of regressive evolution is reduced, as in area D, or it seems to stagnate, like B and C Type Areas. These early performances show the difficulty of defining patterns of evolution.

4.4.- Catalonia and Galicia.

Applying this model to regional scale provides information on the different patterns that can be found in two spatial areas, socially and economically homogeneous. We have chosen two Spanish regions with different economic and demographic situation: Catalonia and Galicia.

4.4.1.- Application to Catalonia

The patterns of evolution of the provinces of Catalonia are different, and in the case of Barcelona, complex. This province, whose demographic and economic dimension is far superior to the other three provinces in the region, shows an extraordinary population growth until 1975. From that year, the pace of

growth stabilizes (that is, matches the rest of the country). Its rate of economic growth, measured by the evolution of its **GDP**, is similar to the rest of the country even decreases slightly from 1980. The province of Lleida shows a slow demographic evolution, less than the general and a significant economic development until the eighties for subsequent show a reduction in its economic dynamism. Finally, the other two provinces, Girona and Tarragona show a dual pattern: until 1990 the evolution its **GDP** is significantly higher than the Spanish average, growing a difference every five years. At that time the population grows at rates slightly higher than the Spanish average. Since 1990, the pattern changes: holding constant the differential growth rate of **GDP** as it grows regularly growth rate **POB**. Note that in these four provinces, we can identify three different patterns none of which shows a "regularity" in its long-term.

CATALUNYA	1955	1960	1964	1971	1975	1081	1985	1991	1995	2000	2005	2010
17 Girona GDP	100	107	137	121	118	120	132	145	128	130	130	137
17 Girona POB	100	99	102	106	106	107	110	113	116	121	130	138
43 Tarragona GDP	100	106	101	105	119	118	128	131	132	134	134	135
43 Tarragona POB	100	97	99	104	108	110	110	112	116	120	130	139
08 Barcelona GDP	100	94	102	102	104	101	95	97	93	93	90	91
08 Barcelona POB	100	109	119	136	142	143	140	138	137	136	138	137
25 Lleida GDP	100	112	117	106	94	92	89	90	95	96	88	93
25 Lleida POB	100	97	95	90	86	83	81	79	79	79	80	83

Tabla 6.- IVR of GDP and POB of Catalonia

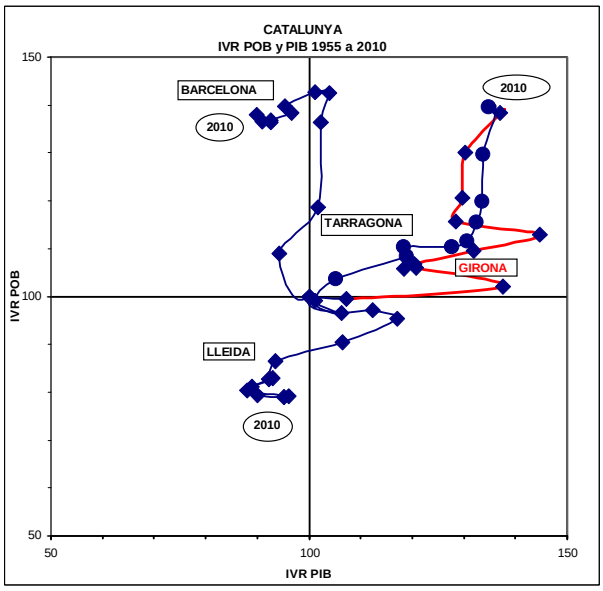

Figure 3.- **IVR** of **GDP** and **POB** of Catalonia

4.4.2.- Application to Galicia

The study of the Galicia region suggests the existence of other patterns of temporal evolution of the **POB** and **GDP**. Figure 4 suggests that two provinces, Lugo and Ourense, patterns of evolution are very similar: regular and systematic move away from the Spanish media, reaching values of their IVR very low, similar for the two provinces. A Coruña shows IVR almost always less than 100 and has a final status -2010 - below the Spanish average. Finally, Pontevedra maintains its GDP growth rates very close to the Spanish average, while its population is slightly lower pace.

GALICIA	1955	1960	1964	1971	1975	1081	1985	1991	1995	2000	2005	2010
36 Pontevedra GDP	100	99	105	103	108	117	113	115	104	104	104	101
36 Pontevedra POB	100	97	96	96	99	101	101	100	100	97	92	88
27 Lugo GDP	100	105	91	70	65	74	74	66	72	64	62	62
27 Lugo POB	100	93	85	71	67	63	62	60	56	53	48	44
32 Ourense GDP	100	98	100	81	83	79	78	80	77	69	73	64
32 Ourense POB	100	94	88	77	73	72	71	69	57	54	49	45
15 Coruña (A) GDP	100	98	91	96	101	105	104	101	102	92	96	93
15 Coruña (A)POB	100	98	95	88	87	87	87	86	84	82	77	73

Table 7.- **IVR** of **GDP** and **POB** of Galicia

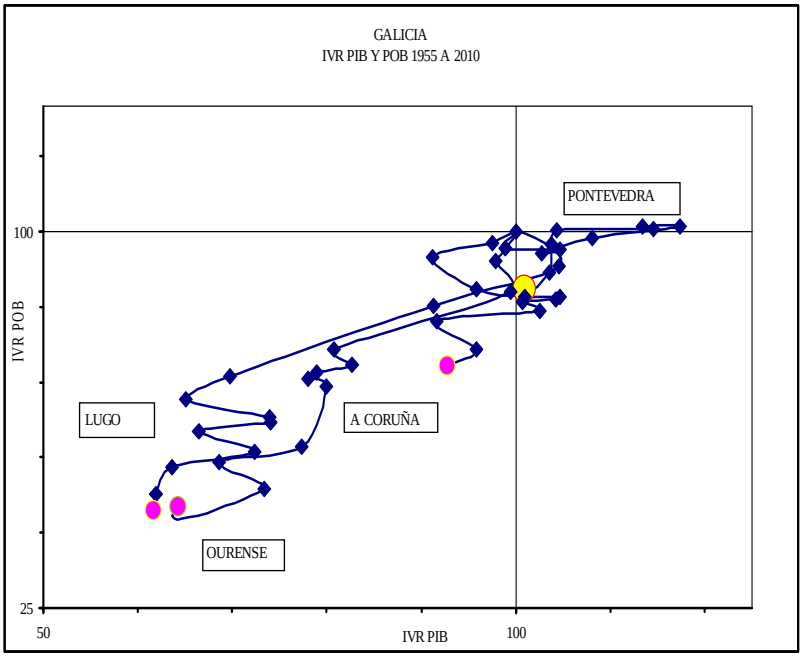

Figure 4.- **IVR** of **GDP** and **POB** of Galicia.

4.5.- Comparison of the 4 provinces

Finally, we present a visual comparison of the series of **IVR** in four provinces that in1955 had fewer than 400,000 inhabitants: Almería, Cuenca, Navarra and Vizcaya. The choice of these subareas was based

on the hypothesis that structural and geographical differences exist between them and that the common thread among them was its population size. Table 8 shows the series of IVR of the POB and GDP for the four provinces.

	1955	1960	1964	1971	1975	1981	1985	1991	1.995	2.000	2.005	2.010
04 Almería GDP	100	97	94	110	115	133	130	137	159	191	161	200
04 Almería POB	100	97	94	90	88	89	93	96	99	104	113	120
16 Cuenca GDP	100	89	82	67	60	51	55	52	56	52	52	50
16 Cuenca POB	100	93	82	64	56	51	50	47	46	44	42	41
31 Navarra GDP	100	96	103	99	95	91	91	96	106	108	105	106
31 Navarra POB	100	98	100	102	100	100	100	98	99	100	100	101
48 Vizcaya GDP	100	88	82	60	54	48	50	47	48	41	43	41
48 Vizcaya POB	100	110	121	140	144	142	138	134	130	126	116	111

Table 8.- **IVR** of the **POB** and **GDP** of Almería, Cuenca, Navarra and Vizcaya.

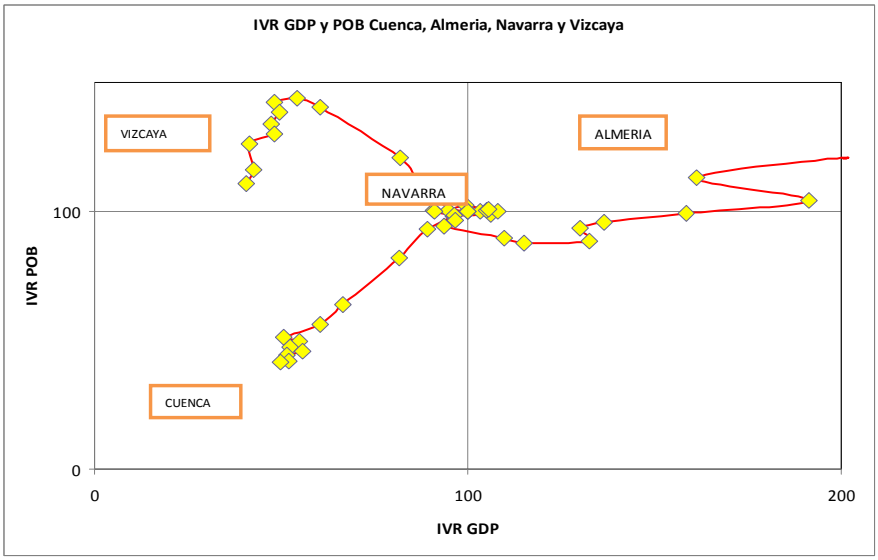

Figure 5.- **IVR** of **GDP** and **POB** of Almería, Cuenca, Navarra and Vizcaya.

Figure 5 shows four distinct patterns: Almería shows that its **GDP** grows at increasingly higher rates in relation to the Spanish average. Only from 2000 shows a population growth higher than the Spanish average. Contrary to this province, the Cuenca **IVR** is reduced to reach values close to 50. It shows a relative decline of the two variables: absolute depopulation and stagnation of **GDP**. Navarra shows an evolution almost exactly like the Spanish, in fact, the pattern of this province is not distinguished in the graphic, as their **IVR** are always very close to 100. Finally, Vizcaya shows paradoxical results. Their **IVR** suggest a strong **POB** growth and a reduction in GDP. In this case highlights one of the limitations of the model presented here, only takes into account the rates of change of variables and not the absolute initial. **GDP per capita** of Vizcaya was in 1955, twice the Spanish average. In 2010 its **GDP per capita** was only 30% higher than the national average.

4.6.- Summary of comparisons

As noted, the four analysis presented are intended to show, the complexity of the process of identifying patterns of evolution. The results show, sometimes slightly different results from those expected by convention, at least for those familiar with the Spanish economy. Thus, it is noteworthy that the provinces of Barcelona and Vizcaya show strong growth relative populations but not by GDP, which evolves in both provinces, below the Spanish average: Vizcaya below 25% and 9% Barcelona. The high level of its **GDP per capita** in 1955 -nearly double the Spanish average- has led to in 2010, this indicator remains above the Spanish average in both provinces. Another fact which is apparent in some provinces is that their evolution is not regular in the sense that there are strong changes in the trend of the **IVR**. Is the case of Tarragona, Girona and Almeria and Vizcaya. This suggests that as important as the trends are turning points that can be detected.

Finally, we note that some provinces shown in these four examples, closely held an evolution similar to the Spanish average. This is the case of Pontevedra and Navarra.

These four examples show the coexistence of different patterns of evolution. Due to in this paper we have used two specific variables, **POB** and **GDP** -the results that can be obtained using other variables may differ from those found here.

5.- Conclusions

The model proposed in this communication and its application to the Spanish economy highlights the diversity of evolutionary patterns found in the process of long-term economic growth of this economy. The four applications show that this diversity of patterns requires a framework to develop a rigorous and operational taxonomy with some general validity.

The proposed model is clearly descriptive and information produced from it in this communication does not identify the causes of this diversity of behavior of subareas of the country. Instead, it allows the development of hypotheses to help meet some of these causes. The test results presented here suggest some interesting questions: Why the different sub-areas of a country with a political, social and economic relatively homogeneous and, above all, common economic policies show a plurality of patterns of evolution economic and demographic? Why are different answers of different sub-areas to the same economic policies? Before attempting to answer these questions it seems necessary to fully exploit the information available on the performance of the selected variables and investigate whether these variables are adequate or is necessary to use other such as the Level of Education of the Hand Work or GDP by sector. Also, if the spatial units used, the provinces in the case presented here, are the relevant spatial units.

This work has attempted to reveal the existence of different patterns of economic developments in the various sub-areas integrated into a country. We have proposed a methodological framework based on analysis of indices of relative variation. This approach allows identifying different patterns of

evolution and suggests the existence of specific types. The application of methodological framework provides preliminary results in this direction while shows its limits by not taking into account the actual values of the variables, but only its dynamics.

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