Convergence across Spanish Provinces: Cross-section and Pairwise Evidence*

Don J. Webber[1], Paul White[2], Asier Minondo[3] and David O. Allen[4]

[1] *School of Economics, University of the West of England, Bristol, UK and Policy Research Institute, Leeds Metropolitan University, UK*

[2] *Faculty of Computing, Engineering and Mathematical Sciences, University of the West of England, Bristol, UK*

[3] *Faculty of Economic and Business Administration Sciences, Universidad de Deusto, San Sebastián, Spain*

[4] *School of Economics, University of the West of England, Bristol, UK*

Abstract

Distribution free statistics are employed to investigate biennial income per capita convergence across 52 Spanish provinces over the period 1955-1997. Based upon ideas of concordance and discordance that capture convergence and divergence properties, the paper presents results that suggest convergence is dominant for the full sample over the entire period, swings in this trend between convergence and divergence are present and switching in rank does take place. When provinces are analysed in pairs some show strong evidence of divergence.

JEL Classification: C14; F19

Keywords: Convergence; Concordance; Spanish provinces; Income per capita.

Corresponding Author: Don J. Webber, School of Economics, 'University of the West of England, Bristol', Frenchay Campus, Bristol, BS16 1QY, UK.
Tel.: (+44/0) 117 328 2741. Fax: (+44/0) 117 328 2295. E-mail: Don.Webber@uwe.ac.uk.

* The authors would like to thank Pino Arqueros for his helpful comments.

Convergence across Spanish Provinces: Cross-section and Pairwise Evidence

Abstract

Distribution free statistics are employed to investigate biennial income per capita convergence across 52 Spanish provinces over the period 1955-1997. Based upon ideas of concordance and discordance that capture convergence and divergence properties, the paper presents results that suggest convergence is dominant for the full sample over the entire period, swings in this trend between convergence and divergence are present and switching in rank does take place. When provinces are analysed in pairs some show strong evidence of divergence.

JEL Classification: C14; F19

Keywords: Convergence; Concordance; Spanish provinces; Income per capita.

1. Introduction

Neo-classical growth theory suggests an inverse relation across economies between the capital-labour ratio and the productivity of capital. Generated by movements in the wage rate, the Solow-Swan model of economic growth suggests that income per capita will convergence due to differences in the rates of return to capital where capital will move from economies with lower rates of return to those with higher rates of return. This leads to the proposition that poor economies should grow faster than rich economies. For example, within Spain, poorer provinces that have lower capital-labour ratios should attract and accumulate capital faster than richer provinces.

The purposes of this paper are, first, to employ the convergence method first used by Webber and White (2003) to identify whether convergence has occurred across the Spanish provinces and, second, to identify whether there are movements within the sample that are atypical of normally assumed whole sample investigations. More specifically, the investigation seeks to identify the pattern of convergence, whether there is persistence in the relative position of Spanish provinces and whether certain Spanish provinces are behaving differently. Our results suggest support for the proposition that convergence has occurred across Spanish provinces, but swings in this trend between convergence and divergence are present thereby lending support for Dolado *et al*. (1994), Mas *et al*. (1994) and María Dolores and García Solanes (2001). However, our results also suggest that switching in rank does take place, somewhat contrary to Gardeazábal (1996), Quilis (1997) and Villaverde and Sánchez-Robles (2001) and that when Spanish provinces are analysed in pairs some appear to have diverged.

The remainder of the paper is structured as follows. The next section briefly reviews traditional measures of convergence and highlights some deficiencies in either estimation procedures or their usefulness in identifying complex evolutionary dynamics. Section 3 then introduces measures of concordance and discordance introduced by Webber and White (2003), which can be applied to a sample in order to identify convergence and other evolutionary properties such as switching and persistence. A description of the data set is presented in Section 4. Section 5 details and discusses the results while Section 6 presents some conclusions.

2. A Review of the Literature

Romer (1986) and Lucas (1988) realised that the rate of growth of an economy might be an endogenous phenomenon, where spillovers in capital and/or human capital create indefinite growth. If skilled labour is complementary to capital (Wood, 1994) then economies with either an abundance of capital or skilled labour will possess non-convergent growth rates to their hypothetical steady state. Combining elements of 'endogenous' and neo-classical 'exogenous' growth theories leads to the theoretical possibility of convergence, divergence and many other churning distributional characteristics, including erratic dynamics.

Convergence might not always be present. Caplan (2003) explains why the convergence hypothesis fails even though good economic policies seem to be a sufficient condition for strong economic growth: divergence may reflect the effects of powerful but temporary national economic shocks, sometimes attributable to energy or agriculture, which affect regions differently. Endogenous growth could also result in divergence due to the presence of 'superstar' economies linked to growth poles or geographically-reliant sector and skill-biased technical change. The presence of transportation costs and associated iceberg effects can constrain spatial competition and create an uneven spatial distribution of output.

The increasing interest on growth empirics over the last decade has fostered analyses on the dynamics of inter-provincial growth rates. For Spain, a first strand of research tests whether there has been convergence among Spanish provinces since the second half of the 20th Century (Dolado *et al*., 1994; Mas *et al*., 1994; María Dolores and García Solanes, 2001). These studies conclude that Spanish provinces have experienced absolute convergence with a speed varying from 1.8% to 2.5% per annum. The analysis of absolute convergence has been combined with the analysis of the so-called sigma-convergence that shows whether there has been a reduction in the standard deviation of income per capita among provinces. These studies highlight that the convergence process that took place ended at the beginning of the 1980s and has stagnated thereafter.

One reason for a lack of convergence across Spanish provinces could be terrorism. Firms might move away from the major areas of Madrid, Barcelona and the Basque country because of the risk of terrorist attack. These firms might move towards the south of the country, thereby increasing output there and lowering average per capita output in Madrid and Barcelona. Terrorism has been identified as affecting the rate of growth in the Basque Country and, according to recent studies (Abadie and Gardeazabal, 2003; Myro *et al*., 2004), the Basque Country's GDP per capita would be between 8% and 9% higher if there was no terrorism present. However, terrorism has not be identified as directly affecting GDP per capita in either in Madrid or in Barcelona. Villaverde and Sánchez-Robles (2001) find that the richest Spanish provinces are increasingly located in the Northeast of the country and that their industrial sector plays an important role in provinces' performance.[1]

A second strand of studies has used a more complex analysis tool to analyse the dynamics of the convergence process and is commonly employed in the investigation of

[1] These results for Spain are similar to studies on other countries. For instance, Easterlin (1960) found inter-regional per capita incomes display a general tendency toward convergence. After decades of apparent convergence up to and throughout the 1970s (Treyz, 1991), US State level income per capita appears to have diverged sharply in the 1970s and late 1980s (Coughlin and Mandelbaum, 1988; Bishop *et al*., 1994).

convergence 'clubs', where economies' income per capita is converging towards each another (Baumol, 1986; Quah, 1996). For Spain this has been done by Gardeazábal (1996), Quilis (1997) and Villaverde and Sánchez-Robles (2001) and they conclude that the convergence dynamics in Spanish provinces does not show convergence clubs and there is a large persistence in the relative position of Spanish provinces.

3. Measures Based on Concordance

Convergence can occur across the whole sample or between individual or groups of observations. This section details the work of Webber and White (2003); it first deals with the possibility of whole sample convergence and then continues to discuss the possibility of convergence between pairs of provinces over time.

Whole Sample Convergence

Let $s_{i,t}$ be a general proxy for income per capita in province *i* at time *t*. For provinces *i* and *j* each at time periods *t* and *t* + *k* define:

$$L_{1,i,j,t,t+k} = \begin{cases} +1 & \text{if} \quad |s_{i,t} - s_{j,t}| \rangle |s_{i,t+k} - s_{j,t+k}| \\ -1 & \text{if} \quad |s_{i,t} - s_{j,t}| \langle |s_{i,t+k} - s_{j,t+k}| \\ 0 & \text{Otherwise} \end{cases} \tag{2}$$

In other words, $L_{1,i,j,t,t+k}$ has the value +1 if and only if the absolute difference in the proxy for income per capita for Spanish provinces *i* and *j* has decreased between time period *t* and *t+k*. This measure of concordance may be viewed as one way of characterising income per capita convergence. Likewise $L_{1,i,j,t,t+k}$ has the value -1 if and only if the absolute difference in income per capita for provinces *i* and *j* has increased between time period *t* and *t+k*. This measure of discordance may be viewed as one way of characterising income per capita divergence.

In a data set of *n* provinces there are *n(n-1)/2* possible ways of selecting two Spanish provinces and hence a proposed measure of income per capita convergence and divergence between time periods *t* and *t+k* is:

$$C_{1,t,t+k} = \frac{2\sum_{i=1}^{n}\sum_{j=i+1}^{n} L_{1,i,j,t,t+k}}{n(n-1)} \tag{3}$$

$C_{1,t,t+k}$ is a simple index for measuring the relative frequency of concordant pairs of observations against the relative frequency of discordant pairs of observations. Clearly, $-1 \le C_{1,t,t+k} \le +1$, with the extreme values of ±1 being obtained whenever all possible absolute differences in income per capita are either concordant or discordant. A value for $C_{1,t,t+k}$ equal to zero is consistent with an equiprobable outcome of randomly selecting two provinces and discovering either convergence or divergence in the absolute differences in income per capita over two time periods.

Absolute differences in income per capita is only one way of characterising income per capita convergence and divergence. An alternative approach is to consider the ratio of income per capita over two time periods. In particular for two Spanish provinces *i* and *j* each at two time periods *t* and *t+k* define:

$$L_{2,i,j,t,t+k} = \begin{cases} +1 & \text{if} \quad \dfrac{\max\{s_{i,t}, s_{j,t}\}}{\min\{s_{i,t}, s_{j,t}\}} \rangle \dfrac{\max\{s_{i,t+k}, s_{j,t+k}\}}{\min\{s_{i,t+k}, s_{j,t+k}\}} \\ -1 & \text{if} \quad \dfrac{\max\{s_{i,t}, s_{j,t}\}}{\min\{s_{i,t}, s_{j,t}\}} \langle \dfrac{\max\{s_{i,t+k}, s_{j,t+k}\}}{\min\{s_{i,t+k}, s_{j,t+k}\}} \\ 0 & \quad\ \text{otherwise} \end{cases} \tag{4}$$

Since there are *n(n-1)/2* possible ways of selecting two provinces from *n* provinces then an intuitively appealing statistic to measure income per capita convergence (divergence) based upon the concordance indicator $L_{2,i,j,t,t+k}$ is $C_{2,t,t+k}$ defined by:

$$C_{2,t,t+k} = \frac{2\sum_{i=1}^{n}\sum_{j=i+1}^{n} L_{2,i,j,t,t+k}}{n(n-1)} \tag{5}$$

$C_{2,t,t+k}$ is an index for measuring the relative frequency of convergence in the ratio of income per capita against the relative frequency of divergence in the ratio of income per capita over time period *t* and *t+k*. Clearly, $-1 \le C_{2,t,t+k} \le +1$, with the extreme values of ±1 being obtained whenever all possible ratios in income per capita are either concordant or discordant. A value for $C_{2,t,t+k}$ equal to zero is consistent with an equiprobable outcome of randomly selecting two provinces and discovering either income per capita convergence or divergence in the ratio of income per capita.

The measures $C_{1,t,t+k}$ and $C_{2,t,t+k}$ do not consider the form of convergence. In particular they do not consider whether there is persistence (meaning that provinces retain their rank order positions over time) or consider whether there is switching (meaning that the provinces successively alter their rank positions over time). Measures of concordance and discordance may readily be formed to consider these possibilities. In particular measures based upon the difference in income per capita and the ratio in income per capita may be considered. For the differences in income per capita assume without any loss of generality that $s_{i,t} \rangle s_{j,t}$ and let:

$$L_{3,i,j,t,t+k} = \begin{cases} +1 & \text{if} \quad (s_{i,t} - s_{j,t}) \rangle (s_{i,t+k} - s_{j,t+k}) \rangle 0 \\ -1 & \text{otherwise} \end{cases} \tag{6}$$

and define:

$$C_{3,t,t+k} = \frac{2\sum_{i=1}^{n}\sum_{j=i+1}^{n} L_{3,i,j,t,t+k}}{n(n-1)} \tag{7}$$

Clearly $-1 \leq C_{3,t,t+k} \leq C_{1,t,t+k} \leq +1$ and $C_{3,t,t+k}$ will attain its upper bound of +1 if and only if there is convergence in absolute differences in income per capita without switching. More generally positive values of $C_{3,t,t+k}$ indicate a convergence in income per capita differences without switching.

Similarly consider if income per capita convergence is to be based upon the ratio of income per capita. If this is the case then without any loss of generality assume that $s_{i,t} / s_{j,t} > 1$ and let:

$$L_{4,i,j,t,t+k} = \begin{cases} +1 & \text{if} \quad s_{i,t} / s_{j,t} \rangle s_{i,t+k} / s_{j,t+k} \rangle 1 \\ -1 & \text{otherwise} \end{cases} \tag{8}$$

and define:

$$C_{4,t,t+k} = \frac{2\sum_{i=1}^{n}\sum_{j=i+1}^{n} L_{4,i,j,t,t+k}}{n(n-1)} \tag{9}$$

Then, $-1 \leq C_{4,t,t+k} \leq C_{2,t,t+k} \leq +1$ and $C_{4,t,t+k}$ will attain its upper bound of +1 if and only if there is income per capita convergence in the ratio of income per capita without switching. More generally positive values of $C_{4,t,t+k}$ indicate income per capita convergence in the ratio of income per capita without switching.

The statistics presented above are intended to capture convergence but do not necessarily require conflation. A logarithmic transformation provides the essential link between $C_{1,t,t+k}$ and $C_{2,t,t+k}$ and between $C_{3,t,t+k}$ and $C_{4,t,t+k}$ but for development purposes it is convenient to consider the statistics as given so as to clarify whether convergence in differences or convergence in ratios is being discussed for any given metric. Rather than consider states *i* and *j* the statistics $C_{1,t,t+k}$ and $C_{2,t,t+k}$ may be evaluated using the *i*-th and *j*-th percentile of distributions indexed by *t* and *t+k*. Using percentile data permits a direct investigation into convergence of distribution whereas using province data permits an investigation focussing on convergence of the entities that comprise the distribution.

Pairwise Convergence

A different way of looking at the data is to consider whether Spanish provinces are converging with each other over time. Using this type of analysis we can identify whether the ratio of the difference in income per capita is increasing or decreasing over time. To identify whether this is the case with two provinces *i* and *j* each at two time periods *t* and *t+k* define:

$$M_{1,i,j,t,t+k} = \begin{cases} +1 & \text{if} \quad \frac{\max\{s_{i,t}, s_{j,t}\}}{\min\{s_{i,t}, s_{j,t}\}} \rangle \frac{\max\{s_{i,t+k}, s_{j,t+k}\}}{\min\{s_{i,t+k}, s_{j,t+k}\}} \\ -1 & \text{if} \quad \frac{\max\{s_{i,t}, s_{j,t}\}}{\min\{s_{i,t}, s_{j,t}\}} \langle \frac{\max\{s_{i,t+k}, s_{j,t+k}\}}{\min\{s_{i,t+k}, s_{j,t+k}\}} \\ 0 & \text{otherwise} \end{cases} \tag{10}$$

Since there are *K(K-1)/2* possible time periods to be compared then an intuitively appealing statistic to measure income per capita convergence (divergence) based upon the concordance indicator $M_{1,i,j,t,t+k}$ is $D_{1,i,j,t,t+k}$ defined by:

$$D_{1,i,j,t,t+k} = \frac{2\sum_{t=1}^{k-1}\sum_{k=t+1}^{K} M_{1,i,j,t,t+k}}{K(K-1)} \tag{11}$$

$D_{1,i,j,t,t+k}$ is an index for measuring the relative frequency of convergence in the ratio of income per capita against the relative frequency of divergence in the ratio of income per capita over time between province *i* and *j*. Clearly, $-1 \leq D_{1,i,j,t,t+k} \leq +1$, with the extreme values of ±1 being obtained whenever all possible ratios in income per capita between two provinces are either concordant or discordant. A value for $D_{1,i,j,t,t+k}$ equal to zero is consistent with an equiprobable outcome of randomly selecting two provinces and discovering either income per capita convergence or income per capita divergence in the ratio of income per capita.

4. Spanish Provincial Income Per Capita

Let $y_{i,t}$ denote the income per capita for province *i* at time period *t*, (*i* = 1, …, 52; *t* = 1955, 1957, …, 1997). The statistics $C_{1,t,t+k}$ $C_{2,t,t+k}$ $C_{3,t,t+k}$ and $C_{4,t,t+k}$ using measures of concordance could be based upon income per capita $y_{i,t}$ or upon transformations of these values such as relative provincial level income per capita $r_{i,t}$ defined by:

$$r_{i,t} = \frac{y_{i,t} - \bar{y}_t}{\bar{y}_t} \tag{12}$$

i.e. $r_{i,t}$ is the relative position of province *i* from the mean at time *t*. In what follows the data for Spanish provincial level income per capita at market prices[2] are analysed using the proposed statistics. It should be borne in mind that the proposed statistics could be based upon absolute income per capita $y_{i,t}$ or relative income per capita $r_{i,t}$ or other transformations of Spanish provincial level income per capita. For brevity of exposition attention is restricted to $y_{i,t}$ and $r_{i,t}$ and a selection of the proposed statistics are reported for selected time periods.

[2] This is the sum of value-added at market prices plus taxes linked to production minus subsidies to production plus indirect taxes on production, imports and consumption net of subsidies in 1986 constant prices in millions of pesetas. Data from 1994 onwards are forecasts. Source: Fundación BBV (1999)

5. Results

Sample Convergence/Divergence

Basic statistics of the maximum, minimum, median and upper and lower quartiles are presented in Figure 1. It appears that there is not much occurring except for the decrease over time at the maximum. A second way of looking at the data is to plot the ratio of rewards of two provinces at one time point (say $\max\{y_{i,t}, y_{j,t}\}/\min\{y_{i,t}, y_{j,t}\}$) against their corresponding ratio at another time point (say $\max\{y_{i,t+k}, y_{j,t+k}\}/\min\{y_{i,t+k}, y_{j,t+k}\}$). A point on the line Y=X would indicate no change in the ratio of rewards for the two provinces whereas a point above the line Y=X would indicate the two provinces had diverged in their ratio of rewards and a point above the line Y=X would indicate the two provinces had converged in their ratio of rewards. Figure 2 is a plot of the ratio of rewards for all pairs of provinces for the time periods 1955 and 1997. The preponderance of points beneath the line Y=X in Figure 2 indicate the general tendency of province convergence between these two points in time using this measure.

{Figure 1 about here}

{Figure 2 about here}

Inspection of Tables 1 and 2 suggests that there has been convergence across the whole sample of 52 Spanish provinces between 1957 and 1997. Table 1 presents the results based on relative rewards. From column '1997', which presents the results of long run convergence analysis relative to 1997, it appears that the longer the time period then the stronger the convergence. This decreases with shorter periods of time leading up to the period 1995-1997. The highest values presented in Table 1 correspond to the 1960s and 1970s, indicating that sample convergence was most frequent over this period.

{Table 1 about here}

{Table 2 about here}

However, there also appear to be a greater presence of convergence leading up to 1997 starting from 1985. This coincides with the integration of Spain into the EU. Spates of divergence also occurred in the late 1950s and early 1960s and the very late 1970s and the early to mid 1980s. However, this divergence is very small, with the greatest coefficient of 0.131 for 1985-1987. Although there has been relatively slow convergence when compared to the earlier periods, the 1980s and 1990s do exhibit convergence, albeit with small periods of divergence, contrary to the evidence provided by Dolado *et al*. (1994), Mas *et al*. (1994) and María Dolores and García Solanes (2001).

Table 2, which presents the results based on absolute rewards, supports the results presented in Table 1. Again, convergence appeared to be a frequent observation over the entire time period with bouts of divergence occurring in the late 1950s to early 1960s and again in the late 1970s and into the 1980s. Convergence was again relatively strong between 1987 and 1997. Apart from the different results for the 1990s, our results are in line with those obtained in previous studies that have analysed, based on the more traditional Beta and Sigma convergence, the evolution of income disparities among Spanish provinces (Dolado et al., 1994; Mas et al., 1994; Villaverde and Sánchez Robles, 2001; Dolores and García Solanes, 2001).

However, $C_{1,t,t+k}$ and $C_{2,t,t+k}$ do not consider the form of convergence. In particular they do not consider whether there is persistence (meaning that the Spanish provinces retain their rank order over time) or whether there is switching (meaning that the provinces successively alter their rank positions over time). Recall from Section 3 that $-1 \leq C_{3,t,t+k} \leq C_{1,t,t+k} \leq +1$ and $C_{3,t,t+k}$ will attain its upper bound of +1 if and only if there is convergence in absolute differences in the proxy for income per capita without switching. More generally positive values of $C_{3,t,t+k}$ indicate a convergence in income per capita differences without switching whereas $C_{1,t,t+k}$ and $C_{2,t,t+k}$ indicate convergence irrespective of whether or not Spanish provinces switch their rank positions.

There is some similarity between Tables 1 and 2 and Table 3. Evidence given in Table 3 using $r_{i,t}$ is supported by $C_{4,t,t+k}$ in which is based on $y_{i,t}$ (see Table 4). Divergence is found to have occurred in the same periods of time, irrespective of switching. However, there are sizeable differences in the respective values in many cases, and this indicates a high level of switching. If we consider Tables 1 – 4 together, the results indicate that although convergence was dominant there was switching in rank, suggesting overtaking and differences in the evolutionary properties of income per capita across provinces.

{Table 3 about here}

{Table 4 about here}

This could be attributable to a number of contributory factors including differences and changes in regional industrial structures of each provinces economy (Kim, 1998) or different levels of public spending in each province, both of which might be related to the growth of tourism in the coastal provinces. In the next sub-section we examine in more depth provinces which exhibit evolutionary characteristics that differ from the norm.

Pairwise Convergence/Divergence

An alternative way of analysing the data is to identify whether individual provinces are converging with each other over time. Using the $D_{1,i,j}$ index we can identify whether the ratio in income per capita is increasing or decreasing over time. A value for $D_{1,t,t+k}$ equal to zero is consistent with an equiprobable outcome of randomly selecting two provinces and discovering either income per capita convergence or income per capita divergence in the ratio of income per capita.

Given that there are 1,326 possible ways of grouping two Spanish provinces in our sample together, it would be advantageous to provide a brief summary of the results and then to analyse some interesting characteristics. These results can be summarised as follows: of our estimates of the 1,326 pairwise relationships, 396 diverged and 930 converged. Focusing on the divergent pairs, Table 5 presents the number of Spanish provinces that each Spanish province is diverging away from.

{Table 5 about here}

The first thing of note is that Madrid and Barcelona are not strongly diverging away from the rest of the Spanish provinces (0 and 3 respectively), neither are the Basque Country areas of Guipűzcoa (4) and Vizcaya (4). Several provinces do appear to be diverging from the rest; these include Badajoz (20), Burgos (22), Cadiz (27), Cordoba (26), Granada (28), Guadalajara (30), Leon (20), Malaga (22), Palencia (21), La Rioja (23), Salamanca (20), Sevilla (28), Teruel (26) and Cuenta (20).

Figure 3 to 14 shows a selection of Spanish provinces detailed above as being different from the rest of the sample. Barcelona, Guipűzcoa, Madrid and Vizcaya do appear to be converging downwards towards the sample mean, while Guadalajara and Teruel appear to be growing towards the sample mean.

{Figures 3 to 14 about here}

6. Conclusion

This paper presents an investigation in to the evolutionary properties of income per capita across Spanish provinces between 1957 and 1997. Although the evolutionary property of convergence was at the core of this investigation, other evolutionary properties of switching, persistence and stratification were also deemed to be important. To identify whether these evolutionary properties exist in the data set the method presented by Webber and White (2003) was employed which is based on the ideas of concordance and discordance. These measures do not suffer from the common identification of a rate of convergence of 2%, irrespective of the variables and units involved. Moreover, the statistics proposed do detect small changes in distributions over time which structural models may not readily detect.

The results suggest that convergence did occur for the whole sample over time and that, contrary to some other literature, this process did not come to an end at the end of the 1980s. When provinces are analysed in pair there is evidence that a selection of regions are diverging from the sample mean and that the richer provinces of Madrid and Barcelona are not diverging away from the whole sample. Further research is recommended here, as it is uncertain whether the government's redistributive policies, technological transfer, transportation improvements or migration is driving these results.

Our results are important in that they represent the first detailed evidence on the evolution of Spanish provincial income per capita to identify a variety of transitional dynamic properties.

References

Abadie, A. and Gardeazabal, J. (2003). "The economic cost of conflict: a case study of the Basque Country", American Economic Review, 93 (1).

Baumol, William. 1986. "Productivity Growth, Convergence and Welfare", *American Economic Review*, 76, 1072-1085

Bishop, J. A., Formby, J. P. and Thistle, P. D. 1994. "Convergence and Divergence of Regional Income Distribution and Welfare", *Review of Economics and Statistics*, 228-235

Caplan, B. (2003) "The Idea Trap: The Political Economy of Growth Divergence", European Journal of Policical Economy, 19, 183-203

Coughlin, C. C. and Mandelbaum, T. B. 1988. "Why have State per capita Incomes Diverged Recently?", *Federal Reserve Bank of St. Louis Review*, September/October, 24-36

Dolado, J., González Páramo, J. M. and Roldán, J. M. (1994). "Convergencia Económica entre las Provincias Españolas", *Moneda y Crédito* 198, 81-118.

Easterlin, R. 1960. "Interregional Differences in per capita Income, Population and Total Income, 1840-1950". In: *Trends in the American Economy in the Nineteenth Century* (NBER Research, Princeton University Press, New York)

Fundación BBV (1999). "Renta Nacional de España y su Distribución Provincial. Serie Homogénea. Años 1955 a 1993 y Avances 1994 a 1997. Tomo II", Fundación BBV, Bilbao.

Gardeazábal, J. (1996). "Provincial Income Distribution Dynamics: Spain 1967-1991", *Investigaciones Económicas* **XX**, 263-269.

Gorostiaga, A. (1999). "¿Cómo afectan el Capital Público y el Capital Humano al Crecimiento?: Un Análisis para las Regiones Españolas en el Marco Neoclásico", *Investigaciones Económicas* **XXIII**, 95-114.

Kim, S. 1998. "Regions, Resource and Economic Geography: The Sources of US Regional Comparative Advantage, 1880-1987", *Regional Science and Urban Economics*, 29, 1-32

Lamo, A. (2000). "On Convergence Empirics: Some Evidence on Spanish Regions", *Investigaciones Económicas* **XXIV**, 681-707.

Lucas, Robert. 1988. "On the Mechanics of Development Planning", *Journal of Monetary Economics* 22, 3-42

María-Dolores, R. and García Solanes, J. (2001). "Convergencia Real en Regiones Españolas: Un análisis del Impacto de los Fondos Estructurales", *Working Paper 1-2001*, Universidad de Murcia.

Mas, M., Maudos, J., Pérez, F. and Uriel, E. (1994). "Disparidades Regionales y Convergencia en las Comunidades Autónomas". *Revista de Economía Aplicada* **2**(4), 129-148.

Myro, R., Colino, A. and Pérez, P. (2004). "Crecimiento económico y conflicto social en el País Vasco", in Buesa, M. (dirección) *Economía de la Secesión. El Proyecto Nacionalista y el País Vasco*, Instituto de Estudios Fiscales, Madrid.

Quah. D. T. (1996). "Empirics for Economic Growth and Convergence", *European Economic Review* **40**, 1353-75.

Quilis, E. M. (1997). "Convergencia de la Productividad en España. Un Análisis Dinámico en su Distribución Regional", manuscript, Instituto Nacional de Estadística, Madrid.

Romer, Paul. 1986. "Increasing Returns and Long-Run Growth", *Journal of Political Economic*, 98, S71-S102

Treyz, G. I. 1991. "Causes of Changes in Wage Variation among States", *Journal of Urban Economics*, 29, 50-62

Villaverde, J. and Sánchez-Robles, B. (2001). "Convergence or Twin Peaks? The Spanish Case", manuscript, Universidad de Cantabria.

Webber, Don J. and White, Paul (2003) "Regional Factor Price Convergence across Four Major European Countries", ***Regional Studies*** 37(8), 773-782

Wood, A. (1994) "Give Heckscher-Ohlin a Chance!", *Weltwirtschlaftliches Archiv*

Table 1: $C_{1,t,t+k}$ Based Upon Relative Rewards $r_{i,t}$ Biennially for 1955 – 1997 (3 d.p.)

	1957	**1959**	**1961**	**1963**	**1965**	**1967**	**1969**	**1971**	**1973**	**1975**	**1977**	**1979**	**1981**	**1983**	**1985**	**1987**	**1989**	**1991**	**1993**	**1995**	**1997**
1955	0.181	0.116	0.086	0.071	0.116	0.152	0.205	0.235	0.293	0.253	0.311	0.321	0.302	0.276	0.296	0.285	0.311	0.333	0.347	0.312	0.361
1957	-	0.051	0.030	0.062	0.110	0.124	0.180	0.216	0.279	0.234	0.299	0.317	0.291	0.285	0.297	0.293	0.299	0.344	0.371	0.317	0.371
1959	-	-	**-0.071**	0.024	0.085	0.116	0.167	0.238	0.302	0.234	0.320	0.344	0.294	0.300	0.324	0.299	0.330	0.379	0.400	0.338	0.395
1961	-	-	-	0.118	0.183	0.234	0.261	0.302	0.379	0.314	0.367	0.380	0.367	0.367	0.382	0.365	0.376	0.412	0.425	0.359	0.406
1963	-	-	-	-	0.282	0.272	0.314	0.341	0.398	0.333	0.397	0.391	0.374	0.371	0.391	0.370	0.368	0.427	0.437	0.380	0.415
1965	-	-	-	-	-	0.244	0.311	0.338	0.376	0.312	0.379	0.380	0.354	0.347	0.370	0.336	0.344	0.401	0.407	0.361	0.401
1967	-	-	-	-	-	-	0.269	0.329	0.379	0.342	0.398	0.383	0.356	0.341	0.373	0.324	0.341	0.389	0.403	0.342	0.386
1969	-	-	-	-	-	-	-	0.308	0.403	0.309	0.376	0.344	0.350	0.342	0.350	0.315	0.317	0.368	0.367	0.306	0.356
1971	-	-	-	-	-	-	-	-	0.326	0.136	0.279	0.305	0.314	0.270	0.299	0.252	0.249	0.305	0.332	0.259	0.327
1973	-	-	-	-	-	-	-	-	-	**-0.124**	0.152	0.201	0.175	0.178	0.178	0.139	0.155	0.229	0.243	0.190	0.269
1975	-	-	-	-	-	-	-	-	-	-	0.415	0.327	0.234	0.219	0.238	0.211	0.196	0.282	0.291	0.217	0.311
1977	-	-	-	-	-	-	-	-	-	-	-	0.154	0.091	0.081	0.136	0.078	0.078	0.170	0.192	0.121	0.226
1979	-	-	-	-	-	-	-	-	-	-	-	-	**-0.077**	0.014	0.074	0.011	0.005	0.121	0.154	0.051	0.172
1981	-	-	-	-	-	-	-	-	-	-	-	-	-	0.072	0.128	0.071	0.098	0.175	0.204	0.097	0.177
1983	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.118	0.041	0.107	0.170	0.189	0.077	0.164
1985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-0.009**	0.059	0.139	0.145	**-0.011**	0.125
1987	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.167	0.181	0.223	0.044	0.169
1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.196	0.249	0.038	0.189
1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.175	**-0.089**	0.125
1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-0.350**	0.032
1995	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.364

Table 2: $C_{2,t,t+k}$ Based Upon Provincial Rewards $y_{i,t}$ Biennially for 1955 – 1997 (3 d.p.)

	1957	**1959**	**1961**	**1963**	**1965**	**1967**	**1969**	**1971**	**1973**	**1975**	**1977**	**1979**	**1981**	**1983**	**1985**	**1987**	**1989**	**1991**	**1993**	**1995**	**1997**
1955	0.211	0.196	0.131	0.145	0.193	0.238	0.282	0.311	0.361	0.312	0.364	0.383	0.379	0.383	0.388	0.362	0.359	0.391	0.389	0.379	0.410
1957	-	0.089	0.005	0.068	0.133	0.193	0.247	0.291	0.344	0.279	0.344	0.376	0.379	0.344	0.361	0.342	0.354	0.385	0.401	0.361	0.407
1959	-	-	**-0.133**	-0.002	0.086	0.167	0.217	0.282	0.350	0.282	0.356	0.379	0.361	0.367	0.383	0.356	0.373	0.409	0.428	0.389	0.424
1961	-	-	-	0.142	0.205	0.275	0.303	0.368	0.403	0.344	0.391	0.419	0.419	0.404	0.415	0.398	0.406	0.434	0.440	0.395	0.428
1963	-	-	-	-	0.272	0.318	0.365	0.397	0.434	0.356	0.412	0.433	0.421	0.428	0.450	0.403	0.407	0.436	0.460	0.401	0.436
1965	-	-	-	-	-	0.275	0.345	0.394	0.409	0.329	0.395	0.425	0.395	0.391	0.419	0.389	0.380	0.421	0.439	0.389	0.425
1967	-	-	-	-	-	-	0.294	0.367	0.398	0.327	0.406	0.415	0.398	0.385	0.404	0.367	0.374	0.412	0.427	0.373	0.425
1969	-	-	-	-	-	-	-	0.323	0.400	0.276	0.382	0.391	0.373	0.386	0.394	0.353	0.350	0.400	0.403	0.324	0.386
1971	-	-	-	-	-	-	-	-	0.302	0.101	0.293	0.327	0.312	0.294	0.339	0.297	0.308	0.336	0.351	0.282	0.338
1973	-	-	-	-	-	-	-	-	-	**-0.142**	0.172	0.235	0.161	0.180	0.205	0.196	0.219	0.264	0.267	0.207	0.275
1975	-	-	-	-	-	-	-	-	-	-	0.428	0.373	0.261	0.256	0.287	0.267	0.256	0.330	0.324	0.234	0.324
1977	-	-	-	-	-	-	-	-	-	-	-	0.154	0.081	0.107	0.161	0.100	0.107	0.195	0.196	0.121	0.217
1979	-	-	-	-	-	-	-	-	-	-	-	-	**-0.054**	0.041	0.110	0.018	0.027	0.146	0.154	0.060	0.175
1981	-	-	-	-	-	-	-	-	-	-	-	-	-	0.113	0.149	0.047	0.081	0.186	0.205	0.095	0.172
1983	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.109	0.044	0.095	0.187	0.193	0.062	0.167
1985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.015	0.038	0.149	0.166	**-0.018**	0.151
1987	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.115	0.189	0.250	0.059	0.183
1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.201	0.259	0.026	0.187
1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.161	**-0.101**	0.115
1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-0.354**	0.020
1995	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.341

Table 3: $C_{3,t,t+k}$ Based Upon Relative Rewards $r_{i,t}$ Biennially for 1955 – 1997 (3 d.p.)

	1957	**1959**	**1961**	**1963**	**1965**	**1967**	**1969**	**1971**	**1973**	**1975**	**1977**	**1979**	**1981**	**1983**	**1985**	**1987**	**1989**	**1991**	**1993**	**1995**	**1997**
1955	0.145	0.065	0.035	**-0.006**	0.027	0.063	0.089	0.119	0.167	0.106	0.157	0.151	0.139	0.104	0.121	0.100	0.080	0.098	0.109	0.072	0.116
1957	-	0.020	**-0.011**	0.006	0.038	0.057	0.095	0.106	0.157	0.106	0.154	0.170	0.142	0.136	0.142	0.127	0.083	0.124	0.152	0.104	0.142
1959	-	-	**-0.094**	**-0.029**	0.015	0.062	0.092	0.142	0.190	0.112	0.190	0.205	0.164	0.164	0.181	0.149	0.122	0.169	0.192	0.130	0.175
1961	-	-	-	0.083	0.134	0.193	0.193	0.213	0.273	0.196	0.234	0.235	0.228	0.238	0.240	0.211	0.172	0.211	0.219	0.155	0.193
1963	-	-	-	-	0.258	0.250	0.262	0.272	0.309	0.226	0.272	0.269	0.256	0.250	0.256	0.222	0.189	0.234	0.247	0.192	0.214
1965	-	-	-	-	-	0.222	0.264	0.276	0.299	0.210	0.264	0.258	0.249	0.232	0.252	0.202	0.166	0.216	0.223	0.183	0.211
1967	-	-	-	-	-	-	0.237	0.267	0.305	0.243	0.287	0.270	0.253	0.237	0.255	0.198	0.170	0.202	0.222	0.166	0.196
1969	-	-	-	-	-	-	-	0.278	0.354	0.232	0.282	0.261	0.259	0.243	0.249	0.201	0.161	0.210	0.219	0.164	0.193
1971	-	-	-	-	-	-	-	-	0.299	0.081	0.211	0.232	0.229	0.174	0.201	0.143	0.106	0.155	0.177	0.121	0.161
1973	-	-	-	-	-	-	-	-	-	**-0.163**	0.103	0.139	0.097	0.091	0.086	0.053	0.039	0.089	0.106	0.059	0.104
1975	-	-	-	-	-	-	-	-	-	-	0.386	0.275	0.170	0.137	0.160	0.122	0.069	0.154	0.152	0.088	0.143
1977	-	-	-	-	-	-	-	-	-	-	-	0.110	0.024	0.003	0.075	**-0.002**	**-0.048**	0.053	0.068	**-0.002**	0.074
1979	-	-	-	-	-	-	-	-	-	-	-	-	**-0.116**	**-0.044**	0.018	**-0.062**	**-0.109**	0.018	0.036	**-0.059**	0.033
1981	-	-	-	-	-	-	-	-	-	-	-	-	-	0.045	0.080	0.005	0.002	0.063	0.091	**-0.006**	0.050
1983	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.086	**-0.011**	0.011	0.075	0.094	**-0.008**	0.054
1985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-0.042**	**-0.014**	0.063	0.065	**-0.083**	0.017
1987	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.124	0.131	0.161	**-0.018**	0.075
1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.158	0.190	**-0.015**	0.092
1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.140	**-0.131**	0.063
1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-0.371**	**-0.017**
1995	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.320

Table 4: $C_{4,t,t+k}$ Based Upon Provincial Rewards $y_{i,t}$ Biennially for 1955 – 1997 (3 d.p.)

	1957	**1959**	**1961**	**1963**	**1965**	**1967**	**1969**	**1971**	**1973**	**1975**	**1977**	**1979**	**1981**	**1983**	**1985**	**1987**	**1989**	**1991**	**1993**	**1995**	**1997**
1955	0.175	0.145	0.081	0.066	0.101	0.151	0.164	0.193	0.228	0.161	0.207	0.210	0.214	0.207	0.205	0.172	0.128	0.148	0.145	0.133	0.160
1957	-	0.057	-0.036	0.011	0.060	0.125	0.160	0.178	0.220	0.146	0.198	0.219	0.232	0.193	0.207	0.178	0.133	0.163	0.186	0.148	0.174
1959	-	-	**-0.155**	**-0.054**	0.017	0.115	0.142	0.186	0.232	0.157	0.225	0.241	0.231	0.231	0.240	0.204	0.160	0.195	0.216	0.180	0.198
1961	-	-	-	0.107	0.155	0.232	0.232	0.279	0.294	0.225	0.258	0.275	0.272	0.270	0.273	0.243	0.192	0.219	0.231	0.184	0.210
1963	-	-	-	-	0.247	0.297	0.314	0.326	0.342	0.252	0.287	0.305	0.299	0.305	0.309	0.256	0.222	0.235	0.261	0.205	0.228
1965	-	-	-	-	-	0.252	0.299	0.326	0.330	0.228	0.278	0.299	0.285	0.275	0.297	0.253	0.199	0.232	0.252	0.204	0.231
1967	-	-	-	-	-	-	0.262	0.305	0.323	0.228	0.293	0.299	0.297	0.278	0.287	0.235	0.199	0.226	0.246	0.195	0.228
1969	-	-	-	-	-	-	-	0.293	0.351	0.196	0.288	0.306	0.279	0.287	0.291	0.235	0.195	0.237	0.253	0.175	0.219
1971	-	-	-	-	-	-	-	-	0.275	0.047	0.225	0.253	0.228	0.198	0.240	0.190	0.164	0.180	0.192	0.137	0.170
1973	-	-	-	-	-	-	-	-	-	**-0.181**	0.122	0.174	0.083	0.095	0.112	0.107	0.103	0.127	0.127	0.077	0.112
1975	-	-	-	-	-	-	-	-	-	-	0.400	0.318	0.198	0.175	0.210	0.180	0.128	0.199	0.184	0.100	0.155
1977	-	-	-	-	-	-	-	-	-	-	-	0.110	0.015	0.032	0.101	0.020	**-0.021**	0.078	0.068	**-0.005**	0.060
1979	-	-	-	-	-	-	-	-	-	-	-	-	**-0.094**	**-0.017**	0.053	**-0.054**	**-0.086**	0.045	0.039	**-0.051**	0.033
1981	-	-	-	-	-	-	-	-	-	-	-	-	-	0.086	0.101	**-0.020**	**-0.015**	0.072	0.091	**-0.008**	0.044
1983	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.077	**-0.008**	**-0.003**	0.094	0.098	**-0.021**	0.057
1985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-0.018**	**-0.036**	0.074	0.086	**-0.092**	0.041
1987	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.071	0.137	0.189	**-0.003**	0.086
1989	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.163	0.201	**-0.027**	0.092
1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.127	**-0.142**	0.053
1993	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-0.376**	**-0.029**
1995	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.296

TABLE 5: $D_{1,t,t+k}$

Province	No.	Province	No.	Province	No.	Province	No.
Alava	10	Castellon	17	Lleida	18	Segovia	16
Albacete	15	Ciudad Real	10	Lugo	11	**Sevilla**	**28**
Alicante	12	**Cordoba**	**26**	*Madrid*	*0*	Soria	13
Almeria	*9*	La Coruna	18	**Malaga**	**22**	Tarragona	17
Asturias	14	Cuenca	11	Murcia	16	**Teruel**	**26**
Avila	*8*	Girona	13	Navarra	15	Toledo	13
Badajoz	**20**	**Granada**	**28**	Orense	10	Valencia	10
Baleares	15	**Guadalajara**	**30**	**Palencia**	**21**	Valladolid	13
Barcelona	*3*	*Guipuzcoa*	*4*	Las Palmas	11	*Vizcaya*	*4*
Burgos	**22**	Huelva	13	Pontevedra	15	Zamora	13
Caceres	*7*	Huesca	12	**La Rioja**	**23**	Zaragoza	10
Cadiz	**27**	Jaen	15	**Salamanca**	**20**	**Ceuta**	**20**
Cantabria	12	**Leon**	**20**	S C Tenerife	17	Melilla	18

Figure 1: Max, min, median and quartiles

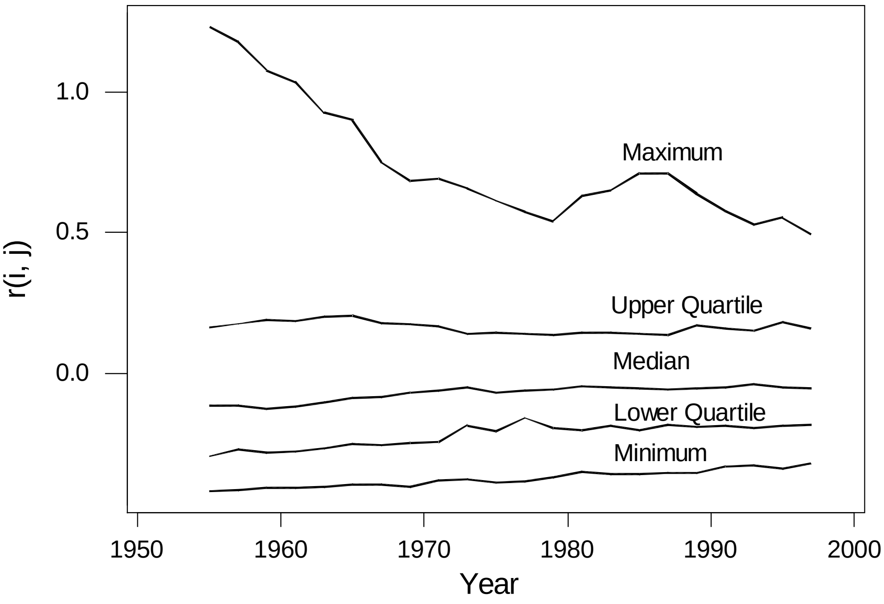
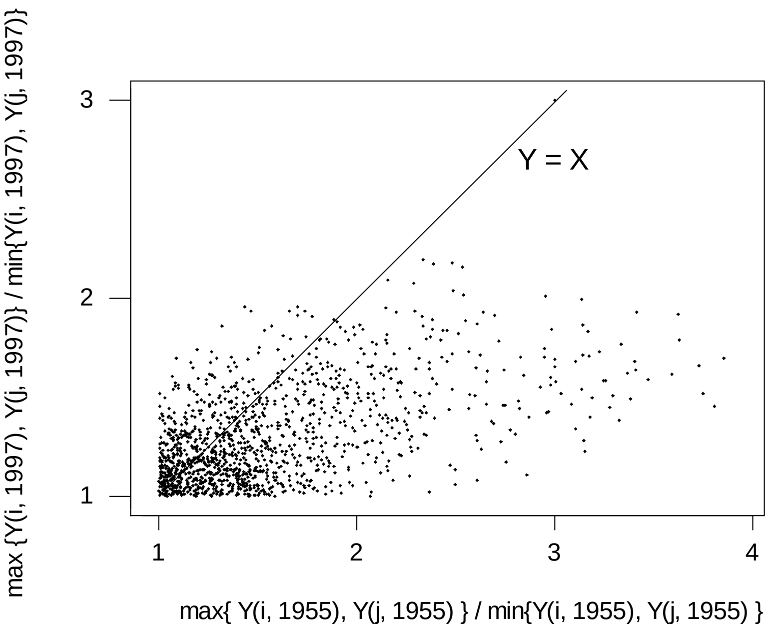
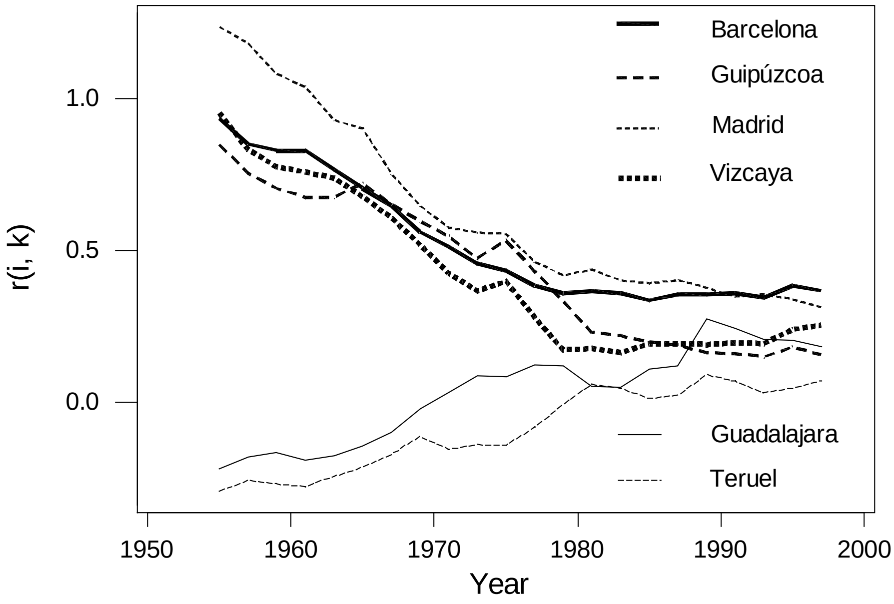


Figure 2:



Y = X
3
2
1
1
2
3
4
max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }

Figure 3:



Barcelona
Guipúzcoa
Madrid
Vizcaya
Guadalajara
Teruel
1.0
0.5
0.0
r(i, k)
1950
1960
1970
1980
1990
2000
Year

Figure 4:

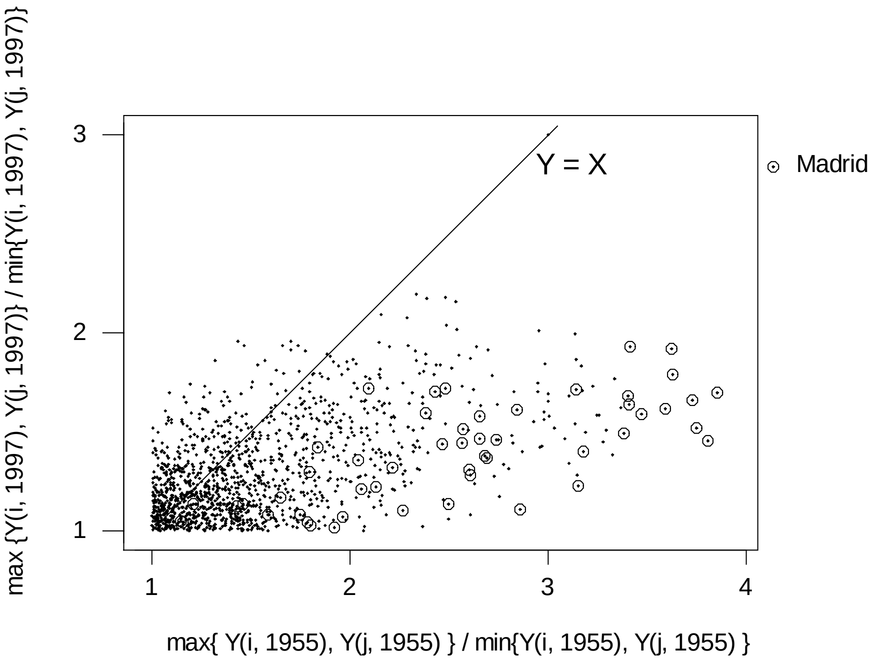

max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}
3
2
1
Y = X
Madrid
1
2
3
4
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }

Figure 5:

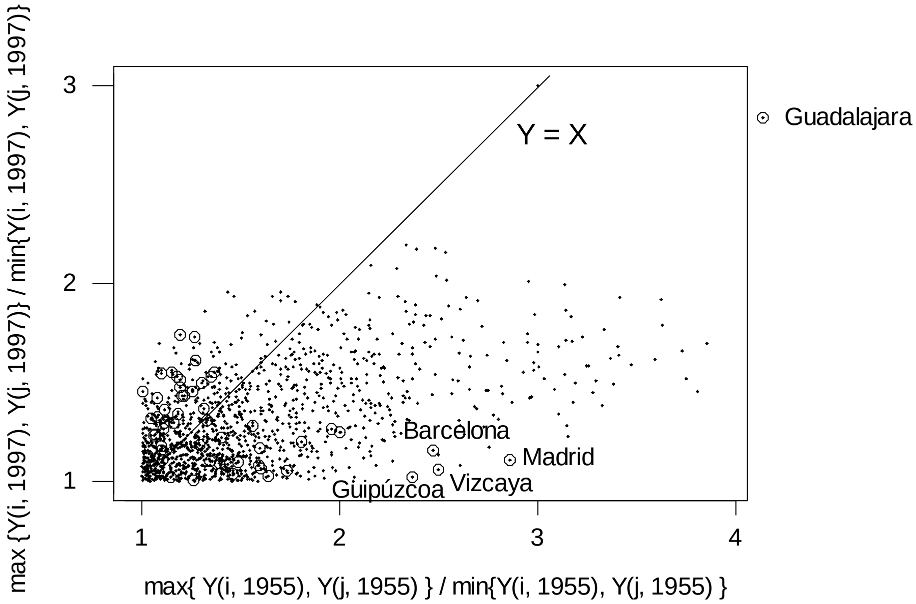
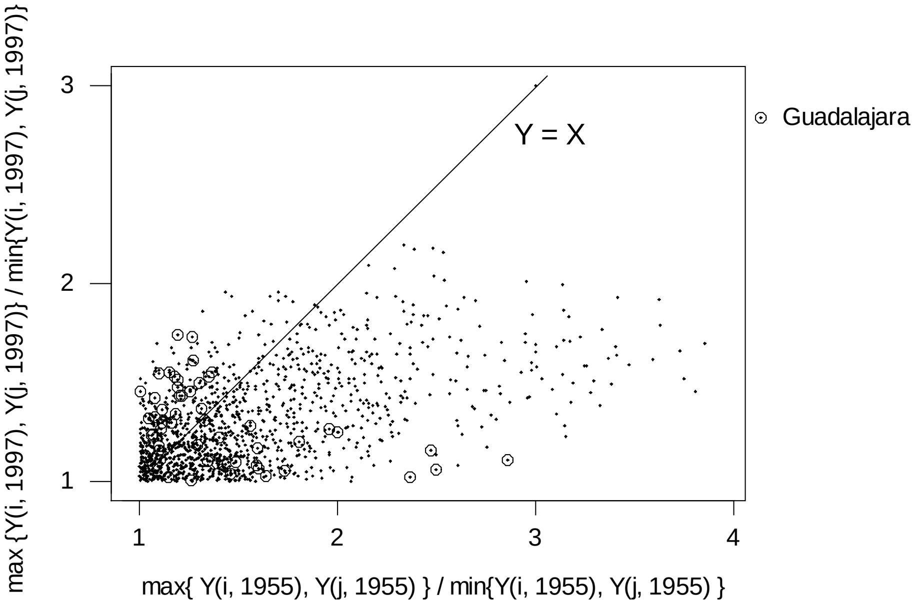
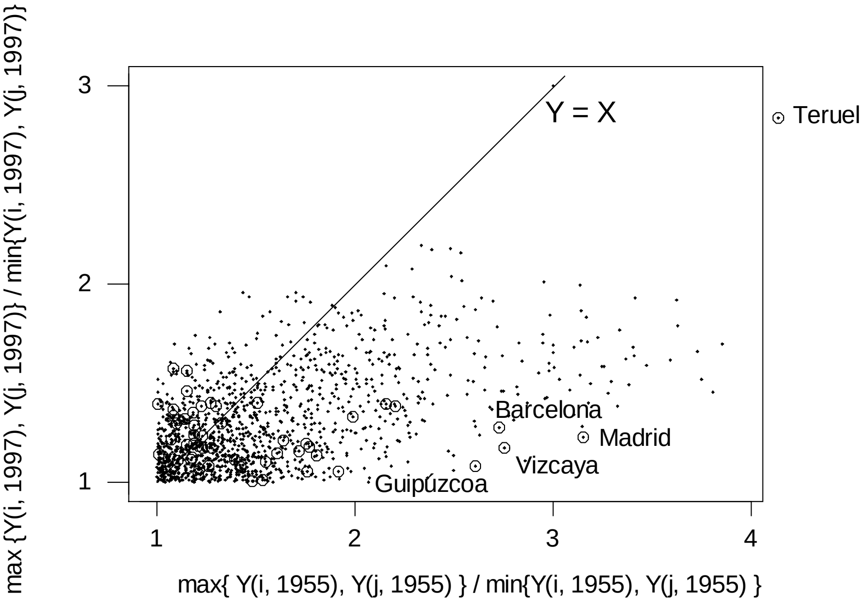

Y = X
Guadalajara
Barcelona
Madrid
Vizcaya
Guipúzcoa
3
2
1
1
2
3
4
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }
max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}

Figure 6:



Y = X
Guadalajara
3
2
1
1
2
3
4
max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }

Figure 7:



Y = X
Teruel
Barcelona
Madrid
Vizcaya
Guipúzcoa
3
2
1
1
2
3
4
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }
max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}

Figure 8:

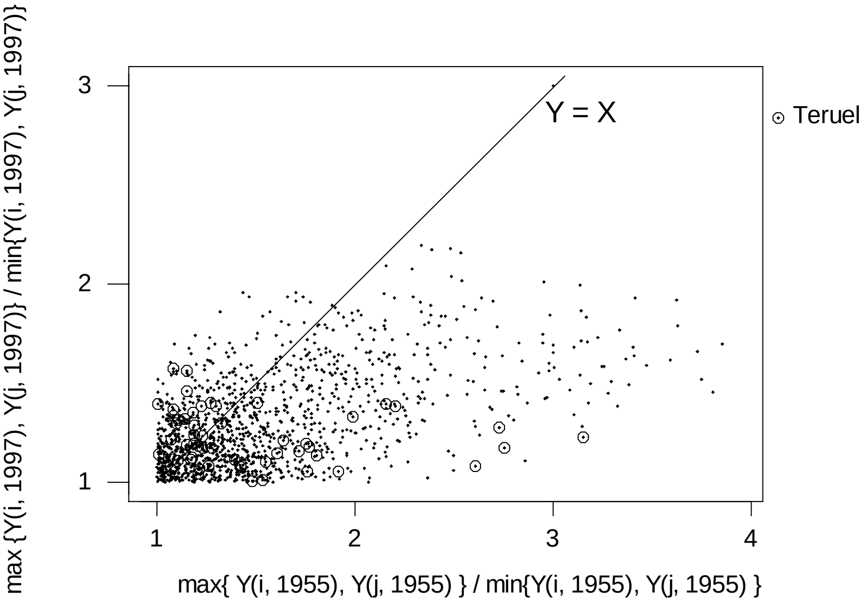

Y = X
⊙ Teruel
3
2
1
1
2
3
4
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }
max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}

Figure 9:

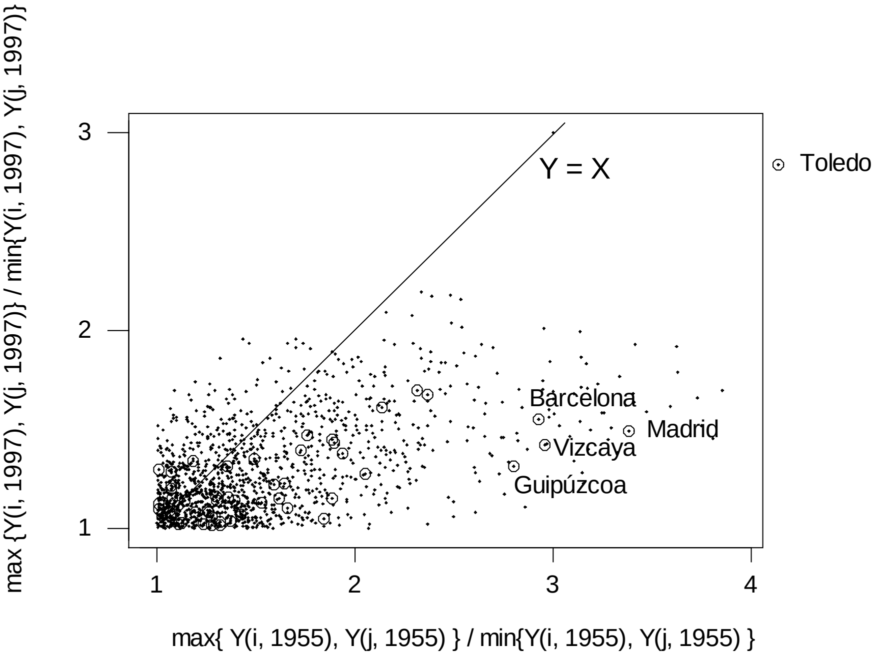

max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}
3
2
1
Y = X
Toledo
Barcelona
Madrid
Vizcaya
Guipúzcoa
1
2
3
4
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }

Figure 10:

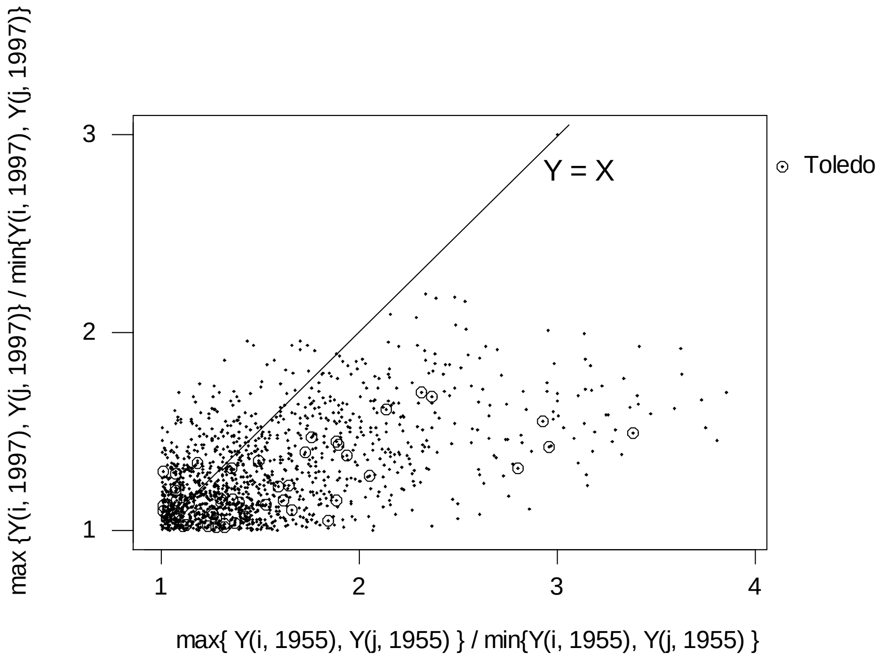

Y = X
Toledo
3
2
1
1
2
3
4
max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }

Figure 11:

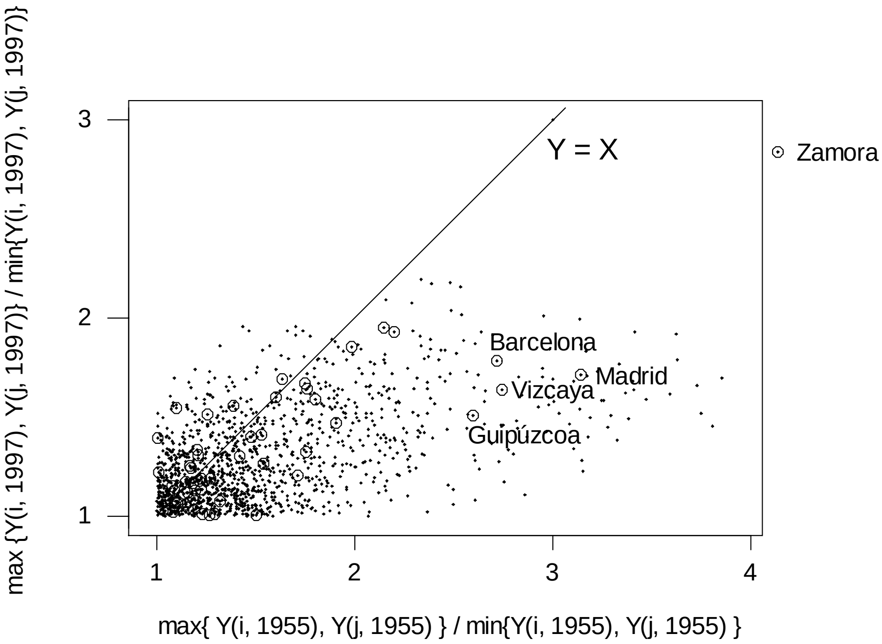
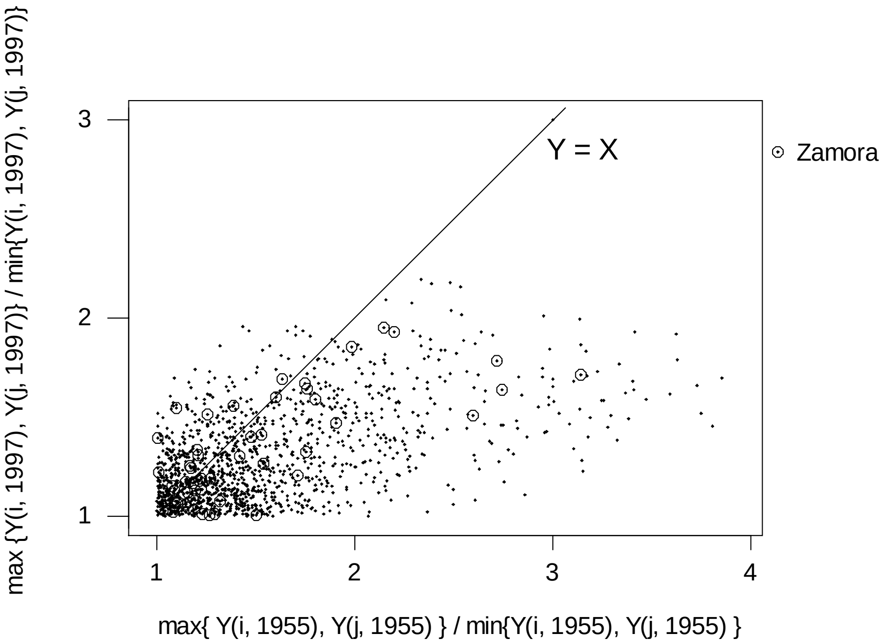
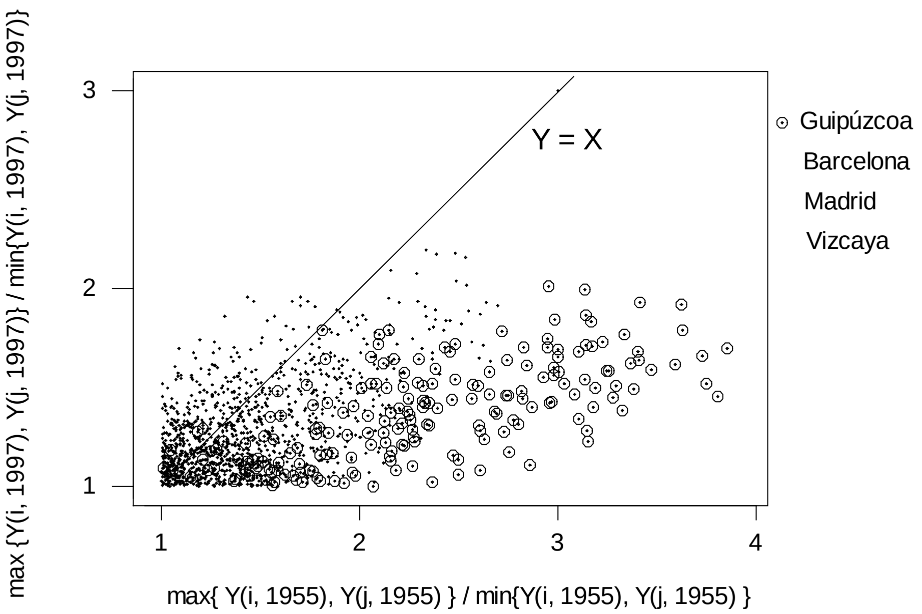

max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}
3
2
1
Y = X
Zamora
Barcelona
Madrid
Vizcaya
Guipúzcoa
1
2
3
4
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }

Figure 12:



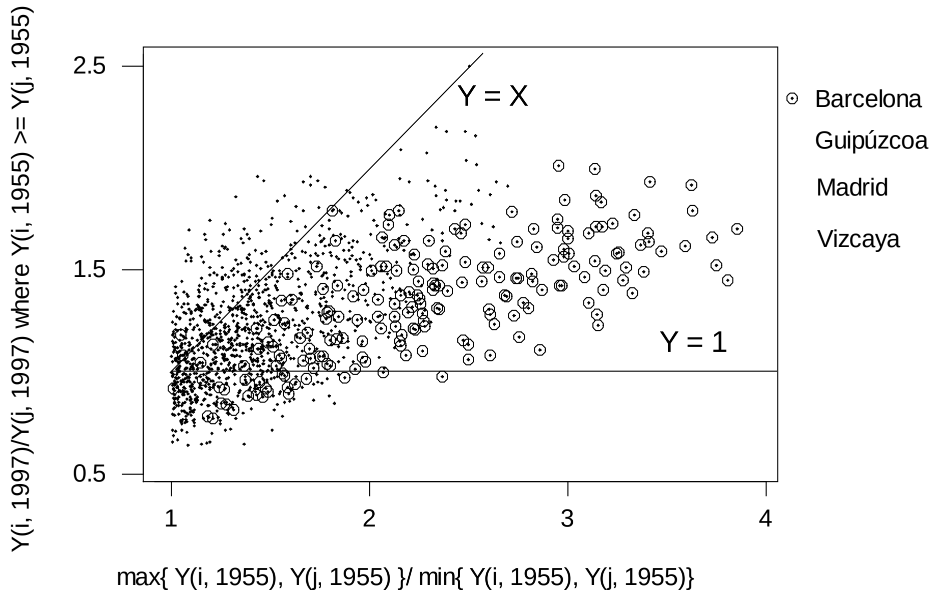
max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}
3
2
1
Y = X
Zamora
1
2
3
4
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }

Figure 13:



3
2
1
1
2
3
4
Y = X
Guipúzcoa
Barcelona
Madrid
Vizcaya
max {Y(i, 1997), Y(j, 1997)} / min{Y(i, 1997), Y(j, 1997)}
max{ Y(i, 1955), Y(j, 1955) } / min{Y(i, 1955), Y(j, 1955) }

Figure 14:



2.5
1.5
0.5
1
2
3
4
Y = X
Y = 1
Barcelona
Guipúzcoa
Madrid
Vizcaya
Y(i, 1997)/Y(j, 1997) where Y(i, 1955) >= Y(j, 1955)
max{ Y(i, 1955), Y(j, 1955) }/ min{ Y(i, 1955), Y(j, 1955)}