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Economic Integration and Regional Business Cycles: Evidence from the Iberian regions*

by

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Abstract

The present paper provides evidence on the impact of economic integration on EU regions' business cycles convergence by focusing on the Spanish and Portuguese experiences. We use quarterly as well as annual series on employment growth to show that the EU integration process has had a positive and significant influence on Iberian regional cycles' correlation. Econometric evidence suggests that the economic size of regions and their respective industrial structure can explain a substantial proportion of regional cycles. We also find that the estimates differ depending on the frequency of the data used. Both the border effect and industrial specialisation seem to have greater influence on the pattern of economic co-fluctuations when using annual rather than quarterly series.

JEL Codes: E32, F15, R110

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1. Introduction

How far can European integration bring the interdependence of national economies? Does the intensification of trade and capital movements influence the pattern of shocks across EU countries? Recent economic literature has provided empirical results on these issues by comparing *intranational* with *international* business cycles. For example Bayoumi and Eichengreen (1993), Wynne and Koo (1997) and Hess and Shin (1997) compare the economic fluctuations among U.S. states and European countries. The main hypothesis of these studies is that intranational business cycles provide natural case studies of economic co-fluctuations between (almost) frictionless regions. Accordingly, regions within the same country tend to have higher business cycles correlations since they are highly integrated. The idea is that EU countries may tend to behave as regions within the same country as EU integration deepens. In a recent study, Clark and van Wincoop (2001) have extended this approach in order to compare business cycle correlations of U.S. states and EU countries and to study the determinant of the so-called *border-effect*, which is represented by the difference between the average within and cross-countries business cycles correlations[1].

The present paper brings the analysis a step forward by arguing that the dynamics of regional business cycles may condition the way national economies adjust to economic integration. In particular, we follow Fatás (1997) by considering that economic integration may have consequences for the pattern of business cycles that may be easier to identify at a regional rather than a national level. We consider in addition that integration may affect regions at different paths. The business cycle of some regions may converge more than others because of historical links, proximity or cultural affinities. Initially, these *convergence nests* may indeed be fostered by more global processes such as monetary or customs unions, because they involve profound changes affecting significantly the movement of persons, capital, goods and services. The global integration process may then have consequences for neighbouring regions that would have been less likely without it. The first aim of this paper is to test this hypothesis by considering the special case of Spanish and Portuguese regions. Spain and Portugal have undergone a profound integration process largely encouraged by the accession of both countries to the European Community in 1986 and the greater openness to international trade and investment that followed. We show in particular that this

[1] The notion of *border effect* in business cycle studies has to be put in parallel with the one generally used by trade economists. For example Mc Callum (1995) in a seminal work on border effects in trade, use a gravity model to study the determinants of trade between Canada and the US, the existence of a border effect being represented by the surplus of intra-country trade compared to inter-country trade.

process has lead to a greater interdependence between these two neighbouring economies.

The second aim of this paper is to test whether trade and industrial specialisation explain the pattern of business cycles of Iberian regions. Our analysis lies on the theoretical framework developed by Mundell (1961) concerning the Optimum Currency Areas (OCA) and the extensions made by other authors. Following this theory, the relevance of adopting a common currency and monetary policy depends on a number of criteria such as the symmetry of shocks and the way countries or regions react to these disturbances via labour mobility, wage flexibility and a system of fiscal redistribution among regions or states sharing a common currency[2]. Following Mundell's seminal work, Kenen (1969) advocated that sectoral specialisation may condition the way regions react to economic fluctuation. The main argument is that if shocks were mainly sector-specific, only those regions or countries with similar industrial structure would experience symmetric business cycles.

The nature of industrial specialisation, trade intensity and business cycle correlations are in fact closely linked providing strong support to the *endogeneity hypothesis* of the OCA criteria as recently shown by Frankel and Rose (1998)[3]. The preceding authors emphasize on trade as a *transmission mechanism* of economic fluctuations providing evidence for a panel of industrialised countries. Here we adopt a similar approach using quarterly and annual series on employment growth to compute cross-correlation coefficients. We extend the existing literature in a number of ways. First, we present evidence for a significant decrease in the border effect in Iberian regions showing in particular that this process has been fostered by the European integration program and has followed (at a higher rhythm though) the decrease in the border effect observed for the rest of Europe. Second, we obtain different estimates of the border effect between Spain and Portugal depending on the frequency of the data used suggesting that the adjustment mechanism may differ depending on the time horizon under scrutiny. A third related result emerges when regressing cross-correlation coefficients on a set of gravity-type and industrial specialisation variables. It appears that the latter plays an important role when considering annual rather than quarterly cycles.

The rest of the paper is structured as follows: Section 2 provides a description of the data used while section 3 analyses the business cycle of Iberian regions with

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[2] Buiter (2000) argues in addition that financial integration may qualify as the main criterion for adopting a single currency and common monetary policy in economies with already well-integrated capital markets. In this case, the sacrifice of losing the exchange rate and the monetary policy autonomy may be more than compensated by the source of stability provided by the adoption of a single currency.

[3] The endogeneity hypothesis suggests that the ex-ante conditions generally used in the OCA theory may themselves be greatly influenced by the existence of a common currency.

a special emphasis on the period following the accession of these countries to the European Community. In section 4 we test econometrically the role played by trade and specialisation variables in explaining the economic co-fluctuations of Iberian regions. Section 5 concludes.

2. Data description

We base our empirical study on employment data rather than other more common types of economic variables such as income, prices or GDP. As mentioned by Fatás (1997), employment series are more easily available at the regional level and need not to be deflated, which would be an almost impossible task when dealing with regional data. We use two datasets: one from the Spanish and Portuguese *Instituto Nacional de Estadística* (INE) providing quarterly series from the first quarter of 1988 to the last quarter of 1998. Initially, Portuguese quarterly data were available for the period 1983-1999. We chose to restrict the analysis to 1988-1998 given that the regions are only defined in a homogenous way for this period. Moreover, some changes in the definition in employment occurred in Portugal in the first quarters of 1992 and 1998. We handled this and also the potential existence of seasonality both for Portuguese and Spanish regions by regressing the series in levels on quarterly dummy variables as suggested by Miron (1994)[4]. We then used the residuals obtained from these regressions using heteroskedastic robust estimates following White's (1980) method. By doing this we assume that seasonal unit roots are absent which is not a stringent assumption given the short time period being considered. The second dataset is taken from the Cambridge Econometrics database and is mainly based on Regio (Eurostat) statistics and provides annual data on employment for Iberian and also for European regions between 1975-1998. In both data sets the regions' definition is the nuts2 level used by Eurostat and provides us with 15 and 5 regions for Spain and Portugal respectively. Tables 1 and 2 provide descriptive statistics.

Before turning to the analysis of the descriptive statistics, the use of employment series calls for a discussion of the special cases of Spanish and Portuguese labour market as well as for an examination of the evidence concerning the regional evolution of employment. Previous studies focusing on labour market mechanisms provide valuable insights in order to analyse the propagation of shocks in Iberian labour markets. The emphasis is generally put on aspects like wage and consumption elasticity to employment variations, labour mobility and institutional factors affecting the labour market. As noted by Blanchard and Jimeno (1995) and Castillo et al. (1998), Spain and Portugal economies share many

[4] The de-trended methods used are based on the HP filter, the first and fourth difference of employment series depending the frequency of the data as explained in the next section.

characteristics, not least the institutional aspects of their labour market. Some striking differences exist however. In particular the level of unemployment was notably higher in Spain from the end of the 1970ies reaching the highest rate in Europe. Portugal was just at the opposite end with one of the lowest unemployment rates. Despite these differences, Castillo et al. (1998) showed that both economies experienced similar shocks to unemployment since the beginning of the 1980ies. The preceding authors also showed that the transmission mechanisms and the persistence of shock differed between both countries. Studies using regional data provide complementary results on the degree of persistence of unemployment. For example, Jimeno and Bentolila (1998) showed that wage rigidity and low labour migration lead to high unemployment persistence in Spanish regions although employment growth shows low persistence. In what follows we put the emphasis on employment growth correlation instead, looking at the way trade and location variables affect the Iberian regions' business cycles.

3. Integration, regional business cycles and the border effect.

Economic integration between Spain and Portugal was given a strong impulse after their accession to the European Community in 1986 and the subsequent implementation of the Single Market Program. In fact, Spain's and Portugal's bilateral economic relationships were already promoted in the late 1950ies when both countries started to liberalise their still tightly regulated economies during their respective dictatorial regimes. Table 3 provides evidence for this by reporting bilateral trade flows growth averages for the period 1961-1998. A clear slowdown in this trend occurred in the mid-1970ies until 1985 following a general downturn in world economic activity and international trade. The following accession of Spain and Portugal to the European Community in 1986 has in turn played in favour of a vigorous increase in trade growth between both countries and also with the rest of Europe. The general economic downturn at the beginning of the 1990ies have, by far, affected more significantly Spain's and Portugal's trade with the rest of the European Union than bilateral trade between them. The last years have also seen growing cross-investment between both countries in particular Spanish direct investment in Portugal providing Spanish firms with a strong position in the Portuguese economy as shown by table 4.

Our starting hypothesis is that growing integration may have direct consequences in terms of business cycles correlation both between Iberian and European regions. As shown by Fatás (1999), the Spanish business cycle had usually been more volatile than its EU counterparts but became more synchronized with the EU cycle from the mid-1980ies onwards. Using Frankel and Rose's (1998) approach, Fatás also shows that growing trade between Spain and the

European Community has exerted a positive and significant role in this process. In a different paper, Fatás (1997) shows that European integration has fostered regional business cycles's correlation to a greater extent than national business cycles. Put differently, the country-specific component of economic fluctuations has decreased in favour of more region-specific fluctuations reducing the significance of national borders, at least from an economic point of view.

It is important to point out the way the border effect is determined. Cross-correlation coefficient (i.e. correlation between all Iberian regions) are first computed and then regressed on a constant (the average correlation) and a dummy variable equal to one when two regions *j* and *k* belong to the same country and zero otherwise. This dummy variable represents then the border effect since it measures the difference between within and cross-country correlation averages. Tables 5-6 provide preliminary evidence on the magnitude of the decline of the border effect among EU regions over the period 1975-98. The reported figures concern annual employment growth cross-correlations between 209 EU nuts2 regions, including the 20 Iberian regions[5]. The results concern country-level average of regions' cross-correlations. It appears that regional between-country correlations have increased over time from an average of 0.10 to 0.28 while within countries correlation have remained fairly stable varying from 0.62 to 0.58. Considering Spain and Portugal in particular we observe an even larger increase in the between-country correlation, from 0.04 to 0.34, which is the highest inter-country correlation for Portugal. The preceding evidence provides some support for a decline in the border effect between both European and Iberian regions. We also confirmed this border effect for the same set of regions using moving windows averages over 10 years starting from 1975-85 and ending in 1988-98 in order to check the robustness of the preceding result. Figures 3 and 4 describe the results obtained using both HP filter and first differences as de-trending methods together with confidence intervals on the border effect estimates[6]. Two important features emerge: first, the border effect is lower and less significant between Spain and Portugal than between other European regions. Second, the decline in the border effect is much more pronounced for Iberian regions in the years following the accession of Spain and Portugal to the European Community. Overall, the figures

[5] We use the Hodrick and Prescott filter and first differences in order to get rid of the trend component of the series and focus on two sub-periods: 1975-87 and 1988-98. Note however that the smoothing parameter λ is set to 6.25 when using the HP filter for annual series as suggested by Ravn and Uhlig (1997) while λ=1600 for quarterly series as suggested by Hodrick and Prescott (1997).

[6] The average correlation coefficient has been obtained by running simple OLS regression of cross-correlation coefficients on a constant term and a dummy variable equal to one when two regions are located in the same country and zero otherwise. Accordingly, the coefficient on this dummy variable represents the border-effect for which confidence interval can be easily computed. Standard errors are corrected for heteroskedasticity using White (1980) method.

show a clear decline in the border estimates with most of this decline occurring at the beginning, that is, when correlations are computed over the first years following Spain and Portugal accession to the European Community. The picture looks similar using first differenced series where the decline occurs in a more progressive fashion over the whole period. Spain and Portugal have not been the only two neighbouring economies to experience a significant decline in the border effect. Going back to table 5–6, we observe also important rise in between-countries correlations for many country-pairs like France and Germany, France and Spain, Netherlands and Germany, Belgium and Netherlands, and Austria and Italy, among others.

Ideally, a more robust test of the impact of growing economic integration on the decline of the border effect would require the use of trade and investment data between regions according to our preceding discussion. However, the lack of information at the regional level does not allow such a test. As shown in the following section, we have to rely mainly on *indirect* explanatory variables that may determine trade such as the size of the regions and the distance between them. However some data on international trade are available on Spanish regions' trade with Portugal for the most recent period. Figure 3 presents evidence using such data and plots an indicator of trade intensity together with business cycle correlation by regions using quarterly data for the period 1988-1998[7]. There seems to be a positive link between each region's business cycle correlation and its trade with Portugal. A simple OLS reported in figure 3 supports this result. The conclusions one may draw from this figure are clearly limited however. First because we do not have information on trade between Spanish and Portuguese regions; second because figure 3 compares a country's employment fluctuations (Portugal) with regions' fluctuations (Spain). Accordingly, we need further evidence in order to explain the general trends observed in the business cycle correlations considering all Iberian regions' cross-correlation. This will help one to draw more conclusive inference on the evolution of the border effect and the impact of economic integration on this process.

[7] Data are from Dirección General de Aduanas, Ministerio de Economía. Figure 3 is based on correlations computed using HP filtered series. Trade intensity is measured by $(X_i + M_i)/(X_t+M_t)$, where *Xi* and *Mi* are the averages export and imports of Spanish region *i* to Portugal over the period 1988-98 and *Xt*, M_t represent the total of Spanish exports and imports with Portugal.

4. Explaining regional business cycles: econometric evidence

We follow the methodology proposed by Clark and van Wincoop (2001) in order to study the determinants of the border effect between Iberian regions. The basic equation we test is as follows:

$$\hat{p}_i = x_i^{'}\beta + e_i \qquad (1)$$

where $\hat{p}_i$ is the estimated correlation coefficient between two regions j and k that form the pair i while x_i is a vector of explanatory variables. Frankel and Rose (1998) use a similar approach to study a set of industrialised countries and regress cross-correlation coefficients on a variable representing trade intensity using White's (1980) correction for heteroskedasticity. Clark and van Wincoop (2001) argue, however, that the resulting estimator does not take into account possible dependencies across residuals. They propose instead an estimation method based on the Generalized Method of Momments (GMM) as we shall describe below. We proceed as follows. Let $\hat{p}$ be the vector of estimated correlations and v the sampling error for the estimated vector:

$$\hat{p} = p + v \qquad (2)$$

Sampling errors are likely to be correlated across $\hat{p}_i$ since, for example, the value of this variable for two regions like Madrid and Extremadura is likely to be correlated with the $\hat{p}_i$ estimated for Madrid and Andalusia. Following the Clark and van Wincoop (2001) methodology, the cross-correlation coefficient are computed using the GMM method proposed by Ogaki (1993) to compute the variance of the estimated correlation vector using the Newey-West (1987) correction for serial correlation with two lags. The estimator obtained is denoted $\frac{1}{T}\hat{\Sigma}_v$ where $\hat{\Sigma}_v$ is the estimated asymptotic variance-covariance matrix and T is the number of time-series observations used to estimate the correlations. The variance-covariance matrix of the OLS estimates of β in (1) then becomes:

$$\mathrm{var}(\hat{\beta}) = (X'X)^{-1} X' \left(\frac{1}{T}\hat{\Sigma}_v \right) X (X'X)^{-1} \qquad (3)$$

Hereafter we describe the set of explanatory variables. As noted earlier the main explanatory variable is the dummy variable representing the border effect.

This variable is equal to one when two regions belong to the same country and zero otherwise. We also use an indicator of industrial dissimilarity (the so-called *Krugman index*) based on sectoral employment using the following formula:

$$Dissimilarity_{jk} = \sum_{n=1}^{N} \left| s_{nj} - s_{nk} \right| \qquad (4)$$

where s_{nj} and s_{nk} denote the employment shares of sector n in region j and k, where j and k forming the pair of regions i mentioned in equation (1). The sector-level data used to compute this index comes from Cambridge Econometrics (UK) and is available at nuts2 regional-level for eight sectors: agriculture, banking and insurance, construction, distribution, energy and manufacturing, transport and communications, non-market services and other market services. We follow Long and Plosser (1983) by assuming that if shocks are sector-specific then two highly dissimilar regions will face asymmetric shocks. The expected sign for our dissimilarity measure is negative. Krugman (1993) puts much emphasis on the industrial structure differences in determining the adjustment process to asymmetric shocks within a single currency area. He suggests that the US states may provide a good example of what can happen in Europe with increased specialisation among European countries given that the US states tend to be more specialized among them than European countries[8]. The Economic integration process may also modify the pattern of sectoral specialisation and trade between potential members. The New Economic Geography models provide a variety of arguments in that sense. The reduction of barriers to trade can encourage the relocation of industries according to the relative strength of comparative advantage and agglomeration economies. The consequence is that industrial structures would tend to diverge while economic integration deepens, see for example Krugman et al. (1999, ch.4) for a theoretical overview of these arguments. On the other hand, Ricci (1997) shows within this framework that monetary integration can in fact promote the dispersion of industries making regions more similar. The nature of the relationship between industries location and economic integration remains then wide open from a theoretical point of view. The consequences of this relationship on the regional business cycles may then follow different scenarios. If greater economic integration causes regions to specialise in certain industries and industry-specific shocks are important, then EU integration should promote asymmetric business cycles. On the other hand, if dispersion and intra-industry trade specialisation prevail, then more intensive trade may result in higher business cycle correlation.

Figure 4 shows that the dissimilarity index remains, on average, fairly stable over the period 1975-98, the dots above the 45^{o} line indicating a rise in

[8] This assertion has been discussed widely in the literature further work suggesting in fact that the level of specialization among US states was roughly similar to the one in Europe when comparing EU countries between them, see Krugman (1991 and 1993), Peri (1998) and Clark and van Wincoop (2001) for further discussion on this issue.

specialisation for the corresponding regions. Non-reported results reveal that the overall mean for dissimilarity index remains equal to 0.41 over the two sub-periods considered in figure 4. Portuguese regions appear to be more specialised than their Spanish counterparts with an average index equal to 0.44 while Spanish regions' average index is equal to 0.31. Regions are also more dissimilar when located in different countries. In this case we observe a decrease in the dissimilarity index from 0.49 on average in 1975-87 to 0.44 in 1988-98. Furthermore in only one case (for the Spanish region Rioja) does one observe a sharp increase in specialisation with respect to all other regions. The decreases of the dissimilarity index are more marked, for example in the case of Portuguese regions Alentejo and Centro or the Spanish regions Galicia and Madrid. All in all, these changes suggest that industrial dissimilarity may have driven some of the modifications that occurred in the business cycles correlations among more similar Iberian regions and, to some extent, may explain the decline in the border effect shown in the preceding section.

As noted earlier, trade data at regional level are usually impossible to obtain at least for the regions under study. We have to rely on two proxy variables: *distance* and *size*. Distance is computed as the spherical distance (taking into account the curvature of the earth) between two regions' capitals[9]. Size is determined by the sum of the natural logarithms of the average population of two regions. Two large regions will tend to trade more with each other as they produce a wider range of product variety. Their respective markets are also more attractive given that some trade barriers may exist[10]. Accordingly, two distant regions should trade less so that a negative sign is expected for the distance variable. Figure 3 provided some contradictory evidence on this ground however. We observe, for example, that the Spanish regions that trade more with Portugal are not necessarily geographically closer to this country. For example Catalonia and Valencia are among the largest traders with Portugal but are not particularly close to this country. Other regions like Andalusia and Extremadura, physically close to Portugal, do not display especially high trade intensity. As noted earlier, this figure only concerns trade between Spanish regions and the whole Portugal so that only partial conclusion can be drawn on this basis. One certainly needs to be cautious when interpreting the results for the distance variable. Alternatively we will use an adjacency variable that is equal to one when two regions *j* an *k* have a common border.

[9] Coordinates were obtained from http://www.getty.edu/research/tools/vocabulary/tgn/index.html

[10] Note that the size and dissimilarity variables may then be co-linear because of the relationship between size and variety. Such co-linearity is however inherent and difficult to avoid in gravity-type analysis as the one we follow here.

Tables 7 and 8 present estimates of the average correlation coefficients using GMM and Ogaki's (1993) specification as outlined above. Table 7 present the results using annual employment series from Cambridge Econometrics using the Hodrick Prescott (1997) filter as well as first differences as de-trending methods while table 8 present the results using INEs' quarterly series using both the HP filter and fourth difference of the series. A first comparison of both tables reveals somewhat similar results excepting for the case of average cross-correlation estimates within Portugal. For example considering the HP filtered series and the period 1988-98 we obtain an average correlation equal to 0.12. This correlation is not significant when using annual series while the correlation obtained is equal to 0.36 and is statistically significant at 1% when using quarterly series for the same period. Overall, the average correlation coefficient between Portuguese regions is low. A closer look at those cross-correlation coefficients reveals in fact that small regions generally display low correlation coefficients, which is also true to some extent for (small) Spanish regions[11]. The magnitude of the border effect also differs according to the series being used and it is much larger when using annual data. In all case the border effect estimates display the expected sign and are highly significant. In the case of annual series for 1988-98, we obtain a border effect equal to –0.27 both for the first differenced and HP filtered series while using quarterly series the border effect is equal to -0.14. Those results may not seem surprising if one considers that in a short horizon, regions within the same country may face asymmetric shocks that tend to be smoothed in the long run by redistributive policy at the national level or labour participation and labour mobility. However, previous studies have shown that labour mobility between Spanish regions was especially low, see Bentolila (1997) for further evidence. Redistribution may also take a more implicit form through unemployment insurance. Our results are also supported by the fact that these adjustment mechanisms may also work differently in the short and long run. Descriptive statistics based on table 1 and non-reported results reproducing table 2 for the period 1988-98 provide evidence for this in that the volatility (measured by the standard deviation) of employment growth is always much higher when using quarterly data.

The decline of the border effect evidenced in the previous section is also apparent from Table 7. We observe a decrease in this border effect from –0.41 in 1975-87 to -0.27 in 1988-98 for HP filtered series and from –0.69 to -0.27 when using first differences. Splitting the quarterly series in two sub-periods does not provide very clear evidence as shown by table 8. The decline of the border effect

[11] We consider that a region is small when it has less than 200.000 workers. Details on the cross-correlation coefficients available from the authors.

lies between 0.03 and 0.04 in absolute term when using both fourth differences and HP filtered series. Clearly, the most important part of this decline has been taking place in the aftermath of 1986 while subsequent economic turbulences (for example, the ones experienced by the European Monetary System in 1992 and the general economic downturn in 1993) may explain part of the relative stability of the border effect that followed. This can also be explained by considering the general decrease in average correlation coefficient both between and within countries so that little can be inferred from splitting the quarterly series in two sub-periods. The results in table 7 concerning annual series over the time span 1975-1998 show that the significant increase in the between-countries correlations explains largely the decrease in the border effect while some mixed evidence appears for within-countries correlation depending on the de-trending method being used.

The question we deal with now concerns the variables that can explain the evolution of the business cycle correlation and the border effect among Iberian regions. As noted earlier, we focus on industrial specialisation and gravity-type variables. The same model is being tested for quarterly data (table 9) and annual data (table 10). Equation (1) is tested using HP filter as well as first and fourth differences of the series in order to check the consistency of our results. The first important result is that the absolute value of the coefficient on the border effect is lower than previously meaning that the set of explanatory variables used here explains part (but not all) of the border effect. The different magnitude of the border effect with annual and quarterly remains however. In table 9 the border effect displays the expected negative sign and is always significant at 1%. The distance variable and its substitute, the adjacency variable, are never significant however and display changing signs. This result confirms doubts previously raised on the appropriateness of using geographical distance as a measure of regional trade barriers, at least in the case considered here. The dissimilarity index displays the expected (negative) sign meaning that two regions with different industrial structure will tend to have asymmetric business cycles. The coefficient on this variable is significant at 1% when using HP filtered series and displays similar values when using fourth-quarter lags while signficance level varies from 1 to 10% according the specification and filtering method being used. Size however displays positive and highly significant coefficients in all cases with values between 0.06 and 0.071. The estimates using annual series display some similarities with the previous results as shown by table 10. In this table, the coefficient on the size variable is fairly close to the one obtained in table 9 ranging from 0.03 to 0.06 and is significant only for the whole time period and the 1975-87 period. The estimates of the distance and the adjacency variables display perverse signs casting strong doubts on the regressions including this variable. The coefficient on the dissimilarity index certainly provides more interesting results. The estimates for this variable vary from –0.43 as shown in the HP versions of equations (v) and (vi) to –0.74 in the first-difference version of equation (iv) of table 10 and it is almost always highly significant. A simple comparison between those results with the ones obtained in table 9 clearly shows that the industrial specialisation plays a more important role in explaining economic co-fluctuations between regions when considering annual series.

5. Conclusion

This paper provides evidence on the positive impact of economic integration on regional business cycles' correlation. Our study is based on the special case of two neighbouring economies: Spain and Portugal. Our analysis mainly uses cross-correlation coefficients based on the GMM method proposed by Ogaki (1993) and used by Clark and van Wincoop (2001) in business cycles study. We show that the so-called border effect (i.e. the difference of between and within country business cycles correlations) has notably decreased in Iberian regions in the aftermath of the accession of Spain and Portugal to the European Community. This evidence supports the view that some convergence nests may appear in Europe, influencing the way EU nations adjust to the economic integration process. Moreover, our results show that the border effect was less significant for Iberian regions and has fallen at a higher rhythm than for their EU counterparts. Further evidence provides some valuable insights on the way regions co-fluctuate according to the time horizon under scrutiny. We argue that those differences may be partially driven by labour-market adjustment mechanisms and redistribution policy between regions. In particular, the border effect appeared to be larger when using quarterly rather than annual employment growth series. When testing the determinant of economic co-fluctuations, we show that the relative size and industrial structures of regions were the most significant variables. The later result means that two regions with asymmetric industrial specialisation will also tend to face asymmetric shocks. Industrial specialisation also displayed higher elasticities for annual rather than quarterly series.

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Tables and Figures:

Table 1: Descriptive Statistics, level and growth (g) of total employment in Spanish and Portuguese (P) regions.
Quarterly employment data from INE, 198801-199804

	L	Std. g	g.	Min g	Max g
Galicia	957.4	0.0207	-0.0126	-0.0440	0.0282
Asturias	328.2	0.0314	-0.0089	-0.0718	0.0479
Cantabria	161.0	0.0457	0.0111	-0.0642	0.1003
Pais Vasco	691.3	0.0316	0.0118	-0.0630	0.0720
Navarra	184.2	0.0378	0.0194	-0.0769	0.0829
Rioja	87.4	0.0324	0.0021	-0.0725	0.0576
Aragon	407.2	0.0302	0.0105	-0.0591	0.0742
Madrid	1649.8	0.0332	0.0193	-0.0613	0.0691
Castilla-Leon	798.0	0.0302	0.0016	-0.0512	0.0602
Castilla-La-Mancha	510.0	0.0377	0.0076	-0.0525	0.0773
Extremadura	286.2	0.0351	0.0019	-0.0801	0.0632
Cataluña	2162.5	0.0355	0.0161	-0.0640	0.0764
Valencia	1272.4	0.0293	0.0137	-0.0442	0.0581
Andalucia	1800.2	0.0362	0.0146	-0.0734	0.0730
Murcia	324.5	0.0448	0.0190	-0.0352	0.1301
Norte (P)	1640.3	0.0430	0.0034	-0.1132	0.0865
Centro (P)	845.8	0.0408	0.0127	-0.0882	0.0713
Lisboa (P)	1526.4	0.0278	0.0024	-0.0609	0.0510
Alentejo (P)	213.4	0.0447	0.0007	-0.0779	0.1488
Algarve (P)	144.4	0.0471	0.0199	-0.0692	0.1082

Notes:
L =employment level average over the period
Std. g = standard deviation of the growth rate over the period
g. = average growth rate over the period
Min g = minimum growth rate over the period
Max g = maximum growth rate over the period

The growth rate is the four-quarters difference of the logarithms. Average level is expressed in thousands workers.

Sources: Instituto Nacional de Estadistica (Spain and Portugal) and authors' computations.

Table 2: Descriptive Statistics, level and growth (g) of total employment in Spanish and Portuguese (P) regions.
Annual employment data from Cambridge Econometrics, 1975-1998

	L	Std. g	g.	Min g	Max g
Galicia	1038.6	0.0181	-0.0066	-0.0405	0.0321
Asturias	382.6	0.0218	-0.0133	-0.0430	0.0255
Cantabria	177.4	0.0313	-0.0064	-0.0596	0.0791
Pais Vasco	723.9	0.0246	0.0013	-0.0301	0.0613
Navarra	192.3	0.0314	0.0071	-0.0336	0.0853
Rioja	96.8	0.0360	-0.0029	-0.0485	0.0705
Aragon	417.8	0.0280	0.0018	-0.0434	0.0538
Madrid	1563.6	0.0285	0.0132	-0.0333	0.0614
Castilla-Leon	856.8	0.0245	-0.0037	-0.0486	0.0578
Castilla-La-Mancha	497.8	0.0281	0.0044	-0.0409	0.0640
Extremadura	292.3	0.0298	-0.0046	-0.0500	0.0809
Cataluña	2080.3	0.0293	0.0036	-0.0421	0.0559
Valencia	1223.2	0.0280	0.0084	-0.0466	0.0702
Andalucia	1755.0	0.0316	0.0020	-0.0489	0.0520
Murcia	304.8	0.0349	0.0123	-0.0369	0.1129
Norte (P)	1350.4	0.0213	0.0026	-0.0290	0.0667
Centro (P)	725.3	0.0368	0.0013	-0.0821	0.0800
Lisboa (P)	1360.2	0.0255	-0.0042	-0.0692	0.0403
Alentejo (P)	195.1	0.0684	-0.0149	-0.2766	0.1185
Algarve (P)	130.9	0.1007	0.0048	-0.2287	0.3611

Notes:
L =employment level average over the period
Std. g = standard deviation of the growth rate over the period
g. = average growth rate over the period
Min g= minimum growth rate over the period
Max g= maximum growth rate over the period

The growth rate is the first difference of the logarithms. Average level is expressed in thousands workers.

Sources: Instituto Nacional de Estadistica (Spain and Portugal) and authors' computations.

Table 3: Bilateral total trade flows: Spain, Portugal and the European Union, Average annual real growth rate by period, 1961-98

	SP-EU*	SP-PT	PT-EU
1961-1975	12.5	16.9	4.6
1976-1985	-3.3	1.6	-10.5
1986-1992	12.3	28.2	15.7
1993-1998	1.4	6.6	-0.9

Sources: OECD and authors' computations.
* excludes Spain and Portugal

Table 4: Bilateral trade and direct investment between Spain and Portugal, 1988-97

year	SP DI	PT DI	total FDI	SP EXP	PT EXP	total trade	fdi/trade	cum_fdi / trade
1988	10864	43	10907	304201	153096	457298	2.4	2.4
1989	46582	164	46746	401397	221259	622657	7.5	9.3
1990	35331	446	35777	392154	245000	637154	5.6	13.0
1991	55839	3664	59503	468491	297609	766099	7.8	12.4
1992	64281	10830	75111	566512	316128	882640	8.5	15.3
1993	109311	2378	111690	611601	285291	896892	12.5	20.8
1994	269170	2317	271487	798595	338996	1137591	23.9	33.7
1995	121283	7392	128675	924660	405765	1330425	9.7	30.1
1996	161841	11277	173118	1103634	443080	1546714	11.2	19.5
1997	182309	3677	185986	1329907	466383	1796290	10.4	20.0

Notes:

SP DI = Total Spanish direct investment flows to Portugal
PT DI = Total Portuguese direct investment flows to Spain
SP EXP = Total Spanish exports from Spain to Portugal
PT EXP = Total Portuguese exports to Portugal

Total trade = sum of bilateral trade between Spain and Portugal
Fdi / trade = ratio of total bilateral direct investment flows on bilateral trade
cum_fdi / trade = ratio of total bilateral cumulated direct investment flows on bilateral trade

Figures are in constant (1990) millions pesetas

Sources: *Ministerio de hacienda- Departamento de aduanas e impuestos especiales*, *Dirección General de Transacciones Exteriores y Economía Internacional* and author computations.

Table 5: Cross-correlations between EU regions, country-level average: Annual series 1975-87

	AT	BE	DE	DK	ES	FI	FR	GR	IE	IT	NL	PT	SE	UK
AT	0.75	0.28	0.45	0.20	0.05	0.07	0.16	0.17	0.39	0.13	0.48	0.13	-0.11	0.36
BE	0.28	0.61	0.26	0.32	0.18	-0.01	0.25	-0.28	0.45	-0.07	0.16	0.05	0.39	0.55
DE	0.45	0.26	0.81	0.40	0.05	0.23	0.05	-0.12	0.27	0.15	0.38	0.08	-0.43	0.49
DK	0.20	0.32	0.40	0.87	0.03	-0.32	-0.07	-0.17	-0.09	-0.11	0.09	-0.21	-0.08	0.26
ES	0.05	0.18	0.05	0.03	0.44	0.03	0.37	-0.23	0.10	0.09	0.05	0.04	0.22	0.09
FI	0.07	-0.01	0.23	-0.32	0.03	0.81	0.08	-0.01	0.34	0.23	0.24	0.31	-0.32	0.08
FR	0.16	0.25	0.05	-0.07	0.37	0.08	0.46	-0.20	0.33	0.11	0.10	0.03	0.22	0.17
GR	0.17	-0.28	-0.12	-0.17	-0.23	-0.01	-0.20	0.92	-0.41	-0.01	0.13	0.13	-0.05	-0.33
IE	0.39	0.45	0.27	-0.09	0.10	0.34	0.33	-0.41	0.94	0.09	0.26	0.10	0.04	0.36
IT	0.13	-0.07	0.15	-0.11	0.09	0.23	0.11	-0.01	0.09	0.10	0.13	0.07	-0.20	0.02
NL	0.48	0.16	0.38	0.09	0.05	0.24	0.10	0.13	0.26	0.13	0.31	0.16	-0.15	0.24
PT	0.13	0.05	0.08	-0.21	0.04	0.31	0.03	0.13	0.10	0.07	0.16	0.07	0.01	0.10
SE	-0.11	0.39	-0.43	-0.08	0.22	-0.32	0.22	-0.05	0.04	-0.20	-0.15	0.01	0.89	0.15
UK	0.36	0.55	0.49	0.26	0.09	0.08	0.17	-0.33	0.36	0.02	0.24	0.10	0.15	0.76

Notes:
Correlations computed on annual series of regional employment (NUTS2 regions) filtered with Hodrick-Prescott filter with λ=6.25 as suggested by Ravn and Uhlig (1997).

Sources: Cambridge Econometrics and authors' computations.

Table 6: Cross-correlations between EU regions, country-level average: Annual series 1988-98

	AT	BE	DE	DK	ES	FI	FR	GR	IE	IT	NL	PT	SE	UK
AT	0.68	0.36	0.69	-0.22	0.28	-0.02	0.37	-0.14	0.28	0.36	0.50	0.30	0.13	-0.05
BE	0.36	0.68	0.46	0.28	0.65	0.47	0.58	-0.08	0.52	0.42	0.52	0.31	0.54	0.32
DE	0.69	0.46	0.89	-0.20	0.35	-0.10	0.38	-0.16	0.27	0.56	0.56	0.30	0.19	-0.16
DK	-0.22	0.28	-0.20	0.54	0.37	0.52	0.26	-0.02	0.36	0.01	0.09	0.05	0.39	0.37
ES	0.28	0.65	0.35	0.37	0.66	0.62	0.59	-0.15	0.52	0.36	0.48	0.34	0.63	0.42
FI	-0.02	0.47	-0.10	0.52	0.62	0.87	0.57	-0.12	0.58	0.04	0.25	0.25	0.77	0.69
FR	0.37	0.58	0.38	0.26	0.59	0.57	0.66	-0.14	0.62	0.27	0.46	0.32	0.71	0.43
GR	-0.14	-0.08	-0.16	-0.02	-0.15	-0.12	-0.14	0.10	-0.04	-0.12	-0.13	-0.16	-0.18	-0.05
IE	0.28	0.52	0.27	0.36	0.52	0.58	0.62	-0.04	0.60	0.18	0.42	0.24	0.64	0.42
IT	0.36	0.42	0.56	0.01	0.36	0.04	0.27	-0.12	0.18	0.42	0.40	0.23	0.18	-0.07
NL	0.50	0.52	0.56	0.09	0.48	0.25	0.46	-0.13	0.42	0.40	0.48	0.32	0.34	0.15
PT	0.30	0.31	0.30	0.05	0.34	0.25	0.32	-0.16	0.24	0.23	0.32	0.12	0.30	0.14
SE	0.13	0.54	0.19	0.39	0.63	0.77	0.71	-0.18	0.64	0.18	0.34	0.30	0.93	0.59
UK	-0.05	0.32	-0.16	0.37	0.42	0.69	0.43	-0.05	0.42	-0.07	0.15	0.14	0.59	0.60

Notes:
Correlations computed on annual series of regional employment (NUTS2 regions) filtered with Hodrick-Prescott filter with λ=6.25 as suggested by Ravn and Uhlig (1997).

Sources: Cambridge Econometrics and authors' computations.

Table 7: Average-correlations and border effect estimates: Annual series

	Hodrick-Prescott filter (λ=6.25)		
	1975-1998	1975-87	1988-1998
(0) Within PT	0.10*	0.07	0.12
	(0.07)	(0.09)	(0.12)
(1) Within ES	0.60***	0.48***	0.67***
	(0.06)	(0.09)	(0.06)
(2) Within countries	0.55***	0.44***	0.62***
	(0.05)	(0.09)	(0.06)
(3) Between countries	0.18***	0.04	0.34***
	(0.07)	(0.06)	(0.07)
(4) Border effect = (2) *minus* (3)	-0.37***	-0.41***	-0.27***
	(0.06)	(0.12)	(0.06)
	First-difference		
	1975-1998	1975-87	1988-1998
(0) Within PT	0.07	0.16**	0.13
	(0.06)	(0.08)	(0.13)
(1) Within ES	0.65***	0.67***	0.61***
	(0.05)	(0.09)	(0.08)
(2) Within countries	0.60***	0.63***	0.57***
	(0.04)	(0.08)	(0.08)
(3) Between countries	0.16**	-0.06	0.29***
	(0.07)	(0.09)	(0.09)
(4) Border effect = (2) *minus* (3)	-0.43***	-0.69***	-0.27***
	(0.09)	(0.13)	(0.04)

Note: Standard errors in parentheses obtained using GMM and Ogaki's (1993) specification
* significant at 10%, ** 5%, *** 1%

Table 8: Average-correlations and border effect estimates: Quarterly series

	Hodrick-Prescott filter (λ=1600)		
	1988:01-1998:04	1988:01-1992:04	1993:01-1998:04
(0) Within PT	0.36***	0.36***	0.34**
	(0.05)	(0.08)	(0.14)
(1) Within ES	0.62***	0.69***	0.50***
	(0.05)	(0.08)	(0.09)
(2) Within countries	0.60***	0.66***	0.49***
	(0.05)	(0.08)	(0.09)
(3) Between countries	0.45***	0.51***	0.37***
	(0.05)	(0.08)	(0.11)
(4) Border effect = (2) *minus* (3)	-0.14***	-0.15***	-0.11*
	(0.04)	(0.02)	(0.06)
	Fourth-difference		
	1988:01-1998:04	1988:01-1992:04	1993:01-1998:04
(0) Within PT	0.35***	0.42***	0.37***
	(0.05)	(0.07)	(0.10)
(1) Within ES	0.55***	0.66***	0.55***
	(0.06)	(0.05)	(0.07)
(2) Within countries	0.53***	0.64***	0.53***
	(0.06)	(0.05)	(0.07)
(3) Between countries	0.39***	0.50***	0.42***
	(0.06)	(0.06)	(0.09)
(4) Border effect = (2) *minus* (3)	-0.14***	-0.14***	-0.11***
	(0.03)	(0.02)	(0.03)

Note: Standard errors in parentheses obtained using GMM and Ogaki's (1993) specification
* significant at 10%, ** 5%, *** 1%

Table 9: Explaining the Border Effect: Quarterly series

	Hodrick-Prescott (λ=1600)			Fourth-difference		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Border	-0.11***	-0.10***	-0.10***	-0.09***	-0.09***	-0.10***
	(0.04)	(0.04)	(0.04)	(0.03)	(0.036)	(0.03)
Distance	0.01	-	-	-0.002	-	-
	(0.02)			(0.023)		
Adjacency	-	0.00	-	-	0.016	-
		(0.02)			(0.02)	
Dissimilarity	-0.18**	-0.17**	-0.17***	-0.198*	-0.183*	-0.194**
	(0.08)	(0.08)	(0.07)	(0.11)	(0.11)	(0.10)
Size	0.06***	0.06***	0.06***	0.071***	0.071***	0.071***
	(0.01)	(0.01)	(0.01)	(0.014)	(0.013)	(0.013)
$\overline{R}^2$	0.39	0.39	0.40	0.40	0.40	0.40
Nobs	190	190	190	190	190	190

Note: Standard errors in parentheses obtained using GMM and Ogaki's (1993) specification
* significant at 10%, ** 5%, *** 1%

Table 10: Explaining the Border Effect between Spain and Portugal: Annual series

HP Filter (λ=6.25)

	1975-1998			1975-1987			1988-1998		
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Border	-0.35***	-0.30***	-0.30***	-0.37***	-0.34***	-0.34***	-0.31***	-0.24***	-0.24***
	(0.06)	(0.06)	(0.06)	(0.13)	(0.13)	(0.13)	(0.06)	(0.07)	(0.06)
Dist	0.13***	-	-	0.06	-	-	0.14***	-	-
	(0.02)			(0.05)			(0.01)		
Adj	-	-0.02	-	-	0.00	-	-	-0.02	-
		(0.02)			(0.04)			(0.02)	
Dissim	-0.56***	-0.49***	-0.47***	-0.46**	-0.43*	-0.43**	-0.55***	-0.53***	-0.51***
	(0.13)	(0.13)	(0.13)	(0.21)	(0.23)	(0.21)	(0.14)	(0.13)	(0.14)
Size	0.05***	0.05***	0.05***	0.03***	0.03***	0.03***	0.03	0.03	0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)
$\overline{R}^2$	0.52	0.49	0.48	0.35	0.34	0.35	0.34	0.29	0.29
Nobs	190	190	190	190	190	190	190	190	190

First-difference

	1975-1998			1975-1987			1988-1998		
Border	-0.41***	-0.36***	-0.36***	-0.62***	-0.59***	-0.59***	-0.30***	-0.23***	-0.23***
	(0.10)	(0.10)	(0.09)	(0.16)	(0.14)	(0.14)	(0.05)	(0.05)	(0.05)
Dist	0.14***	-	-	0.08*	-	-	0.13***	-	-
	(0.02)			(0.04)			(0.02)		
Adj	-	-0.04	-	-	-0.05	-	-	-0.01	-
		(0.02)			(0.04)			(0.03)	
Dissim	-0.65***	-0.59***	-0.57***	-0.74***	-0.73***	-0.70***	-0.63***	-0.60***	-0.59***
	(0.12)	(0.12)	(0.12)	(0.25)	(0.27)	(0.25)	(0.14)	(0.12)	(0.14)
Size	0.05***	0.05***	0.05***	0.06***	0.06***	0.05***	0.05*	0.05*	0.05*
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)
$\overline{R}^2$	0.63	0.59	0.59	0.70	0.70	0.70	0.35	0.31	0.31
Nobs	190	190	190	190	190	190	190	190	190

Note: Standard errors in parentheses obtained using GMM and Ogaki's (1993) specification
* significant at 10%, ** 5%, *** 1%

Figure 1: Border effect in European and Iberian regions
first difference- confidence interval 99%

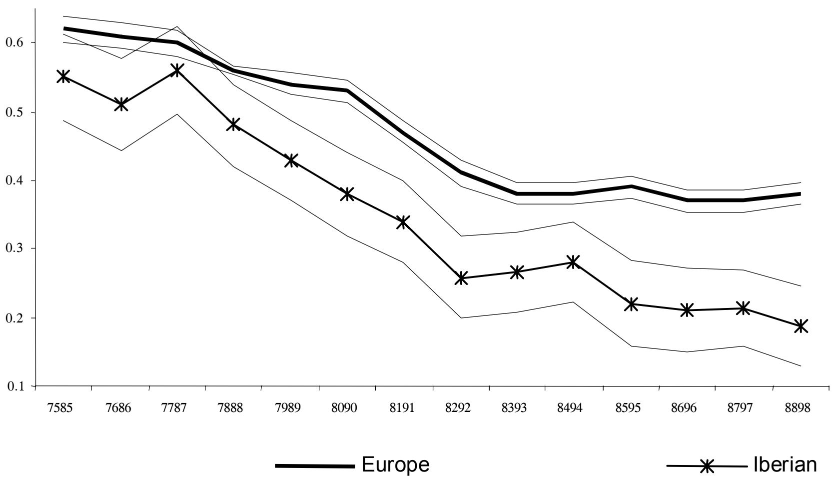


Figure 2: Border effect in European and Iberian regions
HP filter-confidence interval 99%

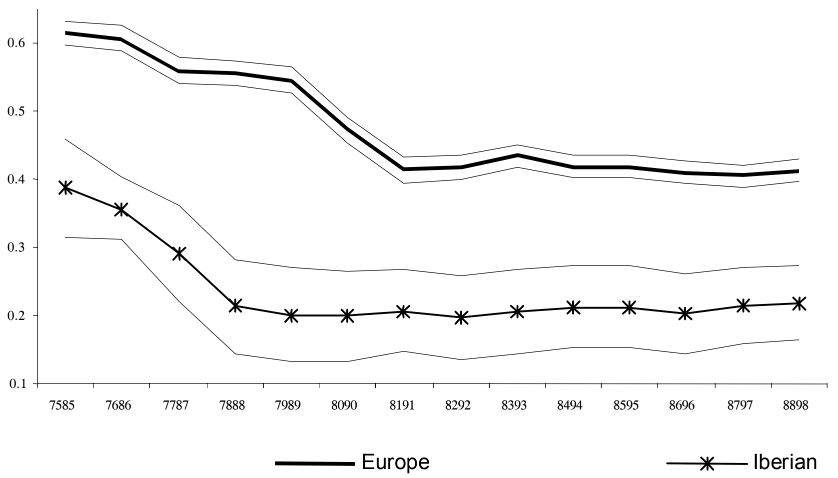


Figure 3: Trade intensity and Business Cycle correlation Spanish regions vs. Portugal, 1988-98

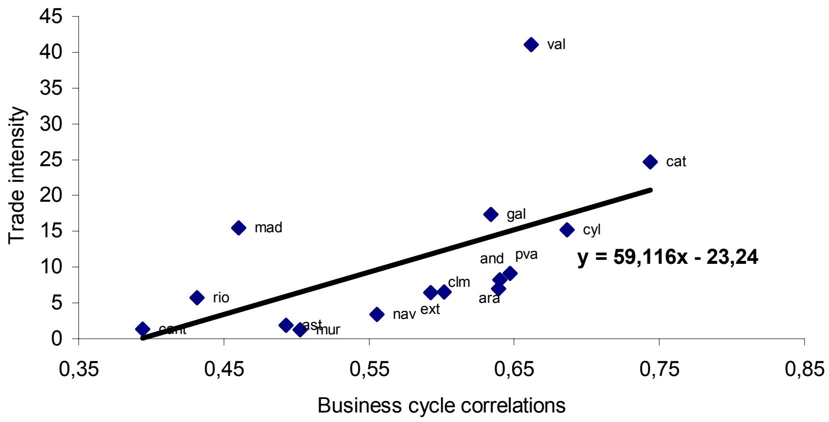
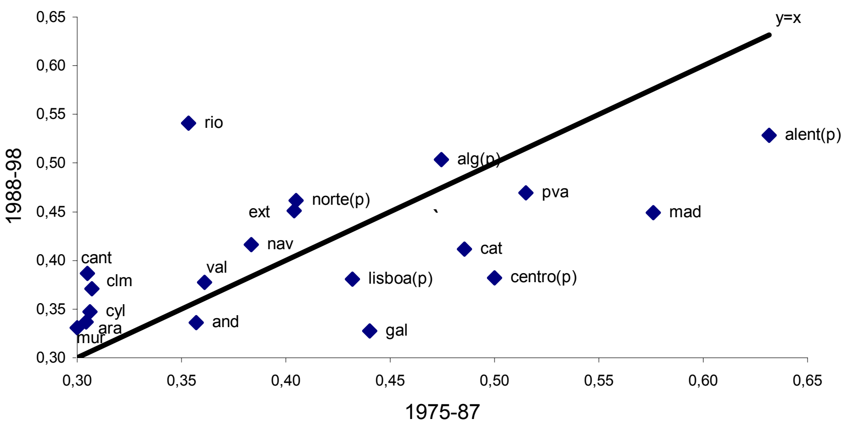


Figure 4: Change in specialisation, average by regions 75-98



Note: (p) Portuguese region

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