

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

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Abstract

This paper provides evidence of the positive impact of economic integration on EU regions' business cycles convergence by focusing on two neighbouring countries: Spain and Portugal. We show that while a rise in cross-country business cycle correlation has also been experienced by other European countries, it has been relatively more pronounced for Iberian regions. Econometric evidence suggests that the existence of an administrative border, the economic size of regions and their industrial structures can explain a substantial proportion of regional cycles.

I. 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

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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 the US 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 as they are highly integrated. In a recent study, Clark and van Wincoop (2001) have extended this approach in order to compare business cycle correlations of the US 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 along 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 two neighbouring countries: Spain and Portugal. Both countries have undergone a profound integration process largely encouraged by their accession to the European Community in 1986 and the greater openness to international trade and investment that followed. We show in particular that this process has led to a greater interdependence between these two economies.

The second aim of this paper is to test whether trade and industrial specialization can explain the pattern of business cycles of Iberian regions. Our analysis lies on the framework developed by Mundell (1961) and Kenen (1969). The later, in particular, advocates that sectoral specialization may play an important role in determining regional economic fluctuations. If shocks are mainly sector-specific, only those regions or countries with similar industrial

¹The notion of *border effect* in business cycle studies has to be considered in contrast to the one generally used by trade economists. For example, McCallum (1995) in a seminal work on border effects in trade uses 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 with inter-country trade.

structure can experience symmetric business cycles. To this respect, Krugman (1993) suggests that the US states may provide a good example of what can happen in Europe with increased specialization among European countries given that the US states tend to be more specialized (and are also more integrated) than European countries.² In addition, the economic integration process may modify the pattern of sectoral specialization as the reduction of barriers to trade can encourage the relocation of industries according to the relative strength of comparative advantage and agglomeration economies, see Fujita, Krugman, and Venables (1999). It follows that the influence of the industrial structure on cross-country business cycle correlation may vary according to the pace of economic integration.

The nature of industrial specialization, trade intensity and business cycle correlations are in fact closely linked, providing strong support for the endogeneity hypothesis of the optimum currency area (OCA) criteria as recently shown by Frankel and Rose (1998).³ The preceding authors emphasize trade as a transmission mechanism of economic fluctuations providing evidence for a panel of industrialized countries. Here we adopt a similar approach and 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 although) the decrease in the border effect observed for the rest of Europe. Secondly, we regress cross-correlation coefficients on a set of gravity-type and industrial specialization variables. Both the size of regions and their industrial specialization appear to be the most significant variables in explaining the growing correlation of Spanish and Portuguese regional business cycles.

The rest of the paper is structured as follows: section II provides a description of the data used, while section III analyses the business cycle of Iberian regions with a special emphasis on the period following the accession of these countries to the European Community. In section IV we test econometrically the role played by trade and specialization variables in explaining the economic co-fluctuations of Iberian regions. Section V concludes.

II. 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

²This assertion has been discussed widely in the literature, further work suggesting in fact that the level of specialization among the US states was roughly similar to the one in Europe, see Krugman (1991, 1993), Peri (1998) and Clark and van Wincoop (2001) for further discussion on this issue.

³The 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.

argued 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 data sets. The first one comes 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 1983–99. We chose to restrict the analysis to 1988–98 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 data set is taken from the Cambridge Econometrics database and is mainly based on Regio (Eurostat). It provides annual data on employment for Iberian and also for European regions between 1975–98. In both data sets the definition of a region is the NUTS2 level used by Eurostat with 15 and five 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 Spanish and Portuguese labour market, and for an examination of the evidence concerning the regional evolution of employment. As noted by Blanchard and Jimeno (1995) and Castillo, Dolado and Jimeno (1998), the Spanish and Portuguese economies share many 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 1970s 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 1980s. The preceding authors also showed that the transmission mechanisms and the persistence of shocks differed between both countries. Jimeno and Bentolila (1998) also 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

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

TABLE 1

Descriptive statistics, level and growth (g) of total employment in Spanish and Portuguese (P) regions. Quarterly employment data from INE, 198801–199804

	<i>L</i>	<i>SD g</i>	<i>g</i>	<i>Min g</i>	<i>Max g</i>
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	1,649.8	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	2,162.5	0.0355	0.0161	-0.0640	0.0764
Valencia	1,272.4	0.0293	0.0137	-0.0442	0.0581
Andalucía	1,800.2	0.0362	0.0146	-0.0734	0.0730
Murcia	324.5	0.0448	0.0190	-0.0352	0.1301
Norte (P)	1,640.3	0.0430	0.0034	-0.1132	0.0865
Centro (P)	845.8	0.0408	0.0127	-0.0882	0.0713
Lisboa (P)	1,526.4	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.

SD 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-quarter difference of the logarithms. Average level is expressed in thousands workers.

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

correlation instead, looking at the way trade and location variables affect the Iberian regions' business cycles.

III. 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 1950s when both countries started to liberalize their still tightly regulated economies during their dictatorial regimes. Table 3 provides evidence for this by reporting bilateral trade flow growth averages for the period 1961–98. While a clear slowdown in this trend occurred in the mid-1970s until 1985 following a

TABLE 2

Descriptive Statistics, level and growth (g) of total employment in Spanish and Portuguese (P) regions. Annual employment data from Cambridge Econometrics, 1975–98

	<i>L</i>	<i>SD g</i>	<i>g</i>	<i>Min g</i>	<i>Max g</i>
Galicia	1,038.6	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	1,563.6	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	2,080.3	0.0293	0.0036	-0.0421	0.0559
Valencia	1,223.2	0.0280	0.0084	-0.0466	0.0702
Andalucía	1,755.0	0.0316	0.0020	-0.0489	0.0520
Murcia	304.8	0.0349	0.0123	-0.0369	0.1129
Norte (P)	1,350.4	0.0213	0.0026	-0.0290	0.0667
Centro (P)	725.3	0.0368	0.0013	-0.0821	0.0800
Lisboa (P)	1,360.2	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:

See footnote of Table 1 for explanation of the variables.

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

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

TABLE 3

Bilateral total trade flows: Spain, Portugal and the European Union, average annual real growth rate during 1961–98

	<i>SP-EU*</i>	<i>SP-PT</i>	<i>PT-EU*</i>
1961–75	12.5	16.9	4.6
1976–85	-3.3	1.6	-10.5
1986–92	12.3	28.2	15.7
1993–98	1.4	6.6	-0.9

Notes:

*Excludes Spain and Portugal.

Sources: OECD and authors' computations.

general downturn in world economic activity and international trade, the 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 last years have also seen

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	10,864	43	10,907	3,04,201	1,53,096	4,57,298	2.4	2.4
1989	46,582	164	46,746	4,01,397	2,21,259	6,22,657	7.5	9.3
1990	35,331	446	35,777	3,92,154	2,45,000	6,37,154	5.6	13.0
1991	55,839	3,664	59,503	4,68,491	2,97,609	7,66,099	7.8	12.4
1992	64,281	10,830	75,111	5,66,512	3,16,128	8,82,640	8.5	15.3
1993	1,09,311	2,378	1,11,690	6,11,601	2,85,291	8,96,892	12.5	20.8
1994	2,69,170	2,317	2,71,487	7,98,595	3,38,996	11,37,591	23.9	33.7
1995	1,21,283	7,392	1,28,675	9,24,660	4,05,765	13,30,425	9.7	30.1
1996	1,61,841	11,277	1,73,118	11,03,634	4,43,080	15,46,714	11.2	19.5
1997	1,82,309	3,677	1,85,986	13,29,907	4,66,383	17,96,290	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 export 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 authors' computations.

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 has been more volatile than its EU counterparts, but became more synchronized with the EU cycle from the mid-1980s onwards as trade intensity deepened. In another paper, Fatás (1997) shows that European integration has notably reduced the significance of national borders in terms of business cycle correlation.

Before going further it is important to point out the way the border effect is determined. Cross-correlation coefficients (i.e. the correlation between all European regions) are first computed and then regressed on a constant (the average correlation) and a dummy variable equal to 1 when two regions j and k belong to the same country and 0 otherwise. This dummy variable represents the border effect as it measures the difference between within and cross-country correlation averages. Tables 5 and 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

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:

AT: Austria; BE: Belgium; DE: Germany (West); DK: Denmark; ES: Spain; FI: Finland; FR: France; GR: Greece; IE: Ireland; IT: Italy; NL: Netherlands; PT: Portugal; SE: Sweden; UK: United Kingdom. Correlations computed on annual series of regional employment (NUTS2 regions) filtered with Hodrick–Prescott filter with $\lambda = 6.25$ as suggested by Ravn and Uhlig (1997).

Sources: Cambridge Econometrics and authors' computations.

and present country-level average of regions' cross-correlation.⁵ It appears that between-countries' regional correlation has increased over time from an average of 0.10 to 0.28 while within-countries' correlation has 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. The decline in the border effect is also apparent when using moving windows averages over 10 years starting from 1975–85 and ending in 1988–98 for the same set of regions. Figures 1 and 2 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

⁵We use the HP 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 $\lambda = 1600$ for quarterly series as suggested by Hodrick and Prescott (1997).

⁶The average correlation coefficient has been obtained by running a simple ordinary least square (OLS) regression of cross-correlation coefficients on a constant term and a dummy variable equal to 1 when two regions are located in the same country and 0 otherwise. Accordingly, the coefficient β on this dummy variable represents the border effect for which a 99% confidence interval can be computed using $\beta_j \pm c \text{SE}(\hat{\beta})$ to compute the lower and upper bound of the confidence, SE being the standard errors of the estimated coefficient and c the appropriate percentile for a t_{n-k-1} distribution where n is the number of observations and k the number of explanatory variables. Note that these confidence intervals are not corrected for possible dependency across residuals, possibly biasing the significance of the border effect. This question will be addressed in the next section.

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 $\lambda = 6.25$ as suggested by Ravn and Uhlig (1997).

Sources: Cambridge Econometrics and authors' computations.

important features emerge: first, the border effect is lower and less significant between Spain and Portugal than between other European regions. Secondly, 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. The picture looks similar using first differenced series where the decline occurs in a more progressive fashion over the whole period.⁷ Spain and Portugal have not been the only two neighbouring economies to experience a significant decline in the border effect. Going back to Tables 5 and 6, we also observe a rise in between-countries correlation for many country-pairs, especially neighbouring countries like France and Germany, France and Spain, The Netherlands and Germany, Belgium and The Netherlands, and Austria and Italy, among others. This suggests that other neighbouring regions in the European Union have experienced a similar increase in cross-country business cycles correlation.

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. We then have to rely 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

⁷We will discuss the differences in the results between the different de-trending methods in the next section.

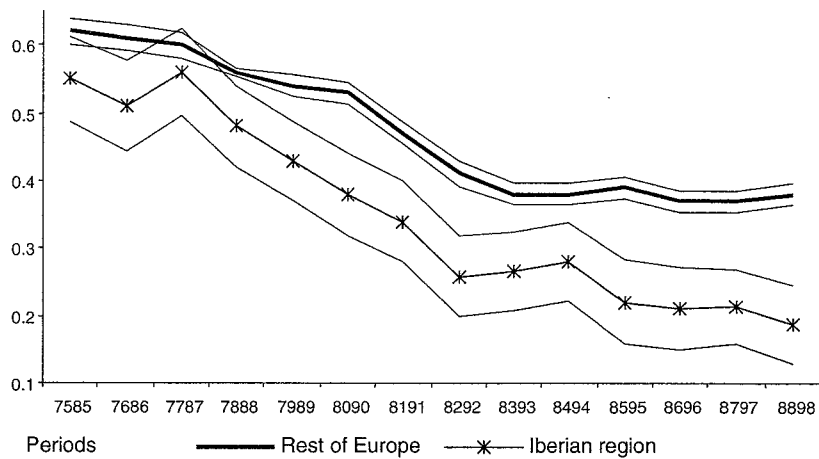


Figure 1. Border effect in European and Iberian regions (first difference—confidence interval 99%)

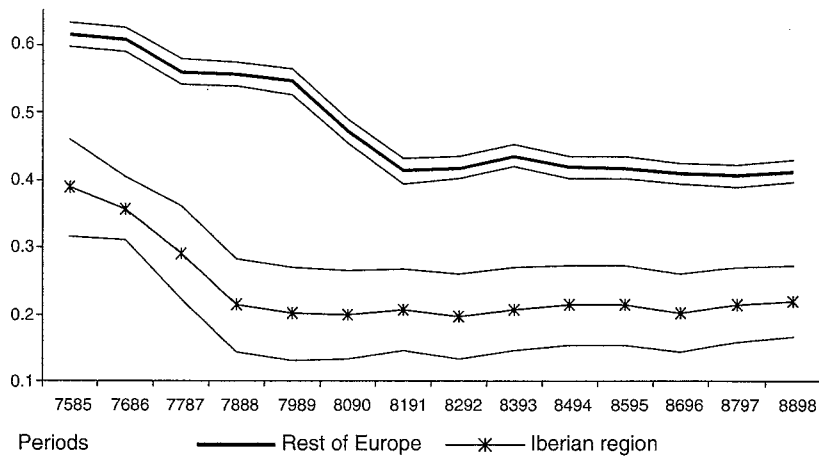


Figure 2. Border effect in European and Iberian regions (HP filter—confidence interval 99%)

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 1988–98.⁸ There seems to be a positive link between each region's business cycle correlation and its trade with Portugal. OLS estimates reported in Figure 3 support this

⁸Data 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 $(X_i + M_i)/(X_s + M_s)$, where X_i and M_i are the averages export and imports of Spanish region i to Portugal over the period 1988–98 and X_s , M_s represent the average of Spain exports and imports with Portugal.

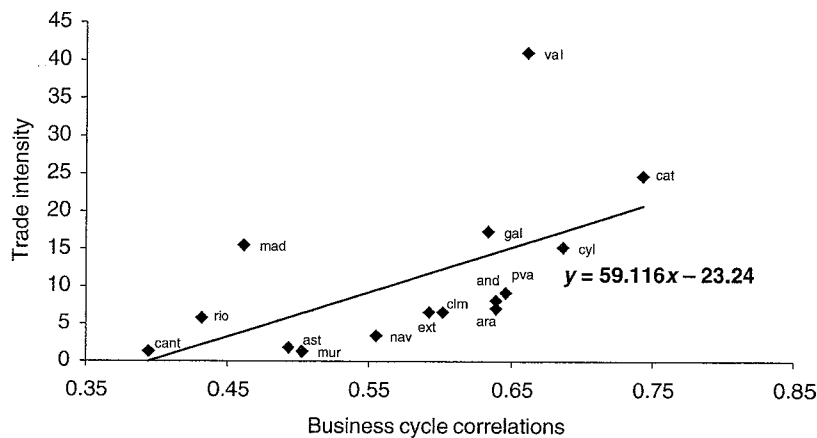


Figure 3. Trade intensity and business cycle correlation (Spanish regions vs. Portugal, 1988–98)

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, and, secondly, because Figure 3 compares a country's employment fluctuations (Portugal) with regions' fluctuations (Spain). Thus we need further evidence in order to explain the general trends observed in the business cycle correlation considering all Iberian regions' cross-correlation.

IV. Explaining regional business cycles

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:

$$\hat{p}_i = \mathbf{x}_i' \beta + e_i \quad (1)$$

where \hat{p}_i is the estimated correlation coefficient between two regions j and k that form the pair i while \mathbf{x}_i is a vector of explanatory variables. Frankel and Rose (1998) use a similar approach to study a set of industrialized 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 based on the Generalized Method of Moments (GMM) following Ogaki's (1993) method.⁹

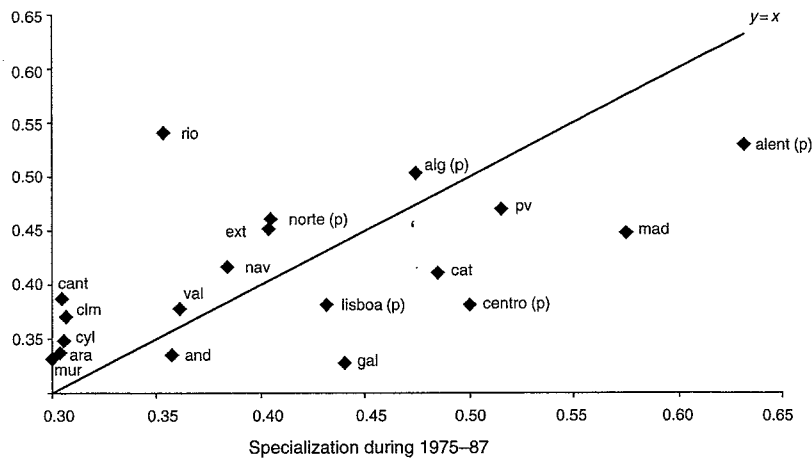
⁹See Clark and van Wincoop for further details.

In terms of our explanatory variables, as noted earlier, the main explanatory variable is the dummy variable representing the border effect. This variable is equal to 1 when two regions belong to the same country and 0 otherwise. We also use an indicator of industrial dissimilarity (the so-called Krugman index) based on sectoral employment using the following formula:

$$\text{Dissimilarity}_{jk} = \sum_{n=1}^N |s_{nj} - s_{nk}| \quad (2)$$

where s_{nj} and s_{nk} denote the employment shares of sector n in regions j and k , where j and k form the pair of regions i mentioned in equation (1). The sector level data covers eight sectors: agriculture, banking and insurance, construction, distribution, energy and manufacturing, transport and communications, non-market services and other market services. According to previous arguments, we assume that if shocks are sector-specific then two highly dissimilar regions will face asymmetric shocks. The expected sign for our dissimilarity measure is then negative.

Figure 4 shows that the dissimilarity index remains, on average, fairly stable over the period 1975–98, the dots above the 45° line indicating a rise in specialization for the corresponding regions. Portuguese regions (indicated by p in the figure) appear to be more specialized than their Spanish counterparts with an average index equal to 0.44, while Spanish regions' average index is equal to 0.31. In addition, regions tend to be more dissimilar when located in different countries. We also 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



Note: (p) Portuguese region

Figure 4. Change in specialization, average by regions 1975–98

(for the Spanish region Rioja) does one observe a sharp increase in specialization with respect to all other regions. 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.

We have to rely on two proxies for trade: distance and size. Distance is computed as the spherical distance (taking into account the curvature of the earth) between two regions' capitals.¹⁰ 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 if transport costs are low.¹¹ Figure 3 provided some contradictory evidence on this ground however. We observe that Spanish regions like Catalonia or Valencia that trade more with Portugal are not necessarily geographically close to this country. Other regions like Andalusia and Extremadura, physically close to Portugal, do not display especially high trade intensity. As mentioned earlier, this figure only concerns trade between Spanish regions and the whole Portugal so that only partial conclusion can be drawn on this basis. In order to check further the explanatory power of size and distance variables we used them in a regression with annual bilateral trade intensity between Spanish regions and Portugal as a whole as dependent variable over the period 1988–98. Results confirmed that alternatively distance or adjacency are not good proxies for trade between both countries while only size displayed the expected results. One then needs to be cautious when interpreting the results for the *distance* or *adjacency* variables.¹²

Tables 7 and 8 present estimates of the average correlation coefficients using GMM and Ogaki's (1993) specification as outlined above using annual and quarterly series, respectively. A first comparison of both tables reveals somewhat similar results, except 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 the 1% level when using quarterly series for the same period. It should be noted that such differences are more likely to be because of the different de-trending methods used here together with the differences in the time span and the frequency of

¹⁰Co-ordinates were obtained from <http://www.getty.edu/research/tools/vocabulary/tgn/index.html>.

¹¹Note 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.

¹²Results from these regressions are available from the authors upon request.

TABLE 7
Average-correlations and border effect estimates: annual series

	1975–98	1975–87	1988–98
Hodrick–Prescott filter ($\lambda = 6.25$)			
(0) Within PT	0.10* (0.07)	0.07 (0.09)	0.12 (0.12)
(1) Within ES	0.60*** (0.06)	0.48*** (0.09)	0.67*** (0.06)
(2) Within countries	0.55*** (0.05)	0.44*** (0.09)	0.62*** (0.06)
(3) Between countries	0.18*** (0.07)	0.04 (0.06)	0.34*** (0.07)
(4) Border effect = (2) – (3)	–0.37*** (0.06)	–0.40*** (0.12)	–0.28*** (0.06)
First difference			
(0) Within PT	0.07 (0.06)	0.16** (0.08)	0.13 (0.13)
(1) Within ES	0.65*** (0.05)	0.67*** (0.09)	0.61*** (0.08)
(2) Within countries	0.60*** (0.04)	0.63*** (0.08)	0.57*** (0.08)
(3) Between countries	0.16** (0.07)	–0.06 (0.09)	0.29*** (0.09)
(4) Border effect = (2) – (3)	–0.44*** (0.09)	–0.69*** (0.13)	–0.28*** (0.04)

Notes:

Standard errors in parentheses obtained using GMM and Ogaki's (1993) specification.

*Significant at 10%, **5% and ***1% level.

the data. For example, first-differences gives much more importance to short term fluctuations with high-frequency series while the HP filter tends to render those fluctuations much smoother.

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.¹³ The magnitude of the border effect also differs according to the series being used in that it is much larger when using annual data. In all cases the border effect estimates display the expected sign and are highly significant. In the case of the annual series for 1988–98, we obtain a border effect equal to –0.28 both for the first differenced and HP-filtered series, while for the quarterly series the border effect is equal to –0.15. These results may not seem surprising if one considers that over a short horizon regions within the same country may face

¹³We consider that a region is small when it has less than 200,000 workers. Details on the cross-correlation coefficients available from the authors.

TABLE 8
Average-correlations and border effect estimates: quarterly series

	1988:01–1998:04	1988:01–1992:04	1993:01–1998:04
Hodrick–Prescott filter ($\lambda = 1600$)			
(0) Within PT	0.36*** (0.05)	0.36*** (0.08)	0.34** (0.14)
(1) Within ES	0.62*** (0.05)	0.69*** (0.08)	0.50*** (0.09)
(2) Within countries	0.60*** (0.05)	0.66*** (0.08)	0.49*** (0.09)
(3) Between countries	0.45*** (0.05)	0.51*** (0.08)	0.37*** (0.11)
(4) Border effect = (2) – (3)	–0.15*** (0.04)	–0.15*** (0.02)	–0.12* (0.06)
Fourth difference			
(0) Within PT	0.35*** (0.05)	0.42*** (0.07)	0.37*** (0.10)
(1) Within ES	0.55*** (0.06)	0.66*** (0.05)	0.55*** (0.07)
(2) Within countries	0.53*** (0.06)	0.64*** (0.05)	0.53*** (0.07)
(3) Between countries	0.39*** (0.06)	0.50*** (0.06)	0.42*** (0.09)
(4) Border effect = (2) – (3)	–0.14*** (0.03)	–0.14*** (0.02)	–0.11*** (0.03)

Notes:

Standard errors in parentheses obtained using GMM and Ogaki's (1993) specification.

*Significant at 10%, **5% and *** 1% level.

asymmetric shocks that tend to be smoothed in the long run by redistributive policy at the national level, labour mobility, or changes in labour participation rates. However, previous studies have shown that labour mobility between Spanish regions was fairly low, see Bentolila (1997) for further evidence. We cannot draw any clear conclusion on this point as it is arguably difficult with the data at hands to distinguish between this kind of mechanism and the possible existence of additional noise in the quarterly series.

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 –0.40 in 1975–87 to –0.28 in 1988–98 for the HP-filtered series and from –0.69 to –0.28 when using first differences. Splitting the quarterly series into two sub-periods does not provide any conclusive evidence, as shown in Table 8. The decline of the border effect 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 turbulence in the early 1990s

TABLE 9
Explaining the border effect: quarterly series

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

Notes:

Standard errors in parentheses obtained using GMM and Ogaki's (1993) specification.

*Significant at 10%, **5% and ***1% level.

may explain part of the lower path in the decline of the border effect that followed. The results in Table 7 concerning annual series over the time span 1975–98 show that the significant increase in the between-countries correlation explains 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 specialization and gravity-type variables using different filtering methods in order to check the consistency of our results. Table 9 shows that the distance variable and its substitute, the adjacency variable, are, however, never significant 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 the 1% level when using HP-filtered series and displays similar values when using fourth quarter lags, where the significance 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 ranging between 0.06 and 0.071. These results are close to the ones presented in Table 10. Finally, the

TABLE 10
Explaining the border effect between Spain and Portugal: annual series

	1975-87			1988-98					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Hodrick-Prescott filter ($\lambda = 6.25$)									
Border	-0.35*** (0.06)	-0.30*** (0.06)	-0.30*** (0.06)	-0.37*** (0.13)	-0.34*** (0.13)	-0.34*** (0.13)	-0.31*** (0.06)	-0.24*** (0.07)	-0.24*** (0.06)
Dist	0.13*** (0.02)	—	—	0.06 (0.05)	—	—	0.14*** (0.01)	—	—
Adj	—	-0.02 (0.02)	—	—	0.00 (0.04)	—	—	-0.02 (0.02)	—
Dissim	-0.56*** (0.13)	-0.49*** (0.13)	-0.47*** (0.13)	-0.46** (0.21)	-0.43** (0.23)	-0.43** (0.21)	-0.55*** (0.14)	-0.53*** (0.13)	-0.51*** (0.14)
Size	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.03 (0.03)	0.03 (0.03)	0.03 (0.03)
\bar{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									
Border	-0.41*** (0.10)	-0.36*** (0.10)	-0.36*** (0.09)	-0.62*** (0.16)	-0.59*** (0.14)	-0.59*** (0.14)	-0.30*** (0.05)	-0.23*** (0.05)	-0.23*** (0.05)
Dist	0.14*** (0.02)	—	—	0.08* (0.04)	—	—	0.13*** (0.02)	—	—
Adj	—	-0.04 (0.02)	—	—	-0.05 (0.04)	—	—	-0.01 (0.03)	—
Dissim	-0.65*** (0.12)	-0.59*** (0.12)	-0.57*** (0.12)	-0.74*** (0.25)	-0.73*** (0.27)	-0.70*** (0.25)	-0.63*** (0.14)	-0.60*** (0.12)	-0.59*** (0.14)
Size	0.05*** (0.02)	0.05*** (0.02)	0.05*** (0.02)	0.06*** (0.01)	0.06*** (0.01)	0.05*** (0.01)	0.05* (0.03)	0.05* (0.03)	0.05* (0.03)
\bar{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

Notes:

Standard errors in parentheses obtained using GMM and Ogaki's (1993) specification.

*Significant at 10%, **5% and ***1%

absolute value of the border effect is lower than previously, meaning that the set of explanatory variables used here explain part (but not all) of the border effect.

V. Conclusion

This paper provides evidence on the positive impact of economic integration on regional business cycles' correlation. We study 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). 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. However, we also observed that other neighbouring European countries have also experienced a clear decline in the border effect, suggesting that the Iberian experience is not unique and can illustrate the impact of economic integration on regional cycles. In testing the determinant of economic co-fluctuations we show that the relative size and industrial structures of regions were the most significant variables. The latter result suggests that two regions with asymmetric industrial specialization will also tend to face asymmetric shocks.

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