

Spanish Regions and the Macroeconomic Benefits of the European Monetary Union

JOAN COSTA-I-FONT and RAMON TREMOSA-I-BALCELLS

Departament de Teoria Econòmica, Universitat de Barcelona, Avinguda Diagonal 690, Barcelona – 08034, Spain.

Emails: jcosta@eco.ub.es; tremosa@eco.ub.es

(Received February 2001; in revised form August 2002)

COSTA-I-FONT J. and TREMOSA-I-BALCELLS R. (2003) Spanish regions and the macroeconomic benefits of the European Monetary Union, *Reg. Studies* 37, 217–226. This paper empirically examines the extent to which regions within the *same country* differ in their exposure to a common currency. We estimate an Optimum Currency Areas (OCA) index based on the main theoretical macroeconomic determinants. We use data from the Spanish regions for the period 1992–98 and Germany is taken as a *numeraire*. Results allow us to forecast whether sharing the same currency is equally suitable for regions differing in the relevant OCA determinants despite being equally exposed to national specific shocks. The results suggest three main findings. First, relatively large, more diversified and open regions are best prepared to share the same currency. Second, real exchange rate differs significantly between Spanish regions although these differences remain smaller than those between countries. Third, whereas at the regional level the degree of synchronization with the European Union (EU) business cycle is strongly associated with the OCA index, differences in fiscal performance and the unemployment rate were poor predictors of monetary integration.

Optimum currency area Regional integration Spanish regions

COSTA-I-FONT J. et TREMOSA-I-BALCELLS R. (2003) Les régions espagnoles et les avantages macroéconomiques de l'Union monétaire européenne (l'UME), *Reg. Studies* 37, 217–226. Cet article cherche à examiner de façon empirique dans quelle mesure les régions au sein du *même pays* se distinguent quant à leur ouverture à une monnaie unique. On évalue une indice des zones monétaires optimales (Optimum Currency Areas; OCA) fondée sur les principaux déterminants macroéconomiques théoriques. On se sert des données provenant des régions espagnoles pour la période de 1992 à 1998 et on considère l'Allemagne comme *numéraire*. Les résultats permettent de prévoir si, oui ou non, la monnaie unique convient de façon équitable aux régions dont les composants déterminants de l'indice OCA diffèrent, en dépit du fait qu'elles sont exposées équitablement aux chocs nationaux particuliers. On peut en tirer les trois conclusions suivantes. Primo, les régions plus grandes, plus diversifiées et plus ouvertes sont plus prêtes à partager une monnaie unique. Secundo, le taux de change réel varie sensiblement d'une région espagnole à une autre, bien que ces variations soient moins importantes au niveau interrégional que sur le plan international. Tertio, tandis que du point de vue régional la synchronisation avec le cycle économique de l'Union européenne (l'Ue) s'avère étroitement liée à l'indice OCA, la variation du comportement fiscal et du taux de chômage sont de mauvais indicateurs de l'intégration monétaire.

Zone monétaire optimale Intégration régionale
Régions espagnoles

COSTA-I-FONT J. und TREMOSA-I-BALCELLS R. (2003) Spanische Regionen und die makroökonomischen Vorteile der europäischen Währungsunion (EMU), *Reg. Studies* 37, 217–226. Der vorliegende Aufsatz untersucht das unterschiedliche Ausmaß, in dem Regionen eines Landes einer gemeinsamen Währung ausgesetzt sind. Die Autoren stellen einen optimalen Währungsgebietsindex (OCA Index) auf, der sich auf die wichtigsten theoretischen makroökonomischen ausschlaggebenden Faktoren stützt. Dazu benutzen sie Daten der spanischen Regionen für den Zeitraum 1992–1998, und Deutschland dient als Kontrollobjekt. Die Ergebnisse gestatten ihnen, vorauszusagen, ob die Benutzung derselben Währung für Regionen gleich gut geeignet ist, die Unterschiede in den relevanten OCA Bestimmungsfaktoren aufweisen, obschon sie gleichermaßen spezifischen überregionalen Schocks ausgesetzt sind. Auf Grund der Ergebnisse bieten sich drei Hauptbefunde an: erstens sind verhältnismäßig große, stärker diversifizierte und offene Regionen am besten darauf vorbereitet, die gleiche Währung gemeinsam zu benutzen. Zweitens schwankt die tatsächliche Wachstumsrate von einer spanischen Region zur anderen bedeutend, obwohl diese Unterschiede sich in engeren Grenzen bewegen als die zwischen Ländern. Drittens erweisen sich Unterschiede in finanzpolitischer Leistung und der Erwerbslosenrate als schlecht zur Vorhersage der Währungsintegration geeignet, doch auf regionaler Ebene hält der Umfang der Synchronisierung mit dem Geschäftskreislauf der Europäischen Union (EU) durchaus mit dem OCA Index Schritt.

Optimales Gebiet für eine Währung
Regionale Integration Spanische Regionen

INTRODUCTION

Economic and monetary integration has a significant impact on the structure and the allocation of resources among countries and regions within countries. In Europe, monetary integration may be characterized by a rise in regional specialization (KRUGMAN, 1990, 1991, 1993), an increase of trade intensity between regions involved (FRANKEL and ROSE, 1997; ROSE, 2000) and, finally, by a stronger business cycle synchronization resulting in the inability to use country specific instruments to overcome regional asymmetries. In a setting like the one described, there is a general concern that the uneven distribution of the macroeconomic costs and benefits of the EMU may exacerbate regional inequalities both *between* and *within* European Union (EU) Member States (NIJKAMP and WANG, 1999); for theoretical findings, see MARTIN, 1999; and PALUZIE, 2001. Empirical evidence (ESTEBAN and VIVES, 1994) suggest that, as a result of differences in productivity, trade intensity and especially asymmetries in the distribution of transaction costs, regional inequalities will increase. ALBEROLA and MARQUES, 2001, using data on Spanish regions, show that there are still persistent price variations across regions within a single country, mainly due to dissimilarities in labour productivity and income between regions. Similar predictions hold when labour productivity is analysed among EU regions (CUADRADO ROURA *et al.*, 2000).

Although the building process of the EMU has remained at the country level, the expected regional effects within an EU country cannot be dismissed. Some studies show that regions within some EU countries are not integrated areas. RAYMOND and GARCIA, 1998, employ association analysis of the cyclical component of the regional GDP to show that Spanish regions appear to be 'heterogeneously integrated'. IAMMARINO and SANTANGELO, 2000, show detectable heterogeneity between Italian regions in their capacity to attract foreign capital and in competitiveness. As a result we would expect regions to differ in their capacity to cope with the adjustment requirements of a common currency despite being part of the same country. This could translate into widespread differentials in relative price variability and, in turn, in significant real exchange rate variability between regions.

This paper examines whether there are significant differences in the exposure of regions within a country to a common currency. The set-up of a common currency entails that nominal exchange rate cannot be used as a policy instrument to improve regional competitiveness artificially. Thus, real exchange rate variability (resulting from price variability) contains the relevant information on the capacity of a region to maintain an irrevocable fixed exchange rate arrangement, such as a monetary union. The main issue tackled in this paper is the following: is the EMU

equally suitable for regions as compared to countries? What determines monetary integration performance at the regional level? Can we extrapolate the same determinants used at the national level to regions *within* a country which, in turn, have been exposed to the same economic policies for a long period of time? To deal with these questions we rely on the optimum currency area (OCA) framework as it has shown to be an appropriate model for predicting real exchange rate at the country level (BAYOUMI and EICHENGREEN, 1997).¹

The EMU has attracted much attention in the academic literature worldwide. Some of this literature attempts to predict the regional effects of monetary arrangements in different geographic areas. Nevertheless, major difficulties arise when it comes to the empirical operationalization (DE GRAWVE and VAN-HAVERBEKE, 1993). A first approach compares the EMU with the US taken as a benchmark. Alternative approaches use data from a set of specific countries (FRANKEL and ROSE, 1997), or rely on a pool of international country-based data to determine the 'optimum' number of OCA's in the world (ARTIS *et al.*, 1998). Prior empirical evidence assessed on a country basis reveals that a relevant set of OCA determinants explains exchange rate variability at the national level (BAYOUMI and EICHENGREEN, 1997; COSTA and BATALLA, 1999). Some studies – conducted after the implementation of the Euro as a common currency – deal with the expected effects on output disturbances of a change in the interest rate. TREMOSA and PONS, 2001, employ a VAR methodology to show that a change in the interest rate has an asymmetric impact on the different EU countries. More recently, ANGELONI *et al.*, 2002, find wide monetary policy heterogeneity in the Euro-area for prices and output but not for interest rates. Finally, a large set of studies examine on the basis of country data whether the EMU will raise trade, although there is no empirical agreement here. Whereas GLICK and ROSE, 2002, show that those countries leaving a currency union experienced a halving of trade between trade partners, THOM and WALSH, 2002, find that the link between the Irish and the sterling pound had no effect on trade.

At the current stage, research on the effects of the EMU is mainly based on the assumption that pre-existing countries are the exclusive 'economic actors' of currency areas. Nevertheless, this is a strong assumption indeed and not always sustainable in the light of the OCA theory. Although a common currency replaces pre-existing national currencies it should be acknowledged the existence of noticeable historical heterogeneity within a single country. The implementation of EMU – as long as it eliminates the possibility to artificially offsetting regional differences – might highlight regional differences that were hidden in the national component of exchange rate variability.

Therefore, country based aggregation might be artificially hiding counterbalancing regional economic effects.

Given that some shocks are sector specific, diversification is a desirable characteristic for regions as it may help to reduce regional shock asymmetry (KENEN, 1969). Prior empirical evidence shows that although national specific cycles are more important than sector-specific cycles, in most countries, e.g. Spain, Belgium and the Netherlands, both types of shocks seem to be of similar importance (RAMOS *et al.*, 1999). Accordingly, the establishment of EMU does not eliminate regional-specific asymmetries within countries. Significant differences might be found across regions in maintaining price stability arrangements although wages are centrally determined (ALBEROLA and MARQUES, 2001). Therefore, it may be worth analysing the determinants of real exchange rate stability from a regional rather than a national perspective.

This paper reports three main empirical results. First, we find support for an application of the OCA theory at the regional level within a country. Second, when OCA is applied to Spanish regions we find significant differences in the capacity of regions to cope with a European common currency. However, regional differences are lower than those observed among states (BAYOUMI and EICHENGREEN, 1997). Third, the OCA index is strongly associated with the degree of synchronization with the EU business cycle and economic regional size, and to a lesser extent associated with the degree of openness.

The paper is organized as follows. The next section introduces some theoretical underpinnings and reports preliminary empirical analysis. In the third section we describe the data and empirical methodology. The fourth section sets out the empirical results and the paper concludes with final remarks and a discussion on the regional policy implications.

THEORETICAL BACKGROUND

The existence of a common currency implies that the nominal exchange rate is no longer an available economic policy instrument to accommodate differences in real exchange rate. The compound consequences are the associated reductions in transaction costs and in the uncertainty resulting from the removal of the currency specific exchange rate risk. Other effects might follow from a possible rise in bilateral intra-EU trade (FRANKEL and ROSE, 1997) although as noted there is no agreement in the literature.

From an overview of economic theory, the appropriate conceptual framework to analyse whether there are differential effects on regions within the same country of joining a currency union is the theory of the optimum currency areas (OCA). This theory has been empirically tested and seems to predict successfully the variability of exchange rates between currencies in

several specific economic areas (BAYOUMI and EICHENGREEN, 1988). Some criticism arises when judging the suitability of a monetary union on the basis of the OCA theory. FRANKEL and ROSE, 1997, 1998, argue that in the event of monetary union in Europe, the structure of these economies is likely to change, since the elimination of nominal exchange rate variability will increase trade, which in turn might lead to a rise in the business cycles synchronization (so called 'endogenous convergence hypothesis'). This was also stipulated in the famous European Commission study entitled *One Money, One Market* (EUROPEAN COMMISSION, 1990). However, theoretical literature based on business cycle models points out that differences in industrial structure may lead to the violation of the endogenous convergence hypothesis (HUGHES HALLETT and PISCITELLI, 2002). Although larger trade links might lead to a greater synchronization of business cycles, they might simultaneously influence industrial specialization, as KRUGMAN, 1993, points out.

The observation that higher trade integration results in a higher business cycle synchronization, might be the combined result of both specialization and integration effects where the second takes a larger effect. Additionally, regions differ in their capacity to take advantage of the greater trade intensity resulting from economic integration, therefore an increase in trade might enhance economic asymmetries between regions. Finally, empirical evidence at the regional level in Spain (ESTEBAN and GUAL, 1999) shows that even though trade links with the European Union are large in most Spanish regions, the degree of synchronization of business cycles is still noticeably small.

The analysis of the OCA determinants in Europe is nonetheless informative regarding the relevant structural limitations associated with the establishment of a monetary area. Historically, factor mobility was the principal determinant to be examined (MUNDELL, 1961). As previous studies show, labour mobility is very low within the European Union and is subject to the strong limitation of cultural and linguistic barriers (BEGG, 1995). Capital mobility may function as an adjustment mechanism under the restrictive assumption of constant returns to scale (BAYOUMI and EICHENGREEN, 1993). Other microeconomic determinants such as wage rigidity and labour mobility have been excluded from our analysis. Instead we concentrate on the macroeconomic determinants of a regional OCA performance. The reason for this is that although microeconomic determinants may play a role at the regional level, nominal wages are still centrally determined and labour mobility is negligible in playing a significant role in predicting real exchange rate variability at the regional level. As in the rest of the European Union, prices and salaries in Spain are not flexible enough to be used as a policy instrument in the short run (VIÑALS and JIMENO, 1996). Evidence from Spain reveals a high real wage rigidity at the regional level

(VILLAVERDE and SANCHEZ-ROBLES, 1999). Finally, as a result of both social and economic factors, regional mobility in Spain has been declining since the 1970s (BENTOLILA, 1997).

As noted, in this paper we concentrate in the macro-economic benefits of OCAs. From the literature revision we selected four relevant determinants influencing the suitability of exposure to a common currency.² First, the degree of regional specialization or product diversification is suggested as a variable that might influence the ability of regions to counteract sector specific shocks (KENEN, 1989). Second, bilateral trade and openness determines the capacity of regions to benefit from reductions in transaction costs (MCKINNON, 1963). Third, as a result of the existence of shock asymmetries once a currency area is set up, no counter-cyclical monetary policy can be applied (BAYOUMI and EICHENGREEN, 1993) and, finally, a fourth determinant is economic size (MUNDELL, 1961).

According to the OCA theory, output disturbances, diversification and trade intensity are important predictors of exchange rate variability. To this extent, we used cluster analysis to classify regions according to these three predictors as a way to guide the further interpretation of results.

Symmetry with the EU business cycle

Regions differ in their business cycles due to two main reasons: regional specialization; and national economic policies. The first refers to the mix of products in which each region specializes, and hence the sensitivity to industry specific shocks. The second is concerned with differences in economic policies, which are responsible for regional fluctuations at the *country level*. ESTEBAN and GUAL, 1999, compared the share of the regional business cycle explained by the European component across the 17 Spanish regions. Empirical analysis shows that the regional business cycle of the Spanish front-runner regions (in particular Catalonia, being open and highly industrialized, and Madrid, as the administrative centre) is mostly driven by the German business cycle. Whereas the cyclical component of the German business cycle explains more than 80% of the Catalan or Madrid business cycles, it explains less than 20% of the La Rioja or Cantabrian business cycle. This implies that Catalonia and Madrid are supposedly the regions which are least sensitive to *country specific shocks* (see Table 1). Additionally, in 1999 the two regions produced 20% and 17% of the Spanish GDP respectively. Other regions that exhibit a large synchronization relative to the EU business cycle are those that are either relatively more open to trade or are largely diversified. If we focus, however, on those regions that are less diversified and more closed to trade, we find a reduced share of the business cycle is explained by the EU component. This result confirms

Table 1. Basic OCA-threshold criteria

	Manufacturing sector in total GDP, 1994 ¹	% European business cycle*
Andalucía	0.17	68
Aragón	0.30	41
Asturias	0.33	59
Balearic Islands	0.10	34
Canaries	0.11	—
Cantabria	0.27	19
Castilla-León	0.27	23
Castilla-La Mancha	0.26	74
Catalonia	0.33	83
Valencian Community	0.28	58
Extremadura	0.19	28
Galicia	0.23	56
Madrid	0.19	82
Murcia	0.23	55
Navarra	0.39	53
Basque Country	0.39	57
La Rioja	0.33	18

Note: 1. Mean of EU-15 was 0.19 in 1994.

Source: *ESTEBAN and GUAL, 1999.

that the theoretical framework employed yields some predictive power.

Diversification and openness

As Table 1 shows, the share of manufacturing production as a proportion of total GDP shows strong regional differences. However, the OCA theory establishes that specialization might play a very important role since a highly specialized region is more likely to be affected by sector specific shocks. Regions such as the Canary and Balearic Islands are more specialized as services account for more than three-quarters of the overall employment. In conjunction with specialization, the openness to trade with the rest of the EU is another variable that should theoretically be relevant. As a result, differences in the degree of openness might determine the capacity of a region to benefit from reductions in transactions costs arising from monetary union. Spanish regions can be classified according to these criteria using cluster analysis. Table 2 shows the

Table 2. Cluster analysis of Spanish regions according to diversification and openness ratios with the EU

	Strongly open	Moderately open	Weakly open
Specialized	Extremadura	Madrid	Balearic Islands, Canaries
Other	Andalucía, Murcia, Castilla La Mancha	Valencian Community, Castilla León	Cantabria, Asturias
Diversified	Catalonia, Navarra, Aragón	Basque Country, Rioja, Galicia	

Note: Cluster analysis to exploratory data analysis tool for solving classification problems. Here we use it to describe a sample in terms of a typology.

Table 3. Variables employed

Variable	Description
Exchange rate variability: $SD(e_{ij})$	Standard deviation of the change in the logarithm of the annual real exchange rate between Germany and each Spanish region. The data were obtained from the National Institute of Statistics.
Size: $SIZE_{ij}$	Arithmetic average of the log of GDP in ECUs of each Spanish region with Germany. The data were obtained from the National Institute of Statistics.
Diversification: DIV_{ij}	Sector composition in employment of the Spanish regions and Germany using measures using the Herfindahl index. Sectors were defined in agriculture, manufacture, service and construction following the National Institute of Statistics.
Output disturbances: $SD(\Delta y_i - \Delta y_j)$	Standard deviation of the change on the log of the relative output between Spanish regions and Germany. The data were obtained from the National Institute of Statistics.
Bilateral trade: $TRADE_{ij}$	Average value of exports scaled by GDP of Spanish regions and Germany. Trade was obtained from the ICEX database in pesetas and was translated into ECUs in a yearly basis.

result of a preliminary cluster analysis of two main variables employed here: the degree of openness; and the degree of specialization. This classification (although partial) shows perceptible regional differences across Spanish regions. Diversification has been measured by the Herfindahl index of specialization using employment data (see Table 3), and openness has been computed on the basis of imports and exports as a share of the total regional GDP (see Table 2). This empirical feature can be viewed as prior evidence of how heterogeneous the benefits from the EMU might be.

Size

The size of a region is purported to have an influence on the level of benefits accruing to a region as a result of EMU. Essentially, it is claimed that being small magnifies the benefits noted above. When considering size at the *regional* (rather than country) level, opposite results may be expected. However, the larger a region is the more likely that the region will influence national economic policy. Additionally, it might be that smaller regions might tend to specialize more in certain industries, and as a result might be more prone to suffer regional specific shocks. Moreover, large regions within a country are nevertheless small relative to the overall size of the EU, and as a result we might find that differences are too small to be empirically significant. For instance, whereas the Catalan GDP was 20% of the Spanish GDP in 1999, it would be only 6.5% of the German GDP.³ Finally, taking account of the economic size of regions may eliminate the common measurement bias introduced when measuring relative trade.

EMPIRICAL METHODOLOGY

Data

The data employed were collected from two different sources. Regional data on GDP at constant prices, industrial production, consumer price index and employment were obtained from the regional database

of the Spanish National Institute of Statistics (INE) so-called *Contabilidad Regional de España*. From this data we computed three main variables that were used in the OCA index estimation: (1) the diversification indices; (2) a variable of output disturbances; and the (3) size index of each Spanish region. Data on regional trade and exchange rates have been obtained from the Spanish Institute of Foreign Trade (ICEX). From this dataset it was possible to obtain relative trade indicators and, in conjunction with the consumer price index, the real exchange rates for the whole period. The period analysed is 1992–98, since this period is the relevant one from the monetary convergence perspective for two main reasons. First, because it refers to the pre-accession period to the EMU, it is therefore worthwhile examining this period rather than going further back, although this entails a smaller data set. In addition, it is too soon to have data on the post accession period. Second, because convergence plans were approved annually by each Member State and involved both the central government and regions, results obtained might show how different regions prepare themselves to become less dependent on the national currencies.

The explanatory variable on which the OCA index was based was the variability of the real exchange rate. The index was obtained from regression panel data analysis using data for all Spanish regions. The country that was taken as a *numeraire* to estimate the suitability of a monetary union was Germany as a proxy of the so-called 'EU core'. An alternative method would have been to look at EU averages, however this data would tend to contain more noise than using a single frontrunner country as a comparative reference (e.g. results might be sensitive in the way an average price index for the EU is computed).

The methodology used implicitly assumes that the purchasing power parity law (PPP) plays a role at the regional level. PARSLEY and WEI, 1996, show a higher robustness of the PPP law at the regional level despite the finding that most factors explaining price variation at the country level (i.e. nominal exchange rate and tariffs) play a very limited role now, while other deter-

minants might instead be relevant. Real exchange rates were computed for each region as the relevant variable from which to measure currency union integration. The reasons for using these variables are various. First, since a common currency mainly leads to price stability, a convergence index should include real rather than nominal exchange rates. Second, following BAYOUMI and EICHENGREEN, 1997, the variability of nominal and real exchange rates is the result of the choice of the exchange rate regime. Therefore if a monetary union implies freezing exchange rates between the countries (and hence regions) involved, the historical exchange rate variability would be the appropriate endogenous variable to use in our model. Bilateral exchange rates were computed as:

$$e_{i1} = 1/\alpha \left[\sum_{i=2}^n (\hat{P}_i + \hat{E}_{i1} - \hat{P}_1) \right] \quad (1)$$

where: e_{i1} refers to real exchange rate; \hat{P}_i is the price level difference between regions; $i = 1, 2, \dots, 17$ with German changes in the price level; \hat{P}_i , E_i refers to the change in the bilateral nominal exchange rate; and finally α is an adjustment term referring to the share of non tradable goods in the economy for each region. This is a common practice and its essentially used to control for possible distortions in the price of non-tradable goods in the estimate of country competitiveness. Differences in price variation levels between regions might respond to additional biases. In this paper we control for demand pressure differentials between regions by looking at differentials between the Spanish average inflation. Additionally, prices were adjusted for the 'composition effect' resulting from different consumption baskets in different Spanish regions.⁴ Consistent with other studies, the evidence confirmed the lack of influence on estimates.

The OCA index estimation

The OCA theory examines those variables that make exchange rates stable and thus those regions that show fewer real exchange rate disturbances may be the most suitable for a monetary union. As a result, the explanatory variables included in the model are the following four; (1) *asymmetric disturbances* as measured by the standard deviation of the differences in output in logarithmic terms; (2) the *degree of diversification* accounted by the commodity composition of production; (3) the degree of *relative trade* with respect to the EU core (e.g. Germany), which allows for measuring trade benefits; and (4) a measure of *relative size* that reflects the fact that small countries would benefit most from the EMU.

The model is empirically specified as follows:

$$SD(e_{ij}) = \alpha + \beta_1 SD(\Delta y_i - \Delta y_j) + \beta_2 DIV_{ij} + \beta_3 TRADE_{ij} + \beta_4 SIZE_{ij} + \mu \quad (2)$$

where: i and j refer to Germany and the specific Spanish region, respectively. The endogenous variable refers to real regional exchange rate variability. As explained above, there are four exogenous variables (Table 3 contains the definitions of all variables). The estimation method is the standard OLS using panel data analysis estimated with and without controlling for time and individual effects. Essentially, we try to capture all the OCA determinants in a unique equation. The data did not show significant multicollinearity problems and the estimation was corrected for the existence of heteroscedasticity.

RESULTS

Table 4 shows the estimates of real exchange rates between Germany and each of the Spanish regions. As is shown, there is a large variability between Spanish regions in the real exchange rate at the regional level, which results from differences in relative prices and confirms that price behaviour is not homogeneous in a monetary union. Estimation results from equation (2) are shown in equation (3) for the period 1991–98. Standard errors are set into the parentheses:

$$\begin{aligned} SD(e_{ij}) &= 0.028 + 0.068 SD(\Delta y_i - \Delta y_j) \\ &+ 0.07 DISS_{ij} - 0.11 TRADE_{ij} \\ &- 5.4 \times 10^{-5} SIZE_{ij} (0.014) (0.024) (0.034) \\ &(-0.022) (-2.5 \times 10^{-5}) \\ N &= 136, Adj - R^2 = 37.4 S.E = 0.0002, \\ F(4,114) &= 14.4 \end{aligned}$$

Table 4. Adjusted real exchange rate Spanish Peseta/
German DM

	1992–94	1995–98	Total: 1992–98
Andalucía	91.17	104.13	98.57
Aragón	93.19	106.58	100.84
Asturias	90.10	102.95	97.44
Balearic Islands	86.49	99.52	93.94
Canaries	92.17	105.48	99.78
Cantabria	88.93	102.03	96.42
Castilla-León	93.25	106.73	100.95
Castilla-La Mancha	89.66	102.53	97.01
Catalonia	84.57	96.35	91.30
Valencian Community	85.72	98.37	92.95
Extremadura	96.97	110.63	104.77
Galicia	90.11	102.97	97.46
Madrid	91.14	103.71	98.32
Murcia	89.65	103.28	97.44
Navarra	106.89	122.43	115.77
Basque Country	84.49	97.05	91.67
La Rioja	86.45	99.25	93.76

Note: Estimates are arithmetic averages of real exchange rate following equation (1).

Table 5. Yearly OCA index versus Germany (predicted values)

Region	1992	1995	1998
Andalucía	0.0295	0.0297	0.0296
Aragón	0.0298	0.0300	0.0299
Asturias	0.0297	0.0300	0.0300
Balearic Islands	0.0311	0.0313	0.0313
Canaries	0.0311	0.0312	0.0312
Cantabria	0.0300	0.0300	0.0301
Castilla-León	0.0300	0.0301	0.0301
Castilla-La Mancha	0.0299	0.0279	0.0299
Catalonia	0.0280	0.0293	0.0275
Valencian Community	0.0292	0.0305	0.0293
Extremadura	0.0303	0.0299	0.0305
Galicia	0.0294	0.0296	0.0295
Madrid	0.0290	0.0291	0.0286
Murcia	0.0298	0.0300	0.0299
Navarra	0.0301	0.0302	0.0302
Basque Country	0.0297	0.0298	0.0298
La Rioja	0.0298	0.0299	0.0299

Results confirm the initial predictions and all coefficients are significant at least at an acceptable 5–10% significance level. A rise in either output disturbances or in the degree of regional specialization is expected to increase real exchange rate variability. Higher trade linkages are influential as they reduce the exchange rate variability by 11%. Interestingly the role of size has an opposite coefficient to the one that we would expect from the OCA theory as it shows a small negative sign. This result is not strange, but in fact is consistent with previous findings pointing out an inverse Balassa–Samuelson⁵ effect at the regional level (ALBEROLA and MARQUES, 2001) and additional arguments pointed out above. Prices tend to increase less in regions that enjoy higher income and productivity and are relatively more open. Explanations given for this phenomenon are several, the centralized setting of wages being one. This result demonstrates that the larger the size of the region within Spain, the smaller the exchange rate variability.

Table 5 shows the OCA index estimates. This was obtained as follows: trade was forecast by running regressions for successive moving averages of eight-year periods, 1985–92, 1988–95 and 1990–98. To forecast asymmetric shocks, we computed the standard deviation of the change in the log of the relative output between Spanish regions and Germany for a 10-year period centred in the current year and regressed to a time trend for the period 1985–92. To extrapolate similarity structures we used the two most recent years. For other variables we used actual data. Fig. 1 shows the movements between 1992 to 1998. Only two regions – Catalonia and Madrid – exhibited significant movements in monetary integration performance. However, the monetary integration index suggests that there were no significant changes in regional positions from 1992 to 1998. This result is consistent with other

empirical studies which reveal that convergence in factor prices did not accelerate after 1992 (WEBBER, 2001).

These findings provide some important insights to explain the determinants of currency area convergence between Spanish regions. From an OCA standpoint, it is interesting to see whether predictions using this index would be consistent with other studies using alternative methodologies. At this stage and taking into account the availability of data, we can only perform correlation analysis to tests some hypothesis.

Table 6 displays the correlation coefficients for the whole period between the OCA index and the relevant variables; on the basis of theoretical background we should expect some specific association. As expected, the OCA index shows a strong and significant association with the EU business cycle synchronization and regional size. The correlation between OCA index and the share of the regional business cycle explained by the EU cycle is -0.67 ($p = 0.004$) and the correlation rate with regional size is -0.701 ($p = 0.002$). However, openness rate with the EU is marginally significant (just at the 10% significance level). The association between openness towards the EU is -0.37 ($p = 0.1$). This finding is consistent with ALBEROLA and MARQUES, 2001. This empirical feature is plotted in Fig. 2. Business cycle synchronization appears to be a good predictor of the regional OCA position. Accordingly, studies using business cycle synchronization as a predictor (ARTIS and ZHANG, 1999) might lead to similar results.

We cannot extrapolate our results to the EMU overall since sources of real exchange rate variability and relative price variation might be markedly different between Spain and the rest of the EU. However, differences in the degree of economic integration with the EU between Spanish regions point out substantial differences in the adaptation process to a common currency across countries. Although the integration process has been built up from country units, regions do play an important role since those regions that adopt similar common economic habits and patterns are presumably in a better position to counteract heterogeneous economic shocks.

CONCLUDING REMARKS

A reduction in the barriers to trade and the rise in factor mobility might lead national borders to exhibit a lower economic significance as the process of European integration deepens (FATAS, 1997). This paper is intended to be a contribution to the study of the regional dimension of monetary union in Spain.

We explore three separate but related questions. First, we have tested the implementation of the OCA index at the regional level and in particular the existence of real exchange rate differences between Spanish regions. Second, the determinants of the exchange rate

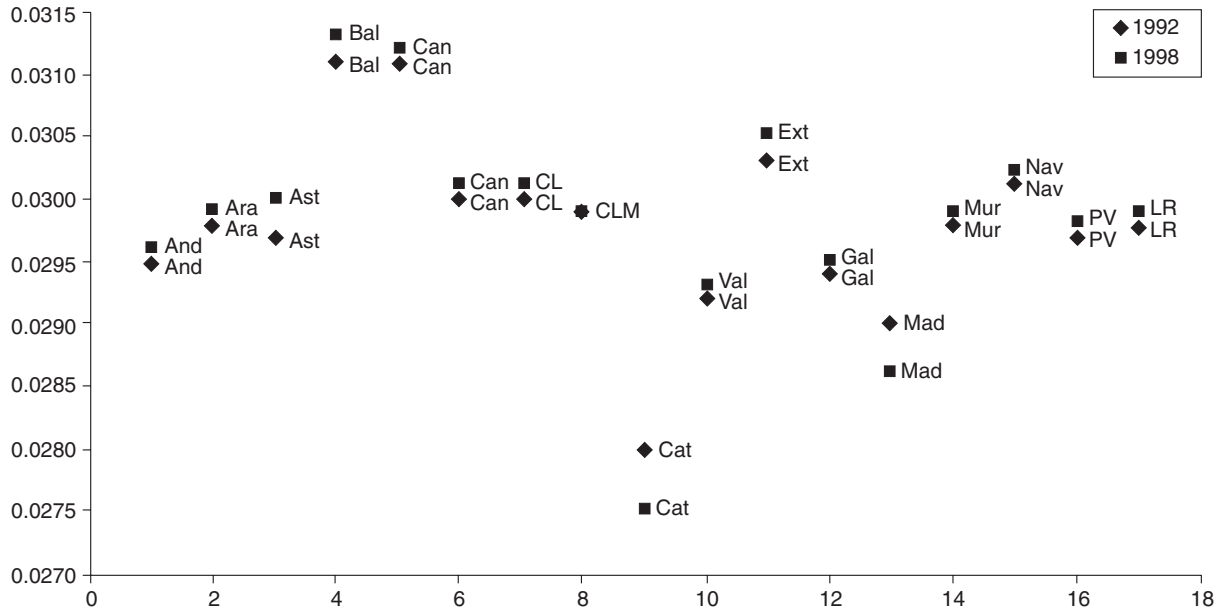


Fig. 1. Movements in the OCA index between 1992 and 1998.

Note: We use the first letters of each region name (i.e. Catalonia is referred as Cat and Madrid as Mad) except for composite names for which we use the two initials.

Table 6. Correlation coefficients with relevant variables

Variable	Coefficient	p-value
Business cycle synchronization	-0.67**	(0.004)
Diversification index	-0.27	(0.200)
Size	-0.72**	(0.002)
Openness rate with EU	-0.36*	(0.100)
Unemployment rate	0.02	(0.921)
Debt as a share in GDP	-0.32	(0.214)
Deficit as a Share in GDP	-0.32	(0.223)

Notes: * Significant at a 10% level; **Significant at a 5% level or less.

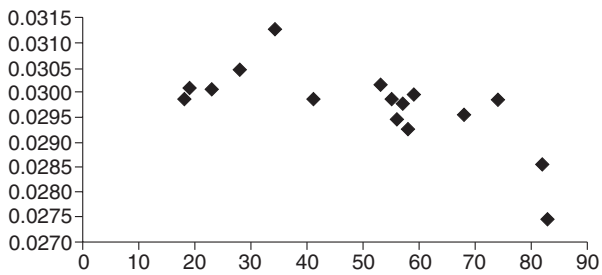


Fig. 2. Association between the business cycle synchronization and the OCA index.

variability at the regional level have been identified, with a discussion of the facts and features on the basis of existing literature at the time of the research. Finally, from the results obtained, the study identifies relevant and theoretically sound variables that are associated with OCA predictions.

Within a specific country, regional shocks may differ according to asymmetric business cycles, trade linkages

and industry specialization. We find that the sustainability of a 'fixed-for-ever' exchange rate arrangement might differ substantially between regions within a country. Regions that are characterized as large relative to the country, and that show strong trade links, large diversification and strong business cycle synchronization with the EU, are those regions that are theoretically expected to perform better than others in currency integration terms. The main difference found when estimating the determinants of the OCA index is the differential role of regional economic size. This feature is connected with the use of real exchange rate instead of the nominal exchange rate, and confirms previous findings on the inverse Balassa-Samuelson effect.

Our results exhibit that OCA theory is helpful in predicting real exchange rate variability not only between countries but also at a regional level within a country, even though some results had to be reinterpreted. Regions that are part of the same country, although being largely heterogeneous, are expected to be more integrated than countries. Real exchange rate stability is found to be higher in richer regions and those relatively more open to trade. Significant regional differences were identified when clustering regions across certain OCA determinants. The OCA index integrates existent regional heterogeneity and suggests that, in the case of Spain, there are two front runner regions, Catalonia and Madrid. Both seem to have achieved a large currency area homogeneity during the convergence period 1992-98. Findings point out small divergence in regional relative prices and in real exchange rates. Our results were fairly consistent with

ALBEROLA and MARQUES, 2001, as real exchange differentials seem to be persistent across Spanish regions, although in this study we introduced other relevant issues such as the role of non-tradable goods when calculating price differentials. The former were introduced as an adjustment term in the real exchange rate calculation. Further, the regional OCA index is highly associated with the synchronization of the EU business cycle and moderately associated with rates of openness.

Public policy implications of these results are not negligible. If the estimated heterogeneity between Spanish regions is replicated within the other EU countries and labour market rigidities remain, then fiscal redistribution adjustments will be the *main* policy instrument available to counteract regional shock asymmetries resulting from a unified monetary policy. Results suggest that regional analysis of European monetary union is required for policy design. Current cross-country analyses may not capture the relevant regional differences that exist within EMU countries.

In the light of the OCA theory, the existence of regional heterogeneity in the exposure to a common currency leads to the use of a series of policy instruments to overcome possible asymmetric shocks (e.g. fiscal benefits to promote EU regional mobility). As NIJKAMP and WANG, 1999, argue, a monetary union, which is non-Pareto-optimal due to unmet OCA determinants, may exacerbate regional inequalities. As far as fiscal policy is the sole remaining policy implemented at the level of EMU Member States, it is expected to play an active role in smoothing regional inequalities at the country level although sometimes leading to very significant fiscal imbalances (CASTELLS *et al.*, 2000). In Spain as in other EU countries, a large part of public expenditure is still centralized and regional redistribution schemes hide strong fiscal imbalances between the regions. Thus it is no coincidence that fiscal imbalances between regions are likely to benefit those most integrated with the EMU (CASTELLS, 1998).

The rise of regional inequalities is expected to bring political issues to the fore in addition to economic considerations. Frontrunner Spanish regions show significant fiscal imbalances. Recent estimates indicate that Spanish frontrunner regions such as Catalonia experience an annual fiscal deficit of around 8% of its

GDP (CASTELLS *et al.*, 2000). The set up of a common currency implies, on the one hand, the withdrawal of nominal exchange rates as a way to *artificially* manipulate regional asymmetries. Therefore, the adoption of a specific monetary policy leaves EU Member States with fiscal redistribution as the main public policy instrument available to counteract regional asymmetries resulting from EMU. On the other hand, we think that in the light of the results obtained, one might expect frontrunner regions to play a more active role in the EU decision-making process.

Acknowledgements – We appreciate the comments and help received from Jordi Pons, Lucy A. Eyre, Joaquin Trigo, Joan Hortala, Elisenda Paluzie and, especially, those from two anonymous referees. We give thanks for the financial support received from SEC2002-03212 and the advice of members of the *Grup de Recerca d'Economia de la Política Social* (EPS) at the University of Barcelona and, especially the helpful comments from the participants in both the *IV Encuentro de Economía Aplicada* and the ERSA Meeting in Barcelona to clarify possible caveats. However, the authors are solely responsible for errors and the usual disclaimer applies.

NOTES

1. The paper differs from BAYOUMI and EICHENGREEN, 1997, in the objective. The latter aimed at deciding which countries would be *plausible* candidates in a pre-EMU scenario. Instead, using their methodology we estimate the extent to which regions within a country may be heterogeneously exposed to a common currency. On the basis of the results obtained we estimate the extent to which OCA predictions based on countries apply equally to regions that have been exposed to common national policy shocks.
2. See BAYOUMI and EICHENGREEN, 1988, for a revision of the OCA macroeconomic criteria.
3. Therefore, if Catalonia were a single country instead of a region, it would qualify as a small country in comparative terms.
4. See ALBEROLA and MARQUES, 2001, for the methodology used.
5. The Balassa-Samuelson effect shows that a high productivity in the *traded goods* sector of the economy translates into an acceleration of non-traded goods' prices and an increase in the aggregate price level relative to other countries.

REFERENCES

- ALBEROLA E. and MARQUES J. M. (2001) On the evolution of the relative prices and its nature at the regional level: the case of Spain, *J. Reg. Sci.* **41**, 451–74.
- ANGELONI A., KASHYAP B., MOJON B. and TERLIZZESE D. (2002) Monetary transmission in the euro area, European Central Bank Working Paper No. 114, Frankfurt.
- ARTIS M. and ZHANG W. (1999) Further evidence on the international business cycle and the ERM: is there a European business cycle?, *Oxf. Econ. Pap.* **51**, 122–32.

- ARTIS M., KOHLER M. and MÉLITZ J. (1998) Trade and the number of optimum currency areas in the world, CEPR Discussion Paper No. 1926, Centre for Economic Policy Research, London.
- BAYOUMI T. and EICHENGREEN B. (1988) Exchange rate volatility and intervention: implications for the theory of optimum currency areas, CEPR Discussion Paper No. 1982, Centre for Economic Policy Research, London.
- BAYOUMI T. and EICHENGREEN B. (1993) Shocking aspects of European monetary integration, in TORRES F. and GIAVAZZI F. (Eds) *Adjustment and Growth in the European Monetary Union*. Cambridge University Press, Cambridge.
- BAYOUMI T. and EICHENGREEN B. (1997) Ever closer to heaven? An optimum currency area index for European countries, *Europ. Econ. Rev.* **41**, 761–70.
- BEGG I. G. (1995) *Factor mobility and regional disparities in the European Union*, *Oxf. Rev. Econ. Pol.* **11**, 96–112.
- BENTOLILA S. (1997) Sticky labour in Spanish regions, *Europ. Econ. Rev.* **41**, 591–98.
- CASTELLS A. (1998) Integració monetaria i desequilibris territorials a la Unió Europea, *Revista Econòmica de Banca Catalana* **114**, 19–45.
- CASTELLS A., BARBERAN R., BOSCH N., ESPASA M., RODRIGO F. and RUIZ HUERTA J. (2000). *Las balanzas fiscales de las Comunidades Autónomas 1991–1996*. Editorial Ariel Economía, Barcelona.
- COSTA J. and BATALLA J. (1999) The Central and Eastern European Union enlargement and the EMU: nominal convergence and the optimum currency areas approach, in FISCHER M. and NIJKAMP P. (1999) *Spatial Dynamics of European Integration*. Springer, Berlin/Heidelberg.
- CUADRADO-ROURA J. R., MANCHA-NAVARRO T. and GARRIDO-YSERTE R. (2000) Convergence and regional mobility in the European Union, paper presented at the 40th Congress of the European Regional Science Association, Barcelona.
- DE GRAWVE P. and VANHAVERBEKE W. (1993) Is Europe an optimum currency area?: evidence from regional data, in MASSON P. and TAYLOR M. (Eds) *Policy Issues in the Operation of Currency Unions*. Cambridge University Press, Cambridge.
- ESTEBAN J. and GUAL J. (1999) *Catalunya dins l'EURO*. Antoni Biosch/Generalitat de Catalunya, Barcelona.
- ESTEBAN J. and VIVES V. (1994) La desigualdad inteterritorial en Europa y España, in ESTEBAN J. and VIVES X. (Eds) *Crecimiento y Convergencia Regional en España y Europa*. CSIC, Madrid.
- EUROPEAN COMMISSION (1990) One money, one market, *Europ. Econ.* **44**.
- FATÁS A. (1997) EMU: countries or regions? Lessons from the EMS experience, *Europ. Econ. Rev.* **41**, 743–51.
- FRANKEL J. A. and ROSE A. K. (1997) Is EMU more justifiable *ex post* than *ex ante*?, *Europ. Econ. Rev.* **41**, 753–60.
- FRANKEL J. A. and ROSE A. K. (1998) The endogeneity of the optimum currency area, *Econ. J.* **108**, 1,009–25.
- GLICK R. and ROSE A. (2002) Does currency union affect trade? The time series evidence, *Europ. Econ. Rev.* **46**, 1,125–51.
- HUGHES HALLET A. and PISCITELLI L. (2002) Does trade integration cause convergence?, *Econ. Letters* **75**, 165–70.
- KENEN P. (1969) The theory of the optimal currency areas: an eclectic view, in MUNDELL R. A. and SVABODA A. K. (Eds) *Monetary Problems of the International Economy*. Chicago University Press, Chicago.
- KENEN P. (1989) *Managing Exchange Rates*, Chatham House Papers. Royal Institute of International Affairs, London.
- KRUGMAN P. (1990) Policy problems of a monetary union, in DE GRAWVE P. and PAPADEMOS L. (Eds) *The European Monetary System in the 1990s*. Longman, London.
- KRUGMAN P. (1991) *Geography and Trade*. MIT Press, Cambridge, MA.
- KRUGMAN P. (1993) Lessons of Massachusetts for EMU, in GIVANZZI F. and TORRES F. (Eds) *The Transition to Economic and Monetary Union in Europe*, pp. 241–61. Cambridge University Press, Cambridge.
- IAMMARINO S. and SANTANGELO G. D. (2000) Foreign direct investment and regional attractiveness in the EU integration process: some evidence for the Italian regions, *Europ. Urban & Reg. Studies* **7**(1), 5–18.
- MARTIN P. (1999) Public policies, regional inequalities and growth, *J. Public Econ.* **73**, 85–105.
- MCKINNON R. (1963) Optimum currency areas, *Am. Econ. Rev.* **53**, 717–25.
- MUNDELL R. A. (1961) A theory of optimum currency areas, *Am. Econ. Rev.* **51**, 657–65.
- NIJKAMP P. and WANG S. H. (1999) Winners and losers in the European Monetary Union: a neutral network analysis of industrial spatial shifts, in FISCHER M. and NIJKAMP P. (1999) *Spatial Dynamics of European Integration*. Springer, Berlin/Heidelberg.
- PALUZIE E. (2001) Trade policy and regional inequalities, *Pap. Reg. Sci.* **80**, 67–85.
- PARSLEY D. and WEY S. J. (1996) Convergence to the law of one price without trade barriers, *Quart. J. Econ.* **111**, 1,211–36.
- RAMOS R., CLAR M. and SURIÑACH J. (1999) Specialization in Europe and asymmetric shocks: potential risks of EMU, in FISCHER M. and NIJKAMP P. (1999) *Spatial Dynamics of European Integration*. Springer, Berlin/Heidelberg.
- RAYMOND J. L. and GARCIA B. (1998) Forman las regiones españolas espacios económicos integrados?, *Cuadernos de Información Económica* **134**, 59–65.
- ROSE A. (2000) One money, one market: the effect of common currency on trade, *Econ. Policy* **30**, 7–45.
- THOM R. and WALSH B. (2002) The effect of currency union on trade: lessons from the Irish experience, *Europ. Econ. Rev.* **46**, 1,111–23.
- TREMOSA R. and PONS J. (2001) Measuring monetary shocks in the European Union, *Appl. Econ. Letters* **8**(5), 299–303.
- VIÑALS J. and JIMENO J. (1996) Monetary union and European unemployment, CEPR Discussion Paper No. 1485, Centre for Economic Policy Research, London.
- VILLAVERDE J. and SANCHEZ-ROBLES B. (1999) The European Union and regional convergence in Spain: a new approach, in MEEUSEN W. (Ed) *Economic Policy in the European Union*. Edward Elgar, Cheltenham.
- WEBBER D. (2001) Convergence of labour's factor reward between EU regions, *Appl. Econ. Letters* **8**, 355–57.