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Ever Closer to Heaven? An Optimum-Currency-Area Index for European Countries

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Abstract

In this paper we develop a procedure for applying the core implications of the theory of optimum currency areas to cross-country data. We demonstrate that these implications find strong empirical support. The relationship between the characteristics of countries to which the theory points and the observed behavior of exchange rates seems sufficiently stable and robust to support simple forecasting. Extrapolating the independent variables, we use our exchange rate equations to predict which countries will be best able to support stable exchange rates in the future -- equivalently, which are likely to be among the founding members of Europe's monetary union.

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I. Introduction

Like it or not, the theory of optimum currency areas remains the workhorse for analyses of European monetary unification. Indeed, many economists do not like it very much. OCA theory, with its focus on asymmetric shocks, labor mobility and the transactions value of a single currency, subsumes but a subset of considerations relevant to the decision of whether to fix the exchange rate or form a monetary union. The theory has advanced only minimally since the seminal contributions of Mundell (1961), McKinnon (1963) and Kenen (1969). It remains difficult to move from theory to empirical work and policy analysis. A popular device is to conclude a review of the theoretical literatures by stating that "Europe is not an optimal currency area" without providing much analysis of how this situation is changing or of the comparative prospects of different countries.

In this paper we develop a procedure for applying the core implications of the theory of optimum currency areas to cross-country data. We demonstrate that these implications find strong empirical support. The relationship between the characteristics of countries to which OCA theory points and the observed behavior of exchange rates seems sufficiently stable and robust to support simple forecasting. Extrapolating the independent variables, we therefore use our exchange rate equations to predict which countries will be best able to support stable exchange rates in the future -- equivalently, which are likely to be best prepared to be among the founding members of Europe's monetary union.

II. Operationalizing the Theory of Optimum Currency Areas

The key to our approach to operationalizing the theory of optimum currency areas is to analyze the determinants of nominal exchange rate variability. By contrast, most earlier analysis of the choice of exchange rate regime has used relatively judgmental categorizations of exchange rate

arrangements.[2] The variability of real and nominal exchange rates is itself the outcome of the choice of exchange rate regime and as such should contain information about the decision of what arrangement to adopt. Actual exchange rate behavior may in fact convey more information about underlying economic determinants than the putative exchange rate regime. Countries not only have to adopt an exchange rate arrangement, in other words; they also have to maintain it. Thus, the limited-dependent variable on which most previous investigators focus does not make use of all the information available in the variability of the exchange rate. Throughout, we analyze annual data on bilateral exchange rates for 21 industrial countries.[3]

OCA theory focuses on characteristics which make stable exchange rates and monetary unification more or less desirable. The most important of these are asymmetric disturbances to output, trade linkages, the usefulness of money for transactions, the mobility of labor, and the extent of automatic stabilizers. While the last two characteristics are clearly important for behavior across regions within a country, they have not played a significant role in responding to shocks that are felt asymmetrically across countries, at least over our sample period. Consequently, our empirical work focuses on capturing the first three factors.[4]

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[2] These previous studies follow the IMF's Exchange and Trade Restrictions volumes in characterizing exchange rates as pegged or flexible, or as pegged, displaying limited flexibility and displaying greater flexibility. See Savvides (1993) for a review of the literature.

[3] These are the principal European economies plus the U.S., Canada, Japan, Australia and New Zealand. This focus on industrial countries distinguishes our work from previous studies of the determinants of exchange-rate variability. While we focus here on nominal exchange rates, results for real exchange rates were quite similar.

[4] In related work (Bayoumi and Eichengreen, 1996) we look at a sonewhat more general specification, including non-OCA variables such as the depth of financial systems. The results are similar to those reported here.

We measure output disturbances as the standard deviation of the change in the log of relative output in the two countries. Thus, for countries in which business cycles are symmetric and national outputs move together, the value of this measure will be small.[5] We add the dissimilarity of the commodity composition of the exports of the two countries as a second proxy for the asymmetry of shocks on the grounds that industry-specific shocks will be more symmetric when two countries have a revealed comparative advantage in the same export sectors.[6]

We measure the importance trade linkages using data on bilateral trade. computing the average value of exports to the partner country, scaled by GDP, for the two countries concerned. The costs of a common currency, in terms of macroeconomic policy independence foregone, should be balanced against the benefits, which will be greatest for small economies where there is least scope for utilizing a separate national currency in transactions. That is, small countries should benefit the most from the unit of account, means of payment, and store of value services provided by a common currency. We measure the benefits from a more stable currency by including the arithmetic

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[5] It would be preferable to decompose relative output movements into relative supply shocks, relative demand shocks, and the respective economies' response to each. Elsewhere (Bayoumi and Eichengreen, 1993) we have applied a methodology for distinguishing supply and demand shocks, but this is infeasible to implement with the relatively short time series utilized here.

[6] To construct this variable we collected data on the shares of manufactured goods, food and minerals in total merchandise trade for each country. Manufactured goods are defined as the total of basic manufactures, chemicals, machines and transport equipment, miscellaneous manufactured goods, and other goods. Food is the sum of food and live animals, beverages and tobacco, and animal, vegetable oils and fats. Minerals amalgamate data on crude materials excluding fuel with mineral fuels, etc. The dissimilarity of the commodity composition of two countries' exports was then defined as the sum of the absolute values of the differences in each share (with higher values indicating less similarity in the composition of commodity exports between the two countries).

average of (the log of) real GDP in U.S. dollars of the two countries as a measure of country size.[7]

The estimating equation is therefore:

$$SD(e_{ij}) = \alpha + \beta_1 SD(\Delta y_i - \Delta y_j) + \beta_2 DISSIM_{ij} + \beta_3 TRADE_{ij} + \beta_4 SIZE_{ij},$$

where $SD(e_{ij})$ is the standard deviation of the change in the logarithm of the end-year bilateral exchange rate between countries i and j, $SD(\Delta y_i - \Delta y_j)$ is the standard deviation of the difference in the logarithm of real output between i and j, $DISSIM_{ij}$ is the sum of the absolute differences in the shares of agricultural, mineral, and manufacturing trade in total merchandize trade, $TRADE_{ij}$ is the mean of the ratio of bilateral exports to domestic GDP for the two countries, and $SIZE_{ij}$ is the mean of the logarithm of the two GDPs measured in U.S. dollars.[8] In each case, the independent variables are measured as averages over the sample period. We focus on the variability of nominal rather than their real counterparts because nominal rates provide an easier benchmark for comparison to a single currency--with a single currency the variability of the nominal exhcange rate is zero. In related work (Bayoumi and Eichengreen, 1996) we have found that equations of the type reported in the text generated similar results for both nominal and real exchange rates.

For 1983-92, estimation yielded the following (with standard errors in

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[7] An alternative, suggested by McKinnon, is to use openness to international trade as a measure of the benefits from stabilizing the exchange rate. However, economic size would appear to be a better measure of the benefits from a stable currency, as a comparison between the benefits of provided by the national currencies of Germany (a large and relatively open economy) and Spain (a smaller and more closed economy) should make clear.

[8] A potential technical concern with this specification is that not all of the entries for the dependent variable are independent of each other. However, while it is true that changes in bilateral rates are not independent (the change in the bilateral rate between the dollar and the yen is equal to the change between the dollar and the deutsche mark and between the deutsche mark and the yen), the standard deviations of these rates are independent as the covariances can differ across pairs of countries.

parentheses):

$$SD(e_{ij}) = \underset{(0.02)}{-0.09} + \underset{(0.21)}{1.46}\ SD(\Delta y_i - \Delta y_j) + \underset{(0.006)}{0.022}\ DISSIM_{ij} - \underset{(0.006)}{0.054}\ TRADE_{ij}$$

$$+ \underset{(0.001)}{0.012}\ SIZE_{ij},$$

$n = 210 \quad R^2 = 0.51 \quad S.E.=0.027$

Thus, all four variables have the anticipated signs and coefficients that differ from zero at the one percent confidence level. We take this as strong support of the empirical implications of the theory of optimum currency areas.

III. Prediction and Forecasting

Out-of-sample forecasting is problematic if the relationship of structural characteristics to exchange rate behavior is not stable over time. We therefore ran the above regression for successive moving averages of ten year periods: 1973-82, 1975-84, 1977-86, 1979-88, 1981-90 and 1983-92. The coefficients on the two trade-related variables (the similarity of exports and the importance of bilateral trade) prove quite stable. In contrast, the two output-related variables (economic size and relative output variable) tend to increase after 1975-84. This may reflect the ERM, through whose operation European countries were increasingly able to stabilize their exchange rates in the face of structural differences and cyclical disturbances. The estimated equation for the most recent period is broadly consistent with those for earlier years, supporting its use for forecasting purposes.

To forecast the dependent variable, it is necessary to construct projections of the independent variables. To project asymmetric shocks, we calculated $SD(\Delta y_i - \Delta y_j)$ over a ten-year period centered on the current year. This variable was then regressed on a constant term and a time trend for the period 1971-87, and the results were used to project for the period 1988-95. The coefficient on the trend was negative, suggesting that asymmetric shocks

have been diminishing; hence, this is our implicit assumption about the effect of continued European integration.[9] To project the similarity of export structures, we extrapolated the change over the two most recent three-year periods. For economic size and the export ratio, we used actual data.

Table 1 shows forecasts of the dependent variable, which we refer to as the OCA index, vis-a-vis Germany in 1987, 1991 and 1995.[10] (See also Figure 1.) 1987 is the last year with full data on all variables (for subsequent years it is necessary to base our measure of asymmetric shocks on projections). 1995 reflects the current state of affairs, while 1991 gives some sense of trends over time. The countries divide into three groups: prime candidates for EMU, those which are converging to EMU, and those for which the index shows little convergence. More work will, of course, be needed to test the robustness of our results to alternative empirical approaches.

In the first group are Austria, Belgium, and the Netherlands, joined recently by Ireland and Switzerland. All these countries have indices in 1995 under 0.025 (less than one standard error for the regression as a whole).[11] There is striking conformance between the make-up of this group and press commentary, circa mid-1996, on the leading candidates for Stage III, except for the presence of Switzerland, which is not an EU member, and the absence of France, whose participation is widely regarded as essential to the political

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[9] Bini-Smaghi and Vori (1993) and Frankel and Rose (1996) similarly argue that European integration should increase the symmetry of shocks.

[10] We consider indices for bilateral rates against Germany because that country is widely viewed as the core member of EMU to which other potential participants need to converge. The value for France in 1994 of 0.074 is the standard deviation of the logarithm of the nominal bilateral exchange rate predicted by the equation. Since the data are in logs, this is approximately 7 1/2 per cent per annum.

[11] By way of contrast, the OCA indexes between the three largest industrial countries, the United States, Germany and Japan, vary between 0.09 and 0.15.

viability of the enterprise. Austria and the Benelux countries have been closely linked to the German economy for many years. The result for Ireland is interesting, since our index of its convergence in economic structure and cyclical position corresponds to the convergence observed under the Maastricht criteria.[12] For the sample as a whole, however, there is strikingly little correlation between the deficit ratio and our OCA index (see Figure 2).

The second group, countries for which there is little convergence, includes the United Kingdom, Denmark, Finland, Norway and France. In all cases, the forecast standard deviation of the exchange rate in 1995 using the OCA index equation is large (greater than 0.07, over 2 1/2 times the standard error of the regression) and shows little tendency to decline over time. These results suggest structural reasons for the decisions of the U.K. and Denmark to demand opt-out clauses from EMU and for Norway's decision to opt out of EMU by opting out of the EU. While the Maastricht criteria show Finland converging over time, this is not evident in our OCA index. The most striking result is that our analysis places France in the group of countries for whom there is little evidence of convergence, despite its recent history of low exchange rate variability vis-a-vis Germany.

The final group, countries that are gradually converging toward EMU, includes Sweden and the EU's southern tier: Italy, Greece, Portugal and Spain. In all cases these countries' OCA indices are declining over time. They average 0.06 for 1995. Spain's is the largest, at 0.072, not dissimilar from that of some of the non-convergers. Assuming for sake of argument that their

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[12] The relationship between structural characteristics of countries, as suggested by OCA theory, and the convergence criteria of the treaty is the subject of De Grauwe (1996). Irelands' OCA index with the UK, a country with which it has traditionally had close monetary ties but with whom these ties have been waning, remains below that of Germany.

OCA indices continue to trend downward at the same rate through 1999, they will remain around 0.05 in most cases, still relatively large by the standards of the first group.

Cross-country differences in the average level of the OCA index are driven mainly by relative size (which does not vary over time) and the importance of bilateral trade. Thus, the poor average OCA index for France reflects the fact that it is large and relatively closed (by European standards), so that while it trades a lot with its EU partners, bilateral trade as a share of GDP is rarely very high. Changes over time in the index are dominated by changes in the intensity of bilateral trade and asymmetric output movements. The first of these findings suggests that an important factor driving convergence is the role of the EU in promoting intra-European trade. Insofar as European integration has worked to encourage trade among EU members, there may have been a tendency to encourage monetary integration.[13] This supports the argument of the EU Commission that perfecting the Single Market, which can be expected to promote trade, is essential for a successful transition to EMU.

While we have focused on structural relationships vis-a-vis Germany, the same approach can be used to analyze other bilateral relationships and shed light on other issues. In Table 2 we show our OCA index for some other bilateral exchange rates. These suggest that Italy and Spain's enthusiasm for EMU may hinge on France's participation, while that of some smaller countries will depend on the participation of larger neighbors; they suggest, for

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[13] This finding could simply reflect the existence of the ERM, but the rolling regressions tend to refute this interpretation.

example, that Finland's interest in EMU may hinge on Swedish participation.[14] Similar considerations are evident in the cases of Portugal and Spain and of Greece and Italy. These results suggest significant interdependencies when the time comes to constitute and enlarge the monetary union.[15]

IV. Conclusion

Our goal in this paper has been to operationalize the theory of optimum currency areas by constructing an OCA index based on a particular empirical specification that summarizes countries' readiness for EMU, as predicted by the core implications of that theory. The results show European countries dividing into three groups: those exhibiting a high level of readiness, those with a tendency to converge, and those in which little or no convergence is evident. The make-up of the groups tends to coincide with popular handicapping of the Maastricht stakes with one notable exception: France. Our estimates of France's OCA index does not indicate that the country's structural characteristics and cyclical performance are consistent with a high level of bilateral exchange rate stability vis-a-vis Germany or an easy transition to monetary union. This finding supports the view that the desire for monetary unification in France is driven by political rather than economic considerations.

A further finding is the symbiotic relationship between economic integration and monetary integration. Countries among whom the completion of the Single Market has led to the greatest increase in bilateral trade have experienced the greatest increase in their readiness for monetary integration

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[14] In contrast, Norway's OCA index vis-a-vis Sweden is rising over time, indicating a diminishing pull to EMU, which plausibly reflects in the impact on its external economic relations of the decision to stay out of the EU.

[15] For a theoretical discussion of these interdependencies, see Bayoumi (1994).

according to our OCA index. Economic integration has thus increased countries' readiness for monetary integration. Conversely, insofar as stable exchange rates encourage trade, monetary integration in the form of the EMS has also helped to advance economic integration. Together, these findings support the notion that EMU and the Single Market can constitute a virtuous, self-reinforcing circle.

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Table 1. OCA Indexes Versus Germany, 1987-95

	1987	1991	1995
France	0.068	0.067	0.074
Italy	0.070	0.065	0.059
U.K.	0.099	0.094	0.089
Austria	0.008	-0.004	0.008
Belgium	0.003	-0.008	0.013
Denmark	0.063	0.060	0.074
Finland	0.098	0.095	0.087
Greece	0.053	0.054	0.054
Ireland	0.043	0.036	0.021
Netherlands	0.003	-0.008	0.007
Norway	0.078	0.078	0.077
Portugal	0.068	0.066	0.062
Spain	0.088	0.082	0.073
Sweden	0.068	0.063	0.056
Switzerland	0.038	0.030	0.023

Notes: For details on the construction of the "OCA indexes" see the text.

Table 2. OCA Indexes for Specific Relationships, 1987-95

	1987	1991	1995
France - Italy	0.060	0.059	0.052
France - Spain	0.064	0.060	0.048
France - Portugal	0.053	0.055	0.053
Sweden - Finland	0.032	0.035	0.027
Sweden - Norway	0.039	0.043	0.046
Italy - Greece	0.057	0.043	0.027
Spain - Portugal	0.037	0.024	0.013

Notes: For details on the construction of the "OCA indexes" see the text.

Figure 1

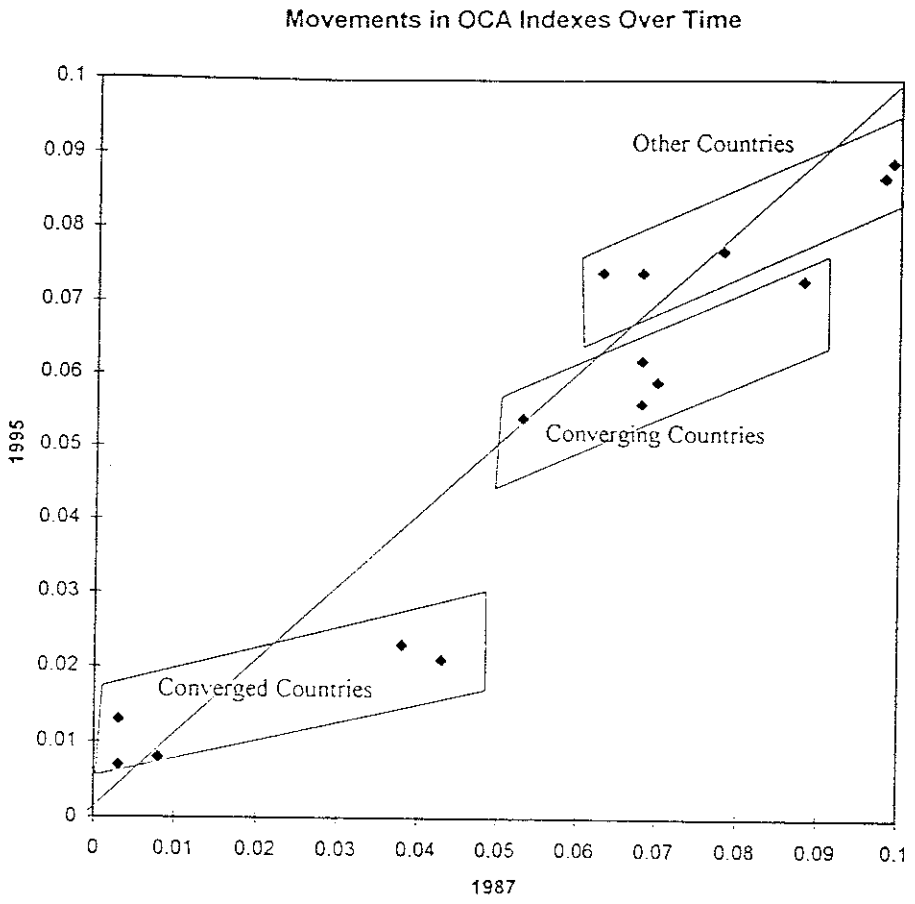
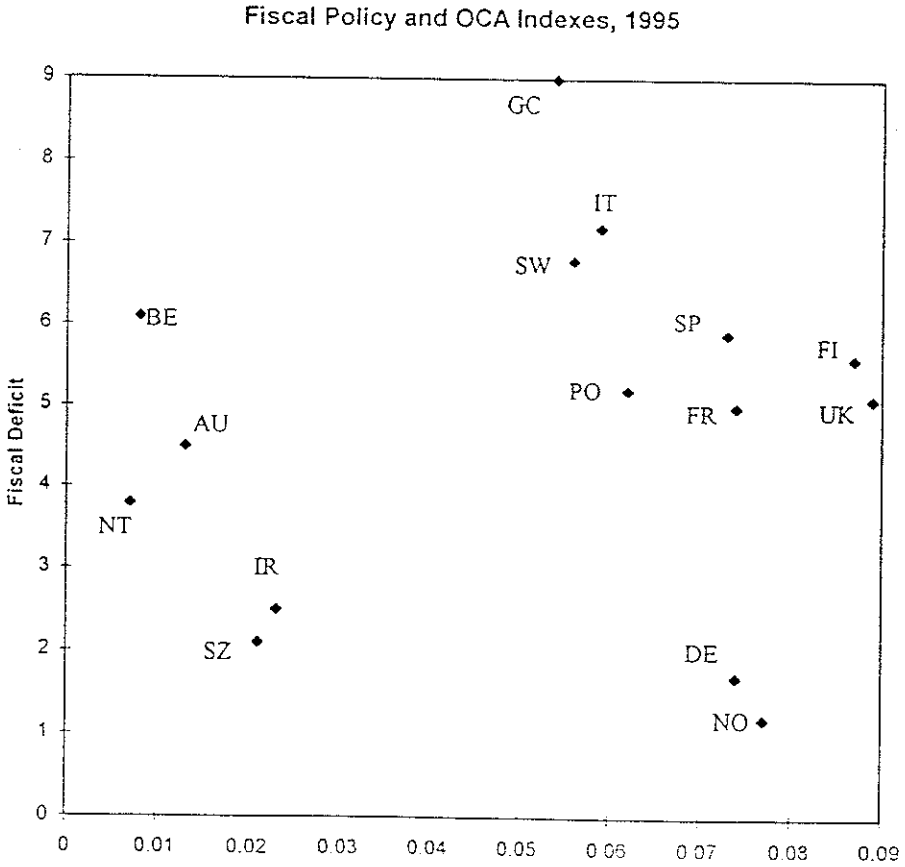


Figure 2



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