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ABSTRACT

Trade and the Number of Optimum Currency Areas in the World*

This paper employs worldwide data on output and bilateral trade in order to identify optimum currency areas (OCA's) on a global basis. By retaining only two of the many criteria that have been mentioned in the literature on OCA's, it has been possible to use computer programming to do the identification. Based on the first of the two criteria, relating to trade, some large continental OCA's can be discerned in the world. Adding the second criterion, which concerns symmetry-of-output-shocks, whittles down the size of the OCA's. Nevertheless, some significant examples remain in the Americas, Europe and Asia, of which the European and the Asiatic are the most noteworthy.

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NON-TECHNICAL SUMMARY

How many 'optimal currency areas' (OCA's) are there in the world? In this study, we make an attempt to use worldwide trade and output data to answer this question. The study is limited to two of the many criteria that have been proposed in the literature on optimum currency areas in order to identify the ideal participants in a monetary union. The first one relates to bilateral trade between countries; and the second to the symmetry in the shocks affecting output in different countries. According to the traditional literature, high levels of bilateral trade provide a potential source of benefits from a common currency. In addition, the lack of symmetry of shocks can make the abandonment of independent monetary policy costly. We have translated the two criteria into five rules, which then makes it possible to use computer programming to identify OCA's.

In total, up to 117 countries or territories come under our searchlight. Four large OCA's emerge in the world based on a liberal application of the trade criterion – or the most liberal one, which permits openness of the union as a whole to fall only slightly below the US and Japanese level. Of these four large unions, one covers virtually all of Western Europe; a second encompasses all of Mesoamerica and the Northern ridge of South America; a third occupies a good part of the Middle East, and a fourth englobes the entire ASEAN area, including Australia and China. Two of these large OCA's – the ones in the Americas and the Middle East but especially the latter – are not too robust. They depend too much on allowing a critical level of openness low enough to admit the United States and Japan while excluding both countries nevertheless, and they dissolve too easily when those conditions are tightened. The other two OCA's, however, withstand a similar test.

Even those last two OCA's dwindle down sizeably once we apply the symmetry-of-shocks criterion. The large European one reduces to two possibilities: 1) a 'greater Deutsche mark' core consisting of Belgium, Germany, the Netherlands and Austria, to which Malta could be added; and 2) a more 'Mediterranean' core consisting of Belgium, Spain, France and Italy. Generally, therefore, our results regarding Europe are mixed. On the one hand, the analysis supports a large OCA in the area – one which completely covers up all the distinctions that have often prevailed in discussion of the European Monetary Union between 'Ins', 'Pre-ins' and 'Outs' (except perhaps those dealing with Scandinavia). This happens under strict reliance on trade considerations. On the other hand, the analysis gives grounding for most of the divisions that have been witnessed in the European debate once we admit

the business cycle symmetry criterion. From the standpoint of our analysis, the emergence of a large union in Europe would then seem to suggest the widespread assumption that the trade criterion is the most important and possibly the further idea that the cost of business cycle asymmetry will tend to fall (if not the view that political considerations prevail).

Following injection of the shock-symmetry criterion, the large OCA in Asia based on the trade criterion alone reduces to Bangladesh, Indonesia, Malaysia, the Philippines and Thailand. But it is still fair to say that a sizeable OCA emerges in Far East Asia. This result is interesting, since efforts to promote exchange rate stability have not gone nearly as far in that part of the world as they have in Europe. These efforts have also centered on the dollar rather than the yen. The question of dollar or yen can be put aside, in our work, however, since the OCA we define does not include either Japan or the United States. Stated differently, our Asiatic OCA could well dispose of a separate currency.

Over and above the size and importance of the OCA's we discern, our programme displays a marked tendency to identify monetary unions on a geographical basis, and, quite pronouncedly, in line with the gravity model of trade. There are exceptions, mostly concerning Australia, Canada, Saudi Arabia and Singapore, which show traces of past days of eminent British influence on world trade.

Whilst on trade grounds alone, then, the world may seem ripe for further consolidation into large currency areas, the shocks-symmetry criterion sounds a qualifying note. Its application would even suggest that the 11-member country European Monetary Union may already be too large. This last judgement, though, may be tempered by giving credence to a small, recent literature which would indicate that the symmetry-of-shocks criterion, as well as the trade one, will tend to be progressively met under monetary union.

Introduction

How many 'optimal currency areas' (OCA's) are there in the world? In this study, we make an attempt to use worldwide trade and output data to answer this question. As a start, we shall discuss the general question itself. Our approach will be to limit ourselves to two of the many criteria that have been proposed in the literature on optimum currency areas in order to identify the ideal participants in a monetary union. The first one relates to bilateral trade between countries; and the second to the symmetry in the shocks affecting output in different countries. We have translated these two criteria into five rules, which we were then able to program to identify OCA's.

All in all, up to 117 countries or territories come under our searchlight. These entities comprise most of the world outside of Africa, for which the only bilateral trade data we have concern Egypt and Libya. There are other gaps: Iraq, Afghanistan, and Cambodia, for example. With respect to the former USSR, we shall rely strictly on the data since the collapse of the Soviet Union. In general, we began the analysis in 1965, but shall concentrate on the nineties in our discussion.

The question

The question of the number of OCA's in the world may seem a bit exotic. The number of currencies in the entire globe today is only moderately inferior to the number of countries. If inferior at all, the reason is not that some countries maintain pegged exchange rates, even in the extreme case of currency boards (Argentina or ex-colonial-French Central and Western Africa), since in these instances, there are still separate currencies in most meanings of the term: conversion costs, margins, and possible changes of par value. The genuine reason lies in small states and principalities such as Luxembourg and Liechtenstein. These political entities

truly do not maintain a separate currency in any sense: no exchange rate, nothing to peg. Interestingly enough, even when a number of new states were created recently with the break-up of the Soviet Union and former Czechoslovakia, almost as many new currencies emerged as did new countries (the exception being Belarus, which is likely to be reintegrated into a greater Russia).

In the same connection, it is often said that unless a currency area coincides with a nation state, serious problems will arise (see Goodhart (1997)). From this perspective, the whole issue of the number of OCA's in the world may seem to be something out of Alice in Wonderland.

Yet there are important reasons for an opposite view. Contrary to the principle of one-country-one-money, the examples of Luxembourg and Liechtenstein (of which there are other instances, such as Puerto Rico, Monaco, and a number of other territories of quasi-independent political status), however innocuous they may seem, are actually very significant. These examples mean that we can go too far in equating the optimal number of currencies with the number of countries. As many currencies as square miles, or multiples of one thousand inhabitants, would obviously be too many. But if the disadvantages of not having a separate money were necessarily overwhelming, why would this be so? Why would tiny political entities not be overwhelmed by the net disadvantages of lacking a separate money, like all the rest? And if there is some small enough country size below which the costs of a separate money exceed the benefits, how do we know that we do not already have too many currencies in the world today? Given the present state of information about the dimensions of an OCA, the minimal size would seem just as foggy as the maximal one. The prediction that the movement toward a single currency in the European Union must fail without further political integration cannot simply be accepted as fact.

In addition, Eichengreen (1994) offers an important perspective on the current evolution of money in the world which may serve to underline the relevance of the question of the total number and composition of OCA's today. As he points out, greater capital mobility makes pegged exchange rates increasingly difficult to maintain. Apart from capital controls, monetary union may therefore become the only viable alternative to flexible exchange rates in the future. Since pressures for freedom of capital movement already exist widely around the globe, and many countries clearly wish to avoid flexible exchange rates (because of problems of exchange rate uncertainty and misalignment), projects for monetary union could arise in other parts of the world than the European Union – all the more so if EMU proves to be a success. Thus, a proper understanding of the composition and the number of OCA's worldwide could help to foresee and even possibly shape the future.

The two criteria

The main driving force behind the potential welfare-improvement of enlarging a currency area is obviously trade. All the essential benefits of one money – fewer units of account and lower transaction costs – depend on trade. Moreover, several attempts to provide formal treatments of OCA's consider the costs of enlarging a monetary union as rising monotonically with the diminution of external trade in relation to output. Lower ratios of trade to output, or lower openness, raise the value of independent monetary policy for stabilization purposes, and therefore as a monetary union widens, losing independent monetary policy becomes costlier. It follows that trade is not only the motor for the gains of monetary union, but also captures many of the costs of monetary union too (See Krugman (1990) and Mélitz (1995, 1996)).

The literature on OCA's since Mundell, however, calls attention to a number of other criteria for an OCA besides trade, either as an index of benefits or (from the standpoint of diminishing openness) as an index of costs.

Evidently trade will not cover two of the most frequently mentioned criteria for OCA's: labor mobility and fiscal federalism. International labor mobility is mostly low, even among close trading partners, and fiscal federalism generally does not exist at all on a supra-national level, or does so only minimally, as in the EU. However, labor mobility and fiscal federalism have had little use in the past in showing how much further a currency area should stretch, but have mostly served to explain why no matter how large countries already are, they nevertheless benefit from a single money. Since we shall not question here that existing currency areas are not too large (except possibly in the case of the emerging 11-member EMU), only that they may be too small, putting the two previous criteria to the side therefore might do limited – or at least only arguable – harm.[1] There are other omissions, however. Trade will also fail to cover reputation or anti-inflationary credibility as a criterion of an OCA. Nor will it embrace issues of the political control and political constitution of the common central bank. Yet the sweep of the trade criterion alone may be wider than meets the eye. In particular, trade could well cover most of the topic that has dominated empirical work on OCA's thus far: namely, the symmetric or asymmetric nature of the shocks affecting the potential union partners.

A recent study by Frankel and Rose (1997a) discloses a positive correlation between bilateral trade intensity and symmetry in output fluctuations, and thereby suggests that there may be no basic opposition between the two criteria of our choice. At the same time, studies

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[1] Quite independently of the previous two criteria, there are powerful reasons to think that no unified political entity could live happily with two or more central banks issuing separate currencies within its boundaries. Not only might the different central banks engage in competitive devaluation in order to gain a trade advantage, but also in order to shift the tax burden to the other's region. This point also underlies our unwillingness even to consider the possibility that existing currency areas may already be too large.

by Artis and Zhang (1997a, 1997b) indicate a correlation between exchange rate stability and business cycle symmetry. Taken together, these studies seem to suggest that a currency union formed on the basis of trade alone would not contain many members who would fail to meet the symmetry-of-shocks criterion. In any case, the number of offenders would likely decline over time. On this ground, the satisfaction of the second of our two criteria could be regarded as 'endogenous', to use Frankel and Rose's term.[2]

Figure 1, based on Krugman (1990), illustrates the matter. The benefits of joining a currency union with other countries are shown (by the curve B_0B_0) as an increasing function of bilateral trade in relation to output, or 'bilateral openness.' The costs of entering such a union are shown (by the curve C_0C_0) as a decreasing function of bilateral openness, since the value of the exchange rate (independent monetary policy) as a stabilization instrument decreases with the degree of integration. The intersection of C_0C_0 and B_0B_0 for the 'representative' country determines a threshold value for openness above which ($b > b^*$) the benefits of membership exceed the costs. However, the position of the C_0C_0-curve depends on the importance of the asymmetric shocks calling for a stabilization effort. A higher degree of asymmetry, represented by the higher curve C_1C_1, would then lead to a higher critical value of b^*. If participation in a monetary union in itself reduces the frequency and size of asymmetric shocks, then the C-curve itself would drift downwards following entry into union. The same factor could cause an upward drift in the B-curve under monetary union, on the assumption that the union may also tend to boost trade integration.

If monetary union would promote progressive diminution in the C-curve, it might even be possible to rely strictly on the trade criterion in our investigation. However, the evidence supporting such an impact is still somewhat scanty and the topic deserves serious further

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[2] See Frankel and Rose (1997b) for specific application to European Monetary Union.

investigation. For this reason, we have chosen to test whether currency unions established on a trade criterion will survive the additional test of a symmetry-of-shocks criterion as well.[3]

Figure 1

Benefits and costs as a function of bilateral openness
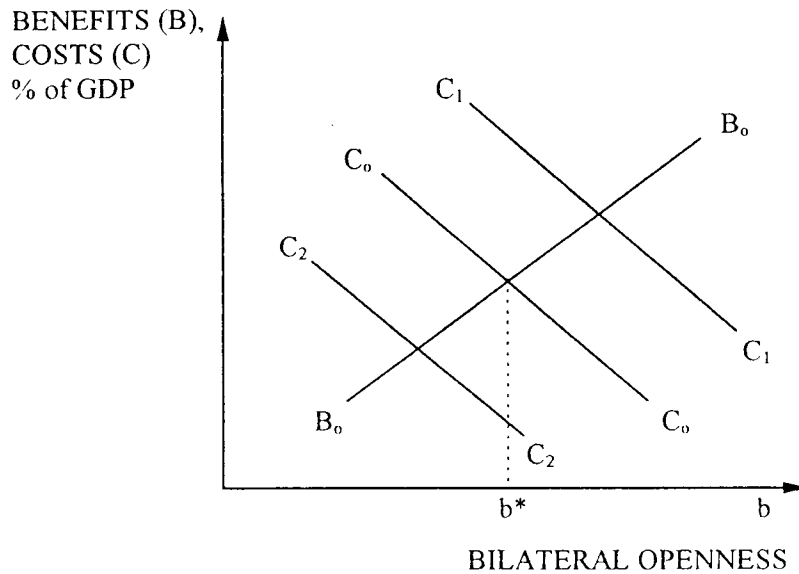
What about Kenen's diversification criterion? The latter is often mentioned too in the literature on OCA's, though it has had little empirical success thus far. Indeed, one of the few empirical regularities about the choice of exchange rate systems seems to be that highly specialized countries favor fixed rates, contrary to Kenen's criterion (see Honkapohja and Pikkarainen (1992)). However, this criterion can be interpreted partly as a restatement – or foreshadowing – of the symmetry one, since the idea that well-diversified countries are less likely to require exchange rate adjustment than others basically relies on the inference that sets of such countries will tend to be hit by symmetric shocks. Kenen seemed to have precisely that

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[3] The related questions whether membership in a monetary union will promote, both, trade integration and business cycle symmetry, will remain in suspense in this paper.

point in mind in his original essay. So far as this interpretation holds, then, the present study will largely cover the diversification criterion as well.

The data

As a preliminary, some discussion of the data is necessary. Our basic data requirements relate to bilateral trade and output. All of our information about bilateral trade comes from the IMF's *Direction of Trade Statistics*. But unfortunately these data cover only goods, whereas services are just as relevant. Rather than base the study strictly on goods, we decided to employ the existing information about aggregate trade in goods and services, and simply to decompose the trade aggregates on the basis of the data for bilateral exchange in goods. Doing so naturally assumes that the geographical composition of trade in services is identical to the one in goods. But still the method has the advantage of taking into consideration the true extent of openness rather than basing this essential aspect on goods alone.

Quite specifically, we collected data for aggregate exports and aggregate imports of goods and services, and for GDP by individual country: the data on aggregate exports and imports were drawn from the IMF's *International Financial Statistics* while the GDP data came partly from this source, and in some cases also from the United Nations' *National Income and Expenditure Accounts*. From these data, we then constructed openness ratios O_i, i = 1, ..., n, for all of the n countries in the study as the sum of exports and imports divided by twice GDP. Given the matrix of bilateral trade in goods found in the IMF data, we then calculated flow values for exports plus imports of goods only for all countries i in trade with countries j, i ≠ j (j = 1,..., n–1). Suppose we designate these next values as t_{ij} and the sum of t_{ij} values for any country i over its n–1 possible trade partners as T_i. The ratio t_{ij}/T_i is a measure of trade intensity (as employed for example in Tichy (1992) and in Frankel and Rose (1996)).

In this study, we use the output-weighted correlate of this measure, $T_{ij} = t_{ij}/T_i$ times O_i, as our basic metric of bilateral trade. The ratio T_{ij} evidently states the trade of country i with country j as a percentage of country i's GDP, and the sum of the T_{ij} values for country i with all possible trade partners equals O_i.

In constructing the t_{ij} terms and the ratios O_i on which our T_{ij} values rest, we compiled the raw data into five-year averages starting in 1965-69 and going up through 1990-95 (involving a six-year average at the very end). The sample of countries in this exercise grew from 69 in 1965-69 to 117 in 1990-95. In the case of missing annual observations during the five- (or six-) year intervals, we averaged over fewer years, but as a rule required at least two. (Some new countries of the former USSR are represented by only one observation in the data set.) As intimated before, however, the evolution from 1965 to 1990 yielded nothing of broad enough interest to warrant general discussion, at least not in the confines of the present paper. Though this aspect has therefore informed our analysis, the statistical material we present will cover essentially the period 1990-95. Trade composition evolves progressively in the absence of dramatic political shifts (such as the break-up of the Soviet Union), and our information for the most recent period is much greater than for the rest.

Measures of symmetry

To construct measures of symmetry in output fluctuations, we focused on cross-correlations of the cyclical components (residuals) of the series for annual real GDP. Those components were obtained by fitting a log-linear trend to the data for the period 1980-1996 prior to detrending. Alternatively, we applied Hodrick-Prescott filters with dampening parameters of either 100 or 400. As a further precaution, we inspected the results of detrending and using Hodrick-Prescott filters for the entire available period, which often exceeded the 1980-1996 time stretch and sometimes started as early as 1965. The set of

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countries for which the required GDP data series was available was limited to 90 (data from IMF: *International Financial Statistics*), the most notable exclusions coming from Central and Eastern Europe.

Identifying currency unions: the procedure

Given our data set, the formal procedure for identifying currency unions comes in two parts. The first part, consisting of four steps or rules, concerns the trade criterion alone, while the second part incorporates the symmetry-of-output-fluctuations criterion as well. Let us first set out these steps in a formal fashion, next discuss some general features of their application, and then present the empirical results. In the empirical discussion, we shall organize the material by geographical area, as it was possible to do. We will also facilitate informed judgement by providing detailed trade data for each geographical area.

Part 1. Identification by the trade criterion.

The application of the trade criterion rested on the following four rules:

(1) *Sample selection.* Countries eligible for monetary union must have a high enough degree of openness, O_i, that is, one exceeding some lower and reasonably high threshold, O^*.

(2) *Partner ordering.* For each country (i) in the sample, partners (j) are selected from the sample in descending order of T_{ij} values, and are progressively added to the union, subject to steps (3) and (4).

(3) *Stopping rule.* The process (2) stops when the openness of the union falls to O^*.

(4) *Reciprocity.* Every additional member of the union must accept every insider and must be accepted by every insider based on the preceding three rules.

These rules are intended to reflect the basic idea that high values of bilateral trade relative to GDP increase the benefits of a currency union as long as the overall openness ratio

of the union, O, stays above a certain limit. Evidently, the lower the critical lower bound of O, O*, the larger the currency unions that can be advantageously formed. In applying the rules, we stuck to values of O* either higher than, or at least in the vicinity of, the O levels displayed by the world's two largest economies, both of which are relatively closed by general international standards. The US has an openness ratio of 10.6 per cent and Japan one of 9.6 per cent.

Two major consequences of the application of our rules do not necessarily meet the eye and should be mentioned at once. First, when the critical level of union openness, O*, is set at the relatively low value typical of the larger countries, adding one of these larger countries to the union brings the 'stopping rule' (3) immediately into operation. Second, alternative monetary unions with partly overlapping memberships will often occur. They can do so for three major reasons. First, adding a number of small members may have the same effect on O for the union as a whole as adding a single large one. Second, though the exports of country A toward country B are necessarily the imports of country B from A, trade is also output-weighted in our work, and therefore asymmetries result. More precisely, many small countries frequently "wish to join" a large country (typically, Germany, the US, or Japan) while the large country is not interested in them. Thirdly, the ordering of partners tends to differ between countries (independently of the preceding point). Thus, Italy may be high on the list of a country which is low on Italy's own.

We shall report results for values of O* a little below the US and Japanese level, 0.09, a little above, 0.11, and one of 0.15. Whenever O* = 0.9 is in question, we always consider the alternative of excluding both the US and Japan as potential partners.

Part 2: Adding the output-shock-symmetry criterion.

Adding the criterion of output-shock-symmetry requires a fifth 'rule' (or step):

(5) *Business cycle symmetry.* Countries identified as putative union members based on steps (1)-(4) will be eliminated if the cross-correlation of their business-cycle output components with those of the largest producer, or the 'centre country,' in the putative union, falls below a critical level.

In deciding on the critical level in applying rule (5), we took note of related earlier work. Based on US data for 1977-1995, Hess and Shin (1997) report an average correlation of GSP (Gross State Product) for individual states with the rest of the Union of about 0.75 (excluding the negative correlations for Texas and Louisiana). Van Wincoop (1995), on his part, finds an average pair-wise cross-correlation of output of only 0.42 among the 47 Japanese prefectures in 1975-1988. Both these studies use the Hodrick-Prescott filter with a dampening parameter of 100. The presence of lower cross-correlations in Japan than the US is perhaps not surprising, since the average size of the Japanese region is much smaller.

With all of these results in mind, we opted for a critical value of the cross-correlation coefficient of 0.6. But since this choice could seem arbitrary, we will also report on cross-correlations in the 0.5-0.6 range under any of our alternative de-trending methods and sample periods. Broadly speaking, only moderate revisions would be needed in the paper if the critical value were reduced to 0.4, whereas setting this value as high as 0.7 would merely cause the monetary unions we identify to shrink (except those with Mexico or Venezuela as center countries, which would then disappear). Our cross-correlations, it may be noted, all rest on GDP statistics whereas much existing work (including that reported by Artis and Zhang (1997a, 1997b)) is based on industrial production data. Even though the latter data has the advantage of appearing at higher frequencies, GDP series may be preferred, since industrial production often accounts for as little as 25-30% of GDP in developed economies.

The results

Western Europe

Figure 2 displays the basic bilateral trade data for Western Europe. The horizontal panels show the output-weighted trade intensities (from here on referred to as 'trade weights') of the Western European countries (whose names are shown on the left in abbreviated form). It is obvious from the figure that those trade weights almost always peak in the column for Germany. The UK, France and Italy represent less important, though still notable poles of attraction for trade. Table 1 provides a summary. The Western European countries are uniformly highly open economies. Even apart from the highly open Benelux countries and Ireland, the openness ratios are frequently above 30 per cent. Moreover, as the second column shows, about one half of this openness comes from trade with the EU6 or among the EU6. This would seem to suggest that the application of the trade criterion might yield a significant return in identifying a large currency union. And so it is.

Part one of Table 2 shows the results of applying the trade criterion based on the preceding programme. Setting the critical value for openness at 0.09, or a little below the value characteristic of the US (0.106) and Japan (0.096), the "big four" – France, Germany, Italy and the UK – and the Benelux would wish to form a monetary union. The only combinations of the other countries that would also join together in Western Europe (the EU+3) are either Scandinavian or Iberian. But those results of the programme are notably affected by the eligibility of the US. As soon as the US is admitted by others in a union based on the first three rules, the value of openness for the union falls below O* (while the US, of course, 'opts out' under the reciprocity criterion) and the stopping rule comes into effect. As indicated above, we alleviate this problem in two ways. One is to keep the critical value of O* just above the US level at 11 percent. The other is to retain a O* at 9 percent but simply rule

out the US as a possible trade partner. In the case of Europe, the two methods give very similar results.

Figure 2:

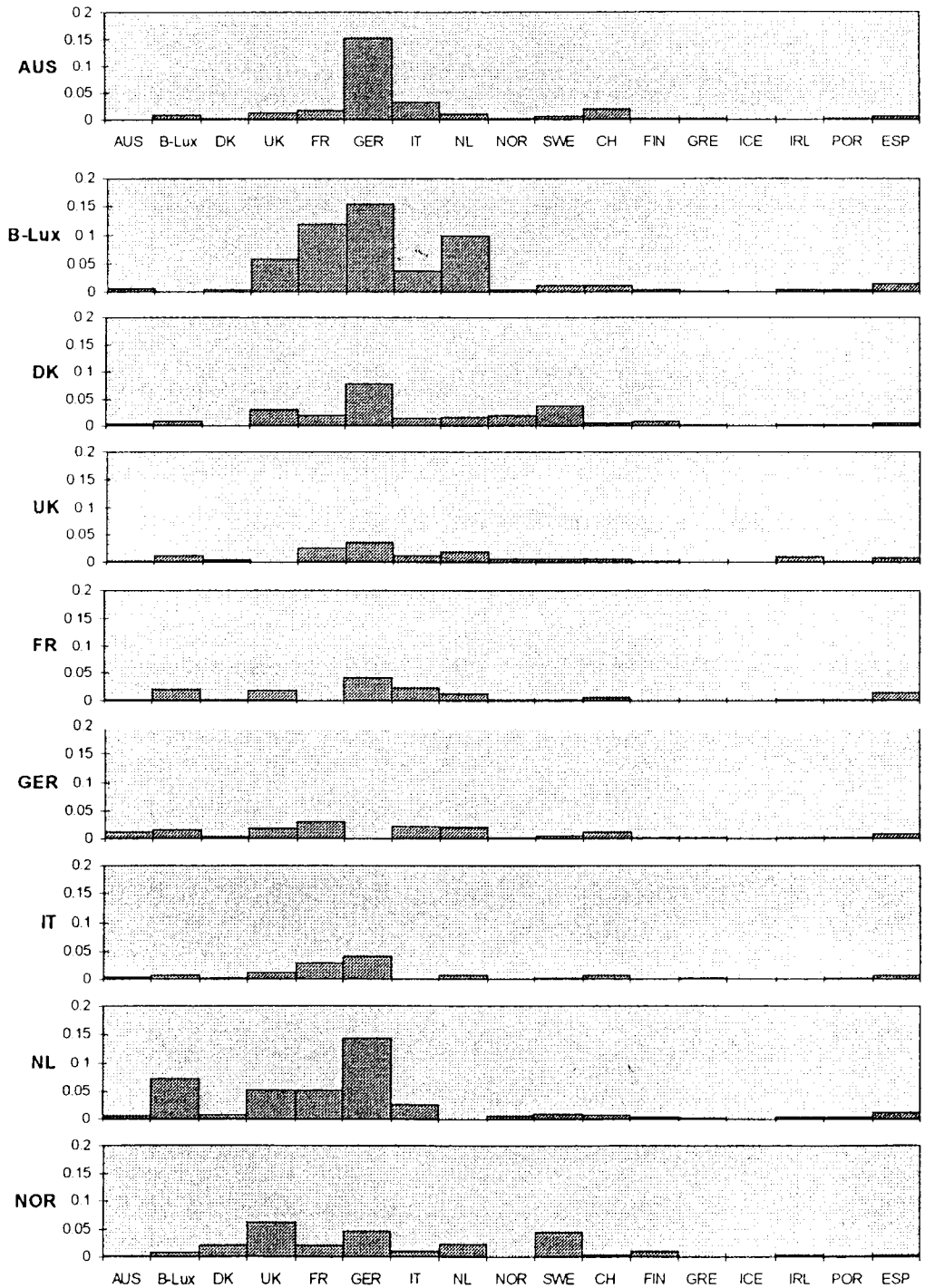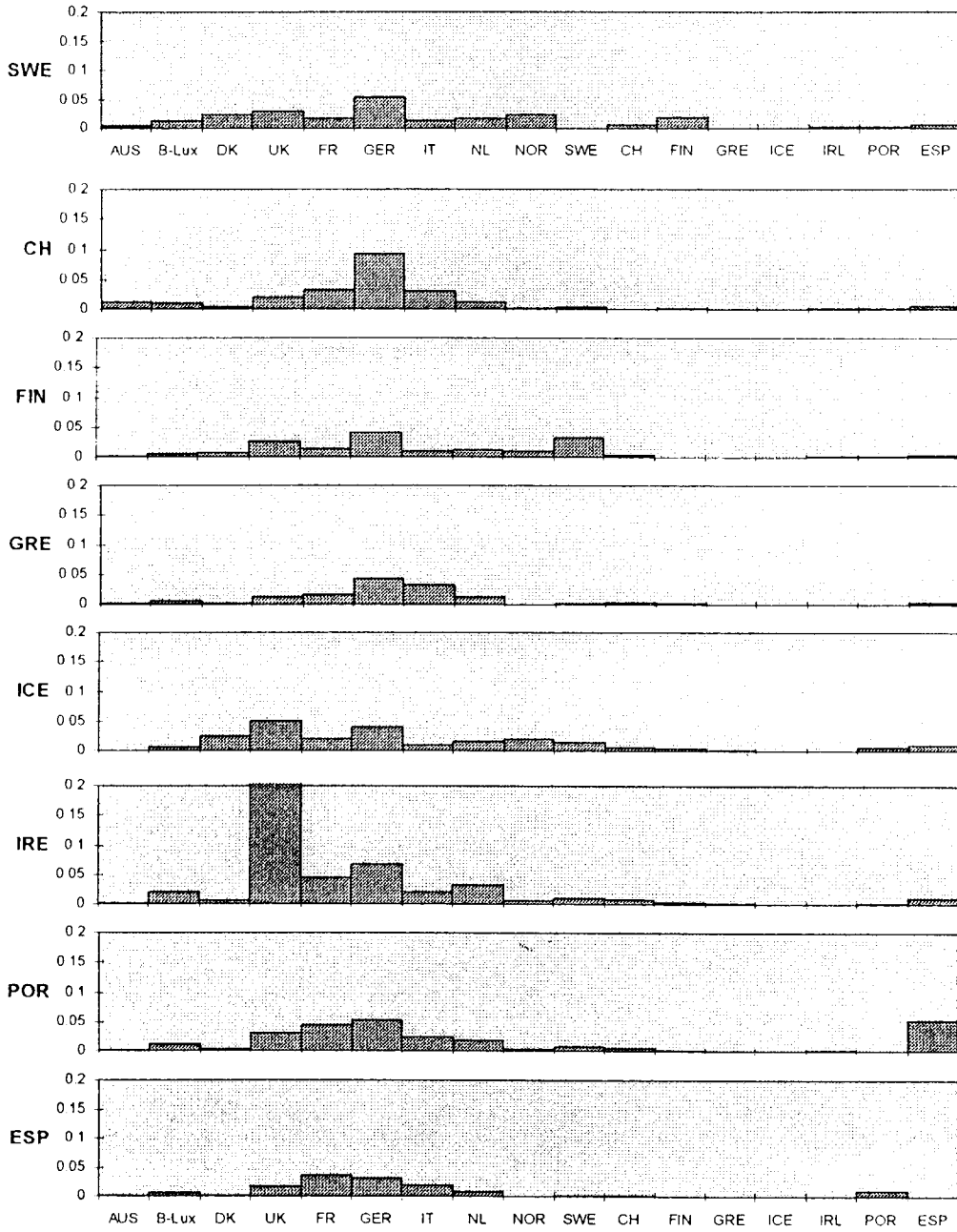### Western Europe: bilateral trade intensities

Figure 2 (cont'd):

Western Europe: bilateral trade intensities

Once the US and Japan are excluded despite $O^* = 0.09$, 16 of the 17 countries in the EU+3 sample would form an OCA – all of them except Iceland. In addition, Russian membership would suit everyone and so would Turkish membership. Only one alternative *large-scale* OCA emerges in Europe that would interfere with this big one according to the programme. It would consist of the UK, Ireland, Canada, Australia, New Zealand, Sweden, Mexico, and Portugal. But this octet, which obviously evokes shades of the British Commonwealth, would disappear from view at $O^* = 0.11$. The other, larger, and strictly European OCA would not. Eight of the countries in the latter grouping, including the "big four," would still hold together (Russia would no longer be accepted). Notably, though, the four Scandinavians would form a separate block.

At a 15 percent threshold for openness, our last major point of reference, the only potential unions are naturally smaller. Those composed of three or more countries belong to one of three types: the "big four" alone; a selection of these four plus either Belgium-Luxembourg or the Netherlands; and a Scandinavian grouping (see Table 2).

The initial result, pertaining to 0.09 openness, is worth underlining: on trade grounds alone and assuming that the union becomes little more closed than the US or Japan, the optimal area is Western Europe as a whole (leaving Iceland aside). Thus, the distinctions that often prevailed in discussion of the European Monetary Union between 'Ins', 'Pre-ins' and 'Outs' are obviously not well reflected in the trade data, except perhaps for the presence of a fairly coherent 'Scandinavian' grouping.

Things change when we bring into account the business cycle symmetry criterion in Part 2 of Table 2. The large OCA based on $O^*=0.9$ when the US and Japan are excluded from consideration dwindles down to two possibilities: (1) a 'greater deutschmark' core consisting of Germany, Austria, Belgium and the Netherlands, to which Malta could be added; and (2) a more 'Mediterranean' core consisting of France, Italy, Spain and Belgium. Quite notably,

France and Germany do not mix together, and this is not simply a marginal matter. As indicated above, business cycle symmetry was tested with six alternative definitions: three de-trending techniques and two different sample periods. In four of these alternatives, the cross-correlation between output in France and Germany was less than 0.45. In the other two instances, the long (1965-95) data sample served.[4] Less surprisingly perhaps, the application of the business cycle symmetry criterion eliminates the UK from all the potential unions identified on trade grounds, except for the one with Sweden, Canada and Australia. In addition, the business cycle symmetry criterion underscores the coherence of the various Scandinavian groupings. Broadly speaking, once we bring output into consideration, Germany does not seem as good a 'centre' country as it does in regard to trade. In a number of European countries (including Italy, the UK and Sweden), business cycle correlations with the US and Canada are much higher than the similar correlations with Germany.

By applying the business cycle symmetry criterion, we thus encounter a lot of the divisions that have been witnessed in the European debate – most notably in relation to the UK and Scandinavia.[5] The fact that a large union is now under way might then be taken to suggest the widespread assumption that the trade criterion is most important and possibly the further idea that the cost of business cycle asymmetry will fall (if not the view that political considerations prevail).

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[4] Note that in their study of the eligibility of European countries for monetary union with Germany based on OCA-type considerations, Bayoumi and Eichengreen (1997) also exclude France from the "converged group" on grounds of the country's "structural characteristics and cyclical performance" (p. 769).

[5] In its "Five Tests" for acceding to the EMU, the UK government has formally included a better convergence of cyclical conditions in the UK with those in the Union-countries (cf. UK Treasury (1997)).

The Rest of Europe

The basic trade data summarized in Table 3 indicate that for most countries in the rest of Europe, trade with the EU6 occupies a much more important place than trade with the US or Japan. At the same time, most of these economies are highly open and do a lot of trade among themselves. The programme identifies only small monetary unions of two or three members at $O^* = 0.09$ in this next part of Europe (see Table 4), including ex-Yugoslavia (with a question mark regarding Serbia, for which we have no data), the Baltic countries, and ex-Czechoslovakia. Once again, the exclusion of the US and Japan yields an enlargement. Specifically, the following monetary unions of four or five members appear:

1. Czech Republic, Hungary, Poland, Ukraine, Russia

2. Czech Republic, Slovakia, Hungary, Russia

3. Poland, Estonia, Latvia, Belarus, Russia

4. Estonia, Latvia, Lithuania, Belarus

5. Romania, Bulgaria, Russia, China

Once the threshold level of openness rises to 15 percent, however, the only monetary unions remaining in the region consist of only two countries.[6] We lack the requisite output data to apply the business cycle symmetry criterion to these countries.

The Americas

The trade data for the Americas suggest a sharp distinction between three regions: (1) North America, Central America, and the Northern ring of South America; (2) the rest of South America; and (3) the Caribbean. Trade ties to the US reign supreme for countries in the

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[6] Compare Honohan (1997), who discusses the prospect of European countries outside of EMU forming miniblocs based on trade alone. Interestingly too, Tichy (1992) uses trade data in order to identify an "optimum customs union" in Europe.

first region, including Venezuela, Colombia and Ecuador or the Northern ring of the South. As a scrutiny of Table 5 will show, if the European "hard core" or the EU6 can be seen as an OCA based on trade alone, then so can this area. But our programme is more demanding. The problem raised by the programme stems from the reciprocity rule and the centrality of relations with the US: the US is simply not interested in such a union.

Unlike Germany, or the "centre country" in Europe, the US is only moderately open and does less than a third of its trade with the rest of the countries of North, Central, and the relevant Northern part of South America. In addition, most of the US trade with those countries is with Canada and the rest predominantly with Mexico, whilst Japan is the US' second-most important trading partner, after Canada. Of course, the US should have no objection if the others in the hypothetical OCA simply adopted the dollar as their home currency, and any objection by the rest would fall outside of our analysis. But based on the strict application of our programme (Table 6), the only viable monetary union with the US includes Canada and possibly also (on trade grounds alone and given a low enough O^*) Japan. As the programme now stands, there are only two other OCA's in the first region: a Central American one consisting of Costa Rica, El Salvador, Guatemala and Nicaragua (whose contiguity is broken by the omission of Honduras); and another one between the two South American neighbors Columbia and Venezuela.

But if we exclude the US and Japan while keeping O^* at 0.09, then all of the countries in Central America, except for Honduras or Haiti, plus Venezuela and Columbia could form a single OCA (while Honduras and Haiti would object to one another but everyone else would be willing to admit both of them). Peru, Bolivia, and Chile almost enter too. Another large grouping, involving Canada, would also be possible. With O^* at 11 percent, however, the large groups break up into three alternative sets of seven, with a sizeable group including Canada still surviving. With O^* equal 15 percent, this last, large grouping disappears from view and

we are back to monetary unions barely bigger (and economically more significant) than those with $O^* = 0.09$ when the US was present: there are simply more of them. As seen in Table 6, the most striking difference at $O^* = 0.15$ is a distinctly Pacific-orientation of Canada, which now looks out toward the distant shores of Australia, Korea and China.

The remainder of South America below the Northern ring has stronger trade links to the EU6 than the US on the whole, except for Peru. Brazil and Chile are also fairly evenly divided in their trade between the EU6 and the US. In addition, a number of countries in this next American grouping are surprisingly closed: namely, Argentina, Brazil and Peru. This was not always true. Brazil had an openness ratio of around 15 percent in the earlier period of 1970-85, and Peru's had been around 17 percent in 1965-85. But for the last ten years, those two countries are relatively closed, while Argentina has been steadily so in the postwar era. Even if we examine the trade relations of the 7 countries in our Latin American grouping with a fine toothcomb, they would seem to be little interested in monetary union with the US, regardless of who else in the Americas joins.

The programme with $O^* = 0.09$ when the US and Japan are excluded shows two possible monetary unions in the southern region involving a core of Bolivia, Chile and Peru. Mexico, Panama, Ecuador and Venezuela additionally always belong to one of these unions, but in one case (mentioned above) so would most of the rest of Mesoamerica, while in the other, Bolivia's Southern neighbor Paraguay would be present instead. However, either union would break up quickly if we set O^* slightly higher.

The third section of Table 5, dealing with the Caribbean, takes us to a region of the world consisting of very small countries, or in some cases territories with no separate currencies at all. The three French-related areas -- Guadeloupe, Martinique, and French Guiana -- fall into this last category: they all use the French franc as their currency, and correspondingly do the bulk of their trade with mainland France and thus with the EU6 rather

than the US. Some of the other islands and territories in the Caribbean also have close political ties to Europe. Yet, in these cases, trade with the US often dominates. This applies to Antigua & Barbuda, Barbados, Grenada, Guyana, and St. Kitts & Nevis, all of whom have some British affiliation, and it holds in both examples of a Dutch connection, Netherlands Antilles and Suriname. But St. Lucia and St. Vincent & Grenadines, with British political ties, do as much trade with the UK as the US. Where no European government plays any active role, as in the Bahamas, Bermuda, Jamaica and Trinidad & Tobago, trade with the US greatly dominates trade with all of the EU6 combined.

In general, the Caribbean presents an unusually varied and complicated picture. None the less, the East Caribbean Currency Area (ECCA) can provide a point of reference. It consists of Antigua & Barbuda, Dominica, Grenada, St. Kitts & Nevis, St. Lucia, and St. Vincent & Grenadines. (We have no data for Anguilla, which is also a member.) The only other monetary union in the zone besides this one is the aforementioned union with France. Our programme (Table 6) would indeed identify the East Caribbean Currency Area as an OCA at $O^* = 0.09$ without the US (with a single qualification for Antigua & Barbuda, which would not admit either St. Kitts & Nevis or St. Lucia). This OCA would then stretch beyond the ECCA to include Belize, Guyana and Jamaica. It could also include Trinidad & Tobago, the largest of this group of countries (by GDP) and acceptable to all other members of the Union except Antigua and Barbuda. Even if we set O^* at 0.15, the only two currency unions that would survive in the Caribbean containing as many as four countries would be composed exclusively of members of the ECCA or harbor strictly one outsider. Thus, our program would essentially detect an OCA somewhere around the precincts of the ECCA. As a final observation, the programme easily discerns Guadeloupe and Martinique as an OCA but does not recognize French Guiana as a member (even at $O^* = 0.09$).

How well do the preceding potential currency areas in the Americas withstand the test of the business cycle symmetry criterion? The answer can be seen by comparing Parts One and Two of Table 6. If anything, in fact, the American unions appear somewhat more robust than the European ones. The union of the US and Canada in the North is confirmed, as is the Central American union (shorn of Nicaragua) and the combination of Colombia and Venezuela. Excluding the US and Japan, but maintaining O* at 0.09, one of the three large groupings in the area that resulted under the trade criterion survives the application of the business cycle symmetry one. The smaller unions suggested by the trade criterion when O* = 0.11 or 0.15 also survive this next test. On down in South America, we find that quite large groupings stand up to the application of the business cycle criterion (though, naturally, none of them include Argentina or Brazil, the big-country participants in Mercosur, which, as mentioned above, are relatively 'closed'). The picture in the Caribbean is complicated by missing data points in a few cases, but rather little remains of the currency areas suggested by the application of the trade criterion.

The Near and Middle East

The Near and Middle East point up an important limitation of the trade criterion. As a rich oil-importing country, Japan figures heavily in trade in this part of the world. But the oil trade is in US dollars, and the US dollar best reflects the monetary concerns of the middle-east exporters of oil to Japan. It is therefore potentially dangerous to draw conclusions from the trade data about membership in an OCA in this part of the world. This problem applies also to the trade of the region with Europe to some extent, but less so – as witnessed by the trade data in Table 7 – for the non-oil-producing countries: Cyprus, Egypt, Israel, Jordan, Lebanon and Syria. All of these states display markedly stronger ties to the EU6 than the US or Japan,

singly or combined. In general, a lot of European trade in the Near and Middle East does not concern oil.

Quite significantly, however, our reciprocity criterion avoids any conceptual anomalies in defining OCA's in the region 9 (see Table 8). Japan would not join any Near and Middle Eastern countries that might wish to hook up with it in a monetary union because of inadequate trade interests with those countries, and the same is true, with minor qualifications, for the Europeans. Saudi Arabia or, alternatively, Israel would be accepted by the EU at $O^* = 0.09$ if we excluded the US and Japan, but only marginally and with exceptions. At 0.09 and without the US or Japan, our programme recognizes all of the oil producers but Lybia (with Jordan added) as a single OCA. This last OCA could well include Cyprus, Lebanon and Syria instead of Omar, Qatar and the UAE. But quite importantly, the grouping dissolves readily with higher values of O^*. Smaller alliances then arise, distinctly pointed toward the East: Pakistan, Singapore and Korea in particular. Those three Asiatic countries feature in all of the OCA's in the region at O^* equal 15 percent except for the one between Saudi Arabia and Bahrain (Table 8).

As seen in Part 2 of Table 8, adding the business cycle symmetry criterion causes many of the earlier unions in the area to dissolve or shrink. The output fluctuations of the largest economy in the potential OCA's in the region, Saudi Arabia, are closely attuned to those of Bahrain and the UAE. Apart from this one example, output fluctuations among Near and Middle Eastern countries are not markedly synchronised.

Asia and Oceania

Consideration of Asia obviously turns the focus upon the possible range of a yen currency area. Accordingly, we have isolated a "yen core" on the basis of trade alone, consisting strictly of some ASEAN (Association of Southeast Asian Nations) members besides

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Japan. The grouping includes Indonesia, Laos, Malaysia, Singapore, Thailand and Vietnam. Myanmar (Burma) might belong to this group as well since one third of its total trade is with these countries; however, Myanmar trade is extremely low: the country is very closed. Unfortunately, we have almost no data for Cambodia, and cannot say whether this ASEAN member also belongs in the core. In the case of Indonesia, Thailand and Vietnam, the dominance of Japanese trade over that with the US or the EU6 is clear from Table 9. For Laos, Malaysia, and Singapore, however, our reasoning is not obvious since these three countries trade as much or more with either the US or the EU6 than with Japan. Yet if we include those countries in the "yen core," then their trade with the rest of the yen bloc (which goes beyond Japan, of course) greatly dominates their trade with either the US or the EU6.

Yet, evidently, Japan poses a similar problem to the one of the US in the Americas: the country does not trade predominantly with the rest of the "yen core." Its trade with this group only matches that with the EU6 and is about half as large as its trade with the US. In addition, Japan is relatively closed. Thus, as in the earlier example of the US in the Americas, the "center" country would only be interested in monetary union (apart from wider political considerations outside of the analysis) if the others in the organization simply allowed it to dictate joint monetary policy.

The next section of Table 9 extends the analysis to the remainder of Asia and Oceania. In the central section, dealing with the rest of Asia, we find that the entire Indian subcontinent, consisting of Bangladesh, India, Nepal, Pakistan and Sri Lanka, would not be particularly attracted to the yen zone. Those five countries do more trade with the EU6 than either Japan or the US. In addition, India, in particular, is too closed to be greatly interested in monetary union with anyone. On the other hand, Korea and the Philippines represent interesting cases. Both are more drawn to the US than Japan through trade, but in the event of a monetary zone embracing the entire "yen core," would trade more with the "yen zone" than the US. The

resulting swing in their trade toward the yen zone, however, would be far smaller than the corresponding one of the ASEAN countries that we classified before in the "yen core." China also belongs to a yen zone based on trade, it would seem, as do the two very small states of Brunei and the Maldive Islands.

As concerns Oceania, the trade of Australia and New Zealand is particularly evenly balanced between the EU6, the US and Japan. Indeed, these two countries' trade tilts more toward Japan than that of Korea and the Philippines, representing two points of comparison. Thus, in the event of a currency area comprising the entire "yen core," Australia and New Zealand would be very much in the same ambiguous position as Korea and the Philippines, as their trade with the yen area would then exceed theirs with either the US or the EU6. Australia would feel the pull toward the yen zone more than New Zealand, but should Australia join the yen bloc, then New Zealand could no longer hesitate about doing so too, based on the trade criterion alone. The parenthetical figures in the "yen core" column, which include Australia and New Zealand in the core, show as much.[7] Except for Kiribati, which remains attracted to the US in any event (yet uses the Australian dollar as its currency), some of the diminutive states in the Pacific, east of Australia, would also have an interest in joining the yen zone. Indeed all of them would if Australia and New Zealand did so.

When we apply our programme to the Far East Asian part of the world, a large OCA stretching across the entire surface emerges. With O* set at 0.09 and both Japan and the US excluded as possible partners, Part One of Table 10 shows an OCA stretching from China and Hong Kong to Korea, embracing the entire "yen core," the Philippines, and extending further south to Australia and New Zealand. Even India and Bangladesh belong. The major

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[7] The parenthetical figures for Korea and the Philippines in this column show how much more these two countries would also be drawn toward the yen zone if Australia and New Zealand were included.

qualification regarding the membership of the entire "yen core" in this OCA concerns Laos, which is only accepted by Thailand, Vietnam and the Philippines. The alternative monetary unions in the region are much smaller. One of them, comprising Brunei and Nepal, would equally admit Korea, but then be limited to the "yen core" (because Brunei and Nepal are not of wide enough trade interest). Similarly, a number of monetary unions could be formed between Australia and New Zealand and the small Pacific islands, but these would then be confined to Oceania.

Quite significantly, at O* of 11 percent, the previous large Asiatic OCA's remain evident. Even with O* equal 15 percent when Malaysia drops out, the OCA does not vanish from view but three of its major members – China, Korea and Australia – remain present along with two or four others. There is therefore plainly a large OCA in Far East Asia without Japan based on our programme.

Adding the business cycle symmetry criterion (see Part Two of Table 10) causes this large OCA to shrink considerably. Only Indonesia, Bangladesh, Malaysia, the Philippines and Thailand hold together as a grouping. Singapore is a likely additional member of this, still considerable, OCA, but we cannot be sure because of a data problem.[8]

Conclusions

This paper has tried to apply the theory of optimal currency areas on a worldwide basis. To achieve our aim, we retained a stripped-down version of the theory, wherein only two of the many criteria that have been mentioned in the literature on the subject remain. We also made a case for choosing these two criteria. It was then possible to use computer programming in order to identify OCA's. One of our criteria pertains to trade. According to the

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[8] Our data show Singapore as Indonesia's third largest trading partner, whilst Singapore is reported as having no trade at all with Indonesia.

traditional literature, high levels of bilateral trade provide a potential source of benefits from a common currency. The other relates to symmetry of shocks. The lack of such symmetry can make the abandonment of independent monetary policy costly. A small, recent literature also suggests that the first criterion may even suffice in itself, since the second one will tend to be progressively met under monetary union. (As a further consideration, the first criterion could also tend to be increasingly satisfied under monetary union.) But we have taken no position on the issue.

Our results suggest that four large OCA's can be identified in the world based on the most liberal application of the trade criterion that we admitted, which permits openness to fall slightly below the US and Japanese level. Of these four large unions, one covers virtually all of Western Europe; a second encompasses all of Mesoamerica and the Northern ridge of South America; a third occupies a good part of the Middle East, and a fourth englobes the entire ASEAN area, including China and Australia. Two of these large OCA's – the ones in the Americas and the Middle East but especially the latter – are not too robust. They depend too much on allowing a critical level of openness low enough to admit the US and Japan while excluding both countries nevertheless, and they dissolve too easily when those conditions are tightened.[9] The other two OCA's in our analysis withstand a similar test. Of the two, the East Asian OCA may be the more interesting one, since efforts to promote exchange rate stability have not gone nearly as far in that part of the world. Those efforts have also centered on the dollar rather than the yen (see Frankel and Wei (1992)). However, the question of dollar or yen can be put aside here since the OCA we define does not include either Japan or the US. Stated differently, our Asiatic OCA could well dispose of a separate currency (compare Bénassy-Quéré (1997)).

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[9] On the other hand, the American OCA holds up rather well to the application of the business-cycle-symmetry criterion.

Of considerable interest as well, our programme displays a marked tendency to identify monetary unions on a geographical basis, and, quite pronouncedly, in line with the gravity model of trade. But there are exceptions, mostly concerning Canada, Australia, Saudi Arabia and Singapore, which show traces of earlier days of eminent British influence on world trade.

Whilst on trade grounds alone, then, the world may seem ripe for further consolidation into large currency areas, the shocks-symmetry criterion sounds a qualifying note. Its application would even suggest that the 11-member country European Monetary Union may already be too large. However, giving credence to the 'endogeneity' of the criteria could reverse this judgement.

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TABLE 1

Trade weights in Western Europe 1990-95

	US	EU6	Japan	Openness
EU6				
Germany	1.8	10.8	1.0	26.0
France	1.8	11.9	0.7	23.4
U.K.	3.1	10.6	1.1	26.2
Italy	1.3	10.0	0.5	20.9
Netherlands	3.4	34.7	1.3	56.3
Belgium-Lux	3.8	46.9	1.4	70.4
Iberia				
Spain	1.3	11.9	0.6	20.6
Portugal	1.3	18.4	0.7	34.0
Scandinavia				
Sweden	2.6	14.2	1.1	32.3
Denmark	1.8	16.9	1.3	35.0
Norway	2.4	17.5	1.2	36.2
Finland	1.9	11.1	1.0	28.9
Iceland	3.8	14.6	2.5	33.5
Other				
Austria	1.4	23.5	1.2	39.1
Greece	0.9	12.9	1.0	23.4
Switzerland	2.5	20.0	1.3	33.2
Ireland	7.6	40.5	2.6	64.3

West European OCA's produced by the programme:

trade criterion only

I. THE EU+3

$O^* = 0.09$

    1. France, Germany, Italy, UK and Benelux

    2. France, Germany, Italy, Switzerland

    3. Belgium-Luxembourg, France, Italy, Spain

    4. Austria, Germany, Italy

    5. Denmark, Norway, Sweden

    6. Ireland, UK

    7. Spain, Portugal

    8. Finland, Norway, Sweden

$O^* = 0.09$ minus US and Japan

    1. All of the EU+3 except Iceland plus Malta.

    2. Same plus Russia and Turkey

    3. UK, Ireland, Portugal, Sweden, Canada, Mexico, Australia, New Zealand.

$O^* = 0.11$

    1. France, Germany, Italy, UK, Benelux, Spain, Switzerland.

    2. Sweden, Norway, Finland, Denmark.

    3. France, Spain, Portugal.

$O^* = 0.15$

    1. France, Germany, Italy, UK

    2. Germany, Italy, UK, Netherlands

    3. France, Belgium-Luxembourg

    4. Denmark, Norway, Sweden

    5. Finland, Norway, Sweden

    6. A few two-country unions (apart from those implicit) arise

TABLE 2: Part 2

European OCA's produced by the programme:
trade and business cycle symmetry criteria*

1. THE EU + 3

O* = 0.09

    1. Germany, Belgium, Netherlands (0.52)

    2. --

    3. France, Spain, Belgium, Italy

    4. Germany, Austria

    5. Sweden, Denmark

    6. --

    7. --

    8. Sweden, Finland

O* = 0.9, minus US and Japan

    1. Germany, Austria, Belgium, Netherlands (0.52), Malta.

    2. Same as preceding.

    3. UK, Sweden, Canada, Australia.

O* = 0.11

    1. Germany, Belgium, Netherlands (0.52)

    2. Sweden, Finland, Denmark

    3. France, Spain

O* = 0.15

    1. --

    2. Germany, Netherlands (0.52)

    3. France, Belgium

    4. Sweden, Denmark

    5. Sweden, Finland

* Countries shown are those remaining from the unions identified by trade alone in Table 2 Part 1; except where otherwise indicated, a cross correlation of 0.6 or higher between the cyclical component of output with the centre country was required. The centre country is underlined.

TABLE 3

Trade Weights in the rest of Europe 1990-95

	The EU6	Japan	U.S.	Openness
I. Ex-USSR				
Belarus	6.7	0.1	1.0	18.7
Bulgaria	12.3	0.5	1.4	41.9
Czech Republic	27.1	0.5	1.3	57.8
Estonia	15.2	1.2	2.3	77.2
Hungary	13.2	0.6	1.1	37
Latvia	11.2	0.3	0.7	49
Lithuania	25.5	0.7	1.5	71.1
Poland	11.8	0.3	0.7	24.6
Romania	6.8	0.2	0.8	22.5
Russia	9.6	1.3	1.7	31.9
Slovakia	19.2	0.1	0.7	63.8
Ukraine	20.4	1.3	5.4	50.4
II. Ex-Yugoslavia				
Bosnia/Herzegovina	4.2	--	1	19.6
Croatia	21.2	0.2	1.1	40.4
Slovenia	33.0	0.7	1.9	60
III. Southeast				
Albania	10.7	0.2	0.9	22.6
Malta	70.4	2.2	5.2	98.6
Turkey	6.7	0.5	1.5	16.3

TABLE 4

OCA's identified by the programme in the Rest of Europe

$O^* = 0.09$

    1. Latvia, Lithuania plus either Estonia or Belarus

    2. Czech Republic, Slovakia and Hungary

    3. Czech Republic, Poland

    4. Croatia and Slovenia, Bosnia/Herzogovina

    5. Romania plus either Bulgaria or Ukraine

    6. Russia, Turkey

$O^* = 0.09$ minus the US or Japan (four or more members)

    1. Czech Republic, Hungary, Poland, Russia, Ukraine

    2. Hungary, Slovak Republic, Russia plus either Czech Republic or Romania

    3. Poland, Estonia, Latvia, Belarus, Russia

    4. Romania, Bulgaria, Russia, China

$O^* = 0.11$

Same first four as with $O^* = 0.09$ (but excluding Czech Republic and Poland) with some additions containing Russia (specifically, Russia plus Bulgaria, Russia plus Ukraine and China, and Russia plus Ukraine, Czech Republic and Hungary)

$O^* = 0.15$

Only pairs remain: Belarus and Latvia, Russia and China, Czech and Slovak Republics, Estonia and Latvia, Croatia and Slovenia, Croatia and Bosnia/ Herzegovina; Latvia and Lithuania.

TABLE 5

Trade Weights in the Americas 1990-95

	U.S.	EU6	Japan	Openness
I. North, central & northern ring of South America				
Canada	21.4	2.1	1.6	29.7
Columbia	7.5	3.7	1.2	19.6
Costa Rica	21.1	6.7	1.5	43
Dominican Republic	12.5	3.2	1.7	27.6
Ecuador	10.4	3.7	1.6	26.9
El Salvador	10.2	2.8	0.9	24.7
Guatemala	9.3	2.4	0.9	22.3
Haiti	8.7	1.9	0.3	14.2
Honduras	18.8	4.5	1.9	34.3
Mexico	11.3	1.2	0.6	15.3
Nicaragua	8.9	3.9	1.6	33
Panama	13.6	3.4	2.1	36.5
U.S.	--	1.9	1.6	10.6
Venezuela	13	3.4	0.9	27.2
II. South America				
Argentina	1.2	1.8	0.3	7.6
Bolivia	4.8	4.5	1.4	21.5
Brazil	1.3	1.6	0.4	6
Chile	5.6	6.2	3.7	29.6
Paraguay	3.6	5	2.1	31.2
Peru	2.6	2.2	0.9	11.1
Uruguay	1.9	3.8	0.5	21

III. The Caribbean				
Antigua & Barbuda	25.2	20.2	--	96.8
Bahamas	26.9	13.5	11.1	78.9
Barbados	15.4	8.2	2	48.3
Belize	31.2	11.9	0.6	59.8
Bermuda	9.5	3.1	0.8	19.8
Dominica	12.4	19.7	2.3	72.3
French Guiana	0.9	15.9	0.4	22.8
Grenada	13.1	12.3	2.2	52.5
Guadeloupe	1.2	16.6	0.4	27.3
Guyana	30.7	32.1	6.3	110.1
Jamaica	28.6	9.3	2.1	60.3
Martinique	0.5	18.1	0.3	23.5
Dutch Antilles	47.2	23.3	4.5	170.3
St. Kitts & Nevis	41.2	18.6	2.1	75.2
St. Lucia	25.6	33.2	3	76.2
St. Vincent & Grenadines	13.5	21.5	2.7	62.9
Suriname	10.2	13.5	2.1	43.7
Trinidad & Tobago	18.3	4.3	1	39.8

North and Latin American OCA's produced by the programme:

trade criterion only

I. NORTH, CENTRAL AND NORTHERN RING OF SOUTH AMERICA

$O^* = 0.09$

    1. US, Canada (marginally Japan)

    2. Costa Rica, El Salvador, Guatemala, Nicaragua

    3. Columbia, Venezuela

$O^* = 0.09$ minus US and Japan

    1. All plus Chile and minus Canada, Haiti and Ecuador (or Chile, Columbia, Costa Rica, Dominican Republic, El Salvator, Guatemala, Honduras, Mexico, Nicaragua, Panama, Venezuela)

    2. Haiti can be substituted for Honduras, and Ecuador, Bolivia and Peru can be substituted for Honduras, Nicaragua and Dominican Republic

    3. Canada, Colombia, Costa Rica, Ecuador, Mexico, Peru, Venezuela.

$O^* = 0.11$

    1. El Salvador, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Venezuela (central branch of the first OCA mentioned under the preceding heading)

    2. Mexico, Dominican Republic, El Salvator, Guatemala, Costa Rica, Panama, Venezuela (northerly branch)

    3. Costa Rica, Panama, Columbia, Ecuador, Venezuela, Peru, Mexico (southerly branch, except for Mexico)

    4. Canada, Mexico, Venezuela, Columbia, Chile (North-South combination)

$O^* = 0.15$

    1. Costa Rica, El Salvador, Guatemala, Nicaragua (same as under 0.09)

    2. El Salvator, Guatemala, plus either Costa Rica and Panama or Honduras

    3. Columbia, Ecuador, Panama

    4. Columbia and Venezuela (same as under 0.09)

    5. Canada, Australia, China, Korea

    6. Canada, Mexico

II. SOUTH AMERICA

$O^* = 0.09$

    none

$O^* = 0.09$ minus US and Japan

    1. Bolivia, Chile, Peru and Paraguay plus Mexico, Panama, Ecuador and Venezuela

    2. Bolivia, Chile, Peru plus Columbia, Costa Rica, Dominican Republic, Ecuador, El

    Salvador, Guatemala, Mexico, Panama, Venezuela (already mentioned under section I).

$O^* = 0.11$

    1. Chile, Peru, Paraguay, Uruguay

    2. Chile, Peru, Bolivia, Columbia

    3. Bolivia, Peru, Paraguay, Costa Rica

    4. Chile enters a number of North-South combinations of 4 or 5 countries in the

    Americas.

$O^* = 0.15$

    none

III. THE CARIBBEAN

$O^* = 0.09$

    1. Trinidad & Tobago, Barbados

    2. Trinidad & Tobago, Netherlands Antilles

    3. Guadeloupe, Martinique

$O^* = 0.09$ minus US and Japan

    1. Antigua & Barbuda, Belize, Dominica, Grenada, Guyana, Jamaica, Barbados, St.

    Vincent & Grenadines

    2. Bahamas can be substituted for Dominica and Grenada, Bermuda can be substituted

    for Grenada and St. Vincent & Grenadines, St. Kitts can be substituted for Antingua &

    Barbuda, Trinidad and Tobago added.

    3. Various other combinations of other Caribbeans with five or six of the

    preceding are possible.

$O^* = 0.11$

    1. Antinua & Barbuda, Barbados, Dominica, Guyana, Jamaica, St. Vincent &

    Grenadines

2. Guyana & Jamaica can be replaced by Grenada

3. Guyana, Jamaica, Netherland Antilles, Suriname, Trinidad

4. Trinidad, Belize, Jamaica, Netherland Antilles

5. Various other 4-5 country combinations are possible.

$O^* = 0.15$

1. Barbados, Dominica, Grenada, St Lucia, St. Vincent & Grenadines

2. Dominica, Grenada, St Kitts, St. Vincent & Grenadines

3. A large number of smaller OCA's are possible. All three of those mentioned above under $O^* = 0.09$ survive.

TABLE 6: Part 2

North and Latin American OCA's produced by the programme: trade and business cycle symmetry criteria*

I. NORTH, CENTRAL AND NORTHERN RING OF SOUTH AMERICA

II. $O^* = 0.09$

    1. US, Canada

    2. Guatemala, Costa Rica, El Salvador

    3. Venezuela, Columbia (0.56)

$O^* = 0.09$, minus US and Japan

    1. Mexico, Chile (0.54), Guatemala

    2. Mexico, Bolivia, Chile (0.54), Guatemala, Ecuador

    3. --

$O^* = 0.11$

    1. Venezuela, Costa Rica, Guatemala, Honduras

    2. Mexico, Guatemala

    3. Mexico, Ecuador

    4. --

$O^* = 0.15$

    1. Guatemala, Costa Rica, El Salvador

    2. See Part 1; (Panama drops out) or Guatemala, El Salvador, Honduras

    3. --

    4. Venezuela (as under 0.09), Columbia (0.55)

    5. Canada, Australia, Korea

    6. --

II SOUTH AMERICA

$O^* = 0.09$

    none

$O^* = 0.09$ minus US and Japan

    1. Mexico, Bolivia, Chile (0.54), Paraguay, Ecuador

2. <u>Mexico</u>, Bolivia, Chile (0.54), Ecuador, Guatemala. *But* using Guatemala as centre country (3rd largest after Mexico and Peru): <u>Guatemala</u>, Bolivia, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Mexico, Venezuela.

<u>O* = 0.11</u>

    1. --

    2. --

    3. --

    4. Only <u>Mexico</u>, Chile (0.54), Ecuador

<u>O* = 0.15</u>

    none

III THE CARIBBEAN

<u>O* = 0.09</u>

    1. --

    2. -- (no data for Netherlands Antilles)

    3. -- (no data for Guadeloupe)

<u>O* = 0.09 minus US and Japan</u>

    1. <u>Jamaica</u>, Belize

    2. Same as preceding

    3. Other combinations... <u>Trinidad & Tobago</u>, Suriname,

                                 <u>Jamaica</u>, Suriname

<u>O* = 0.11</u>

    1. –

    2. <u>Barbados</u>, Antigua&Barbuda, Dominica (0.58), Grenada

    3. <u>Jamaica</u>, Suriname

    4. --

<u>O* = 0.15</u>

    1. <u>Barbados</u>, Dominica (0.58), Grenada, St. Lucia

    2. <u>Grenada</u>, St. Kitts

* Countries shown are those remaining from the unions identified by trade alone in Table 6 Part 1; except where otherwise indicated, a cross correlation of 0.6 or higher between the cyclical component of output with the centre country was required. The centre country is underlined.

TABLE 7

Trade Weights in the Near and Middle East 1990-95

	U.S.	EU6	Japan	Openness
Bahrain	5.1	8	4.3	105.6
Cyprus	3.8	19.5	3.6	53.3
Egypt	3.9	8.2	0.1	24.8
Israel	8.4	14.2	1.8	36.9
Jordan	6.5	16.1	2.5	71.4
Kuwait	9.2	12.4	8.4	56.7
Lebanon	2.8	16	1.3	43.8
Lybia	0.1	60.0	1.2	91.7
Oman	2.5	6	10.5	43.5
Qatar	1.8	4.9	15.4	35
Saudi Arabia	9.2	10	6.9	44.2
Syria	0.6	5.6	0.5	14.3
United Arab Emirates	3.3	9.1	16.3	57.2

TABLE 8: Part 1

Near and Middle Eastern OCA's produced by the programme:

trade criterion only

$O^* = 0.09$

1. Lebanon and Syria

$O^* = 0.09$ minus US and Japan

1. Bahrain, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates (UAE)

2. Bahrain, Cyprus, Jordan, Kuwait, Lebanon, Saudi Arabia, Syria

3. Egypt plus two of the preceding (never Bahrain)

$O^* = 0.11$

1. Bahrain, Saudi Arabia, UAE, plus Pakistan

2. Kuwait, Saudi Arabia, plus either Korea, Pakistan and Singapore or plus Korea, and the Philippines

3. Saudi Arabia, the UAE, Pakistan, China, Hong Kong, Korea, Malaysia, Thailand and Singapore or Indonesia, or else Oman, UAE, Korea, Singapore, Thailand and China

$O^* = 0.15$

1. Saudi Arabia, Korea , Singapore

2. Oman, UAE, Korea

3. Bahrain, Saudi Arabia

4. Kuwait, Pakistan

5. UAE plus either Pakistan or Singapore

Near and Middle Eastern OCA's produced by the programme:

trade and business cycle symmetry criteria*

$O^* = 0.09$

    1. --

$O^* = 0.09$ minus US and Japan

    1. Saudi Arabia, Bahrain, UAE

    2. Saudi Arabia, Bahrain, Syria (0.54)

    3. --

$O^* = 0.11$

    1. Saudi Arabia, Bahrain, UAE

    2. Saudi Arabia plus Singapore (0.52) or plus the Philippines

    3. --

$O^*=0.15$

    1. --

    2. --

    3. Saudi Arabia, Bahrain

    4. --

    5. Singapore, UAE

* Countries shown are those remaining from the unions identified by trade alone in Table 8 Part 1; except where otherwise indicated, a cross correlation of 0.6 or higher between the cyclical component of output with the centre country was required. The centre country is underlined.

TABLE 9

Trade Weights in Asia and Oceania 1990-95

	U.S.	EU6	Japan	Yen core	Openness
I. Yen core					
Indonesia	3.5	4	7.8	10.2	26.4
Japan	2.6	1.3	--	1.2 (1.6)	9.6
Laos	0.4	2.9	2.4	19.6	26.8
Malaysia	14.9	11.1	16.9	36.5	85
Singapore	29.8	19.9	25	59.9	168.4
Thailand	6.7	6.3	10.4	16.1	43.1
Vietnam	0.1	2.9	4.7	11.5	29.5
II. Rest of Asia					
Bangladesh	2.3	3	1.1	2.6	16.4
Brunei	4.9	8.9	18.4	33.5	55.2
Myanmar	0.0	0.0	0.1	0.5	1.5
China	2.5	2.2	3.5	4.5	19.9
Hong Kong	17.8	13.7	12.8	20.6	116.6
India	1.4	2.8	0.8	1.5	10.3
Korea	7.2	3.4	6.4	9.2 (10.1)	31.2
Maldives	5.2	15.6	4.5	62.2	113.2
Nepal	2.7	6.3	2.2	6.3	25.3
Pakistan	2.5	5.1	2.2	3.7	21.1
Philippines	8.9	4.3	6.7	10.1 (10.9)	33.8
Sri Lanka	6.1	8.1	3.3	7.3	39
III. Oceania					
Australia	3	3	4.2	6.1 (7.1)	19.5
Fiji	6.5	8.1	5.1	9.3 (25.8)	60.9
Kiribati	47.3	16.4	11.5	11.5 (29.8)	109.9
New Zealand	4.5	4.6	4.6	6.2 (11.8)	30.2

Papua New Guinea	2.2	4.7	9.6	13.7 (34.9)	48.3
Solomon Islands	4.7	8.3	28.1	38.1 (56.4)	84.9
Tonga	4.5	0.8	6.5	9.4 (26)	42
Vanuatu	1.3	11.3	19.5	20.6 (32.7)	54.3
Western Samoa	8.3	3.3	6.7	7.5 (54.3)	84.7

TABLE 10: Part 1

Asian and Oceanian OCA's identified by the programme: trade criterion only

$O^* = 0.09$

 1. China and Hong Kong

 2. Malaysia and Singapore

$O^* = 0.09$ minus US and Japan

 1. Bangladesh, China, Hong Kong, India, Indonesia or Singapore, Korea, Malaysia, Philippines, Singapore, Thailand, Australia, New Zealand, Vietnam or Sri Lanka and Pakistan

 2. Brunei, Korea, Malaysia, Nepal, Philippines, Indonesia or Singapore, Thailand,

 3. Australia, New Zealand, Fiji, plus either Papua New Guinea and Solomon Islands, or Western Samoa and Tonga, or Papua New Guinea, Tonga and Vanuatu

 4. Australia, Fiji and Kiribati

$O^* = 0.11$

 1. China, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Thailand, Vietnam, Australia or with Singapore replacing Indonesia and Vietnam

 2. Somewhat smaller unions with Singapore

$O^* = 0.15$

 1. China, Hong Kong, Korea, Singapore, Thailand, Australia

 2. China, Indonesia, Korea, Malaysia, Australia

 3. There are a few distinct, smaller OCA's

TABLE 10: Part 2

Asian and Oceanian OCA's identified by the programme:
trade and business cycle symmetry criteria*

O* = 0.09

    1. Not sufficient data on Hong Kong

    2. Singapore and Malaysia

O* = 0.09 minus US and Japan

    1. Not sufficient data on Hong Kong. If China and Korea excluded as centre countries, then Indonesia, Bangladesh, Malaysia, Philippines, Thailand

    2. --

    3. --

    4. --

O* = 0.11

    1. Excluding China and Korea as 'centre countries,' Indonesia, Malaysia, Philippines, Thailand

    2. --

O* = 0.15

    1. Thailand and Singapore if China, Korea, Australia excluded as centre countries

    2. Indonesia, Malaysia, if other centre countries excluded

    3. --

* Countries shown are those remaining from the unions identified by trade alone in Table 10 Part 1; except where otherwise indicated, a cross correlation of 0.6 or higher between the cyclical component of output with the centre country was required. The centre country is underlined.