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*Optimum Currency Area Theory and Monetary
Integration as a Gradual Process*

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INTRODUCTION

The concept of (regional) economic integration refers both to a state of affairs and a process (Balassa, 1961).¹ In this contribution we will refer to integration seen as a gradual process. Both in terms of the agenda of the negotiations, as in terms of the number of countries taking part in the integration treaties, post-war regional integration can indeed be perceived and observed as a cumulative and partly irreversible (or, at least, costly-to-reverse) process. Integration in the European Union context and in other geographical areas can easily be modelled as a process of both ‘deepening’ and geographical expansion.

In this theoretical contribution, we analyse the phenomenon of monetary integration seen as a gradual process, and evaluate the usefulness of optimum currency area (OCA) theory – essentially a static theory – in order to predict the path of integration. More specifically, the following aspects are studied:

- Is the idea of a monetary union with an incremental number of participating countries consistent with Kenen’s thesis about interindustry labour mobility, for given industrial structures?
- Does the theory of optimum currency areas, according to Mundell and Kenen, yield time-consistent (and politically feasible) recommendations about the suitability of monetary integration for a group of economies characterised by divergent industrial development patterns?
- Given the fact that the theoretical literature on OCAs suggests different criteria for testing the suitability of forming currency unions, are the rankings of countries according to their suitability to enter a monetary union sufficiently independent from the choice of the criteria? And, by extension, how robust are the results of the empirical methods that are used?

¹ See also De Lombaerde (1996).

Before addressing these questions however, we present a brief review of basic OCA theory², and some recent contributions that are also relevant for our dynamic perspective on OCA theory (Frankel and Rose, 1997, 1998; Gros and Steinherr, 1997).

THE THEORY OF OPTIMUM CURRENCY AREAS : A BRIEF REVIEW

Mundell's OCA theory

Mundell's central ideas

According to Mundell, the choice of an exchange rate regime should be the result of a cost-benefit analysis (Mundell, 1961).³ He considers the traditional argument of macroeconomic stabilisation (the central argument in his article) as an argument in favour of flexible rates. But he also stresses that this should be evaluated in the light of other (mainly microeconomic) arguments in favour of fixed rates: the reduction of transaction and valorisation costs (the efficiency argument), the elimination of the risk of currency speculation and the absence of money illusion. This last aspect refers to the fact that it is improbable that wage earners will accept a reduction in their real income in the form of a devaluation, but not in the form of a reduction in their nominal wages in open economies or in small monetary unions. Mundell adds other conditions of efficiency and effectiveness to the case for flexible rates: the dynamic stability of international prices, the limited cost of structural adjustments provoked by changes in the exchange rate, the existence of instruments to cover exchange rate risk, the absence of speculation by the central banks, a sustainable monetary discipline in conditions of depreciation and political instability, and the absence of a significant negative effect of exchange rate variability on long-run capital flows.

² See also Mundell (1997) and De Lombaerde (2000).

³ Mundell's original article was reproduced in: Mundell (1968), Krauss (1973) and Blejer et al. (1997, 17-27).

The importance and originality of Mundell's contribution consists, among other things, in the fact that he explains the necessity to distinguish between the concepts of 'region' and 'country'. The region is defined as a zone within which factor mobility exists, but not between the zone and the rest of the world. Using the words of Kenen (1969, p. 42),

Mundell's notion of a region is functional, not literal. You will not find his regions on an ordinary map but must instead use an input-output table. As I understand the substance of his argument, a region is defined as a homogeneous collection of producers that use the same technology, face the same demand curve, and suffer or prosper together as circumstances change.

According to Mundell, the region is, at least theoretically, the adequate level to define the exchange rate policy. The countries in the real world might coincide with the region, might count various regions within their borders, or might be smaller than the region. Mundell shows, using some simple examples, that the exchange rate regime can be ill-defined from the perspective of macroeconomic equilibrium when the country and the region do not coincide.

Incorporating the dimension of the extension of the currency areas in the analysis, the arguments in favour of floating and fixed exchange rates can also be interpreted as arguments in favour of smaller or bigger areas, respectively. In other words, Mundell reoriented the academic debate on exchange rates. Today, the debate is not only about whether countries should adopt a fixed or flexible rate, but also about the level from which geographical aggregation exchange rates should be flexible. Or, which is the same, from what level of geographical desegregation should exchange rates be fixed.

It is well known that Mundell recommended that exchange rates be fixed between different geographical entities when factor mobility exists between them, and that they should be flexible when the factors are not mobile. However, in the same article, Mundell also argues that the exclusive use of this criterion would imply an exaggerated number of currency

unions, characterised by specific dominant economic activities, given the fact that only this type of region would not face the problem of interindustry factor immobility. But in this case, however, the transaction and efficiency costs would obviously be too high.⁴

Asymmetries in Mundell's theory

In Mundell's reasoning about the stabilisation argument, two types of asymmetries appear: (i) the asymmetries related to the vulnerability towards (internal or external) shocks between different entities (countries or regions), (ii) the asymmetries related to the preferences of the economic (monetary) authorities of the different entities.

Mundell states that the arguments in favour of flexible exchange rates between geographical entities are valid:

- when the latter come close (or, ideally, coincide) with 'regions', as defined above, and,
- when the possibility exists that asymmetric shocks occur, without co-ordination (or coincidence of preferences) between the respective monetary authorities.

The asymmetric shocks in Mundell's first example (1961) are a direct consequence of the structural differences between the different economies. Any shock, in these circumstances, is necessarily asymmetric.

With the previous assumptions, suppose now an asymmetric shock (regardless of its origin) that changes the relative demand and/or supply of the goods in the distinct zones, and suppose that the shock occurs under initial conditions of full employment and trade balance equilibrium. With the additional (realistic) assumptions of (downward) rigidity of prices and nominal wages, and monetary authorities controlling the rate of inflation, one country would

⁴ Kenen agrees with Mundell (1961) that the logical implication of the application of the factor mobility criteria is an exaggerated and unrealistic number of currency areas. Kenen clarifies that when the regions are defined in terms of their activities, the perfect interregional mobility of labour requires a perfect mobility between occupations. And this is only possible when labour is homogeneous or when the different regions of a monetary union have very similar requirements in terms of labour qualifications. In practice, the OCA coincides with a region of homogeneous production or single-product

suffer unemployment whereas the other would suffer inflationary pressures. The adjustment of the exchange rates permits the distribution of the burden of macroeconomic adjustment between both countries. However, a restrictive monetary policy in the country(ies) with inflationary pressures ('favoured' by the demand shock) places the adjustment in the hands of the country(ies) with the unemployment problem. With (downward) rigid prices, this necessarily implies a reduction in production and employment levels.

The implication is the recessive impact of the adoption of anti-inflationary policies in countries with (initial) surpluses in their trade balance. Only an asymmetric supra-national institutional mechanism, compromising the surplus countries to inflate, could reduce the world unemployment level.

In Mundell's second example, the economic zones share a currency (or fix their exchange rates 'forever'), but they still have the same characteristics as presented before. A similar shock initially has similar effects on the relative demands, the employment levels, prices, and 'inter-zone' trade balances as in the previous case. The monetary authorities can only induce full employment when they relax the monetary policy, worsening the inflation problem in the zones with inflationary pressures.

Mundell juxtaposed the two examples to show that the existence of an adjustment cost in terms of unemployment or inflation, caused by a shock, is independent from the choice of the exchange rate policy.

McKinnon's openness criteria

McKinnon argues that in open economies – characterised by a high rate of imports to GDP or a high proportion of tradables to non-tradables – with a flexible exchange rate regime, the domestic currency loses 'utility' as a value of deposit, because it loses stability in terms of

region (Kenen, 1969). Kenen shares with Mundell and also McKinnon the (efficiency) reasons for which the high number of monetary unions that would result from this logic is not adequate.

purchasing power and future transactions (McKinnon, 1963). Additionally, the exchange rate volatility is directly reflected upon domestic prices. Devaluation automatically produces inflation and may signify a loss of export competitiveness when the exportables have a high import content. McKinnon recommends fixed exchange rates for small, open economies, and flexible rates for large, closed economies. In closed economies, the flexible exchange rates facilitate balance-of-payments adjustment and the restoration of internal and external equilibrium, without causing inflation.

Mundell anticipated McKinnon's vision and agrees with the latter that in very open economies – with a high proportion of imports to total consumption – monetary illusion, one of the central assumptions behind the argument in favour of flexible rates, is less probable and less realistic (Mundell, 1961). In this case, a vicious circle might be expected: a devaluation that initially improves export competitiveness causes an almost immediate adjustment of salaries and prices; this effect neutralises the competitiveness gain and requires a new devaluation, starting a new cycle...

McKinnon supposes that the shocks are internal. However, this is not obvious; the source of volatility might be found abroad, which would invalidate McKinnon's proposition. According to the author, it would make sense to fix the bilateral exchange rate when the country is more sensitive to shocks than its commercial partner. This would be the case if the country's economy were smaller, more open and less diversified than the economy of its partners. The logic of McKinnon's argument leads to an impossibility: with two countries, it is impossible for both to find, in monetary integration, a solution to fix their currency in terms of the currency of a 'more stable' partner.

Kenen's diversification criteria

Kenen proposed an alternative criterion to define OCAs. He argues that the diversification of the productive structure – the number of regions with homogeneous production within a

country – is more relevant than Mundell’s criteria of labour mobility. According to Kenen, (i) very diversified national economies with, consequently, a diversified export supply, do not need to adjust their terms of trade as frequently as non-diversified economies, and (ii) when they suffer specific negative shocks, the effect on the unemployment level is not as drastic (Kenen, 1969). Fixed exchange rates are thus more adequate for diversified economies.⁵

Kenen also showed that the links between external and domestic demand, especially the link between exports and investment, are weaker in diversified economies, so that the ‘imported’ variations in domestic employment are not strengthened by the respective variations in investment (Kenen, 1969).⁶

⁵ Kenen stresses further the necessity to have effective internal policies to accompany the fixed exchange rates: nominal wage controls and regional fiscal policies.

⁶ This argument is not valid when the ‘imported’ shocks affect the whole range of exports; for example shocks related to the economic cycles abroad.

A DYNAMIC PERSPECTIVE

The validity and endogeneity of the OCA criteria

The contribution of Gros and Steinherr

McKinnon (1963) established that the costs of participating in a monetary union, and losing the exchange rate as an instrument of adjustment, diminish with higher degrees of openness. In a context of globalisation and increasing openness and interdependence of the world economy, this assertion, if true, would offer support for a scenario of monetary integration as a continuing process. Taking the Mundell-Fleming model as a starting point, Gros and Steinherr (1997) question this generally accepted proposition. The authors reach the conclusion that the cost of fixing the exchange rate increases with higher openness ratios in the case of external shocks, given the fact that the cost of an inadequate exchange rate is higher when the external sector is more important. But given that openness diminishes the impact of an internal shock on domestic demand or production, the cost of fixing the exchange rate, in this case, diminishes with openness. The implication of this conclusion for policy formulation is that in order to evaluate the cost of abandoning flexible exchange rates, it is not sufficient to analyse the degree of openness of an economy: the importance of external shocks should also be considered. In other words, the cost of losing the exchange rate as a policy instrument for macroeconomic adjustment would be greater for an economy with a high degree of openness and industrial and export structures that are very different from those of the rest of the region, than for a country that also possesses a different export structure but that is relatively closed. From a dynamic perspective, this suggests that it is not only relevant to monitor the degrees of openness, but also the degrees of structural convergence/divergence between countries.⁷

The contributions of Frankel and Rose

⁷ It should be noted, however, that the classification in external and internal shocks is perhaps not satisfactory. For the purpose of the debate on monetary integration it might be more adequate to consider three categories: internal shocks, external

The trade intensity and the correlation of the economic cycles are important criteria for establishing the convenience of the formation of a monetary union, according to the OCA theory. Nevertheless, although the values of these parameters can offer indications, *ex ante*, on the desirability of a monetary union, it is important to understand that, in turn, these parameters are also a function of the chosen exchange rate regime. That is, the trade intensity and the (non-)synchronisation of the economic cycles are cause and consequence. It is very probable, for example, that trade is stimulated within a monetary union because of the lower transaction costs. In the same way, it is theoretically possible that the conditions for monetary union are not achieved *ex ante*, but rather *ex post*. This phenomenon is referred to as ‘the endogeneity of the OCA criteria’. Frankel and Rose (1997, 1998) published a number of important contributions on this topic. The authors start from the theoretical observation that when the higher mentioned parameters are endogenous, the effect of greater trade interdependence on the correlation of the economic cycles between countries is ambiguous. As is well established in the theory of international trade, the elimination of trade barriers is able to produce more inter-industry trade or more intra-industry trade, or what amounts to the same, more or less specialisation. In the first case, the integration results *ex post* in a lesser correlation in the respective cyclical movements (asymmetric shocks). Theoretically, this raises a difficult problem. It means that the effects of a decision of economic policy – here, monetary integration – change the values of the variables that were used to justify the same decision, in the sense that the pre-established conditions are not satisfied *ex post*. Frankel and Rose showed, nevertheless, that this problem is more theoretical than empirical. Based on an econometric exercise with a panel of data on 20 countries and for a period of 30 years, they showed the existence of a clear positive relationship between bilateral trade intensity and the correlation of the business cycles. The consequence of this is that a simple analysis of

shocks originating within the (prospective) monetary union, and external shocks originating outside the (prospective) monetary union.

historical data might not be sufficient to establish the desirability of forming monetary unions.⁸

Labour mobility and monetary integration as a process

Labour mobility and OCA theory

Both international (interregional) and interindustry labour mobility are relevant criteria in the OCA theory. Mundell referred to both forms of labour mobility, applied to the regions that were defined as single-product regions with homogeneous production. Labour mobility was thus, by definition, both of the interregional and interindustry type. Kenen clarified that when the regions are defined in terms of their economic activities, the perfect interregional mobility of labour requires a perfect mobility between jobs. This is only possible when labour is homogeneous or when the different regions of the currency area have very similar requirements in terms of labour qualifications. In practice, the OCA coincides then with the homogeneous production or single-product region (Kenen, 1969). Kenen shared with Mundell (1961) and McKinnon a view on the reasons why the number of monetary unions that would follow from this logic is not realistic.

In relation to interindustry labour mobility, Kenen made the important observation that stability of export income will normally be greater when the shocks are mutually independent, and this, in turn, is more probable when the produced goods are not substitutes. As a consequence, as goods differentiated by their final use are generally also differentiated by their method of production, this might reduce interindustry labour mobility. In this way, export diversification assures external equilibrium but not internal stabilisation. If, on the contrary, related goods are being exported, the shocks are not independent and the law of

⁸ Herz, in a previous publication, studied the relationship between exchange rate stabilisation in the framework of the EMS and the trade and financial integration (Herz, 1995). His point of departure is the observation that the main effect of the EMS has been the reduction of the real and nominal exchange rate volatility in the short run; the effect in the long run is not

large numbers does not hold, although interindustry factor mobility may increase. According to Kenen, however, this anyway does not question the fact that a diversified economy, that produces a *continuum* of goods, will have higher labour mobility because it widens the labour opportunities for specific qualifications. Kenen reaches the conclusion that fixed exchange rates are more adequate for highly diversified national economies. We note that this proposition is not necessarily incompatible with Mundell's criteria of internal labour mobility.

Although the contributions of Kenen and McKinnon and Kenen are generally considered as complementary to Mundell's proposition, Kindleberger (1986) emphasised the fact that the Mundell and McKinnon criteria do not necessarily lead to the same conclusions. The case of Canada, for example, shows that countries may have low levels of interregional factor mobility, which pleads against fixing the exchange rates. But at the same time, they can show a high degree of openness and the dominance of a particular trade partner, which are characteristics in favour of fixed exchange rates.⁹

Labour immobility and capital mobility

Inspired by the situation in the European Union, Krugman and Obstfeld (2000) consider the case of a combination of capital mobility and labour immobility as an application of second best theory. According to these authors, the possibility exists that the non-satisfaction of one condition – labour mobility – out of all those indicated by basic OCA theory in order to reach an economic optimum (free trade, capital mobility, labour mobility, fixed exchange rate) might lead, on the contrary, to a greater loss of macroeconomic stability and welfare. For example, an unfavourable shift in the demand of a country's products might, in these circumstances, lead to a capital outflow, worsening even more the employment situation in

observable. His results confirm those of previous studies: it is not possible to establish empirically a significant relationship between the reduction of the exchange rate volatility and the integration of the markets of goods, services and capital.

⁹ Kindleberger (1986) stressed also that it is important to consider the sociological and cultural factors to explain the degree of labour mobility, and that the mobility also depends on the receptivity of the non-mobile labour.

this country, compared with the alternative of flexible exchange rates and internationally immobile production factors.¹⁰

Labour mobility and monetary integration as a process

Returning to standard OCA theory, it has been established that labour mobility might increase with the degree of diversification of the economies (Kenen, 1969). The reason is that with a larger number of industries it will be more feasible and probable to find industries with similar demands for different labour qualifications.¹¹

Consider now a situation with a heterogeneous workforce, and let us classify the industries from lower to higher degrees of ‘sophistication’ or from less to more ‘demanding’ tasks. Suppose further that there exists limited upward labour mobility, consisting of the fact that a worker employed in industry i can only be employed at most in industry $i + 1$, and suppose that there are no limitations to ‘downward mobility’. This might seem obvious from the perspective of capacities; however, in reality there might also be downward rigidities (limits to mobility) for sociological, cultural or psychological reasons.

It can be shown then that the choice for monetary integration as a gradual process might not be a valid one. Whereas a monetary union with a given number of members might have a high degree of internal labour mobility (Mundell’s criterion), paths of monetary integration that include stages with monetary unions with a smaller number of countries might have lower levels of interindustry labour mobility. This has to do with the fact that the existence of a continuous chain of industries in the planned monetary union (that is, the presence of industries $1, 2, \dots, i - 1, i, i + 1, \dots$ in the sense explained above) is a necessary condition for (upward) labour mobility. This is of course more likely to be the case within a large set of

¹⁰ The situation might even be worse when a limited labour mobility would lead to an emigration of the most qualified persons, which is not an unrealistic assumption.

countries. With few countries, the chain might be discontinuous (e.g., a chain of industries like $1, 2, \dots, i-d, i, i+d', \dots$ with d and $d' > 1$ for one or more values of i), thus reducing labour mobility. In other words, if the criterion of Mundell combined with Kenen's criterion is valid for a given number of countries, this does not imply necessarily that it is valid for a smaller set of countries and, vice versa, if it is not for a given set of countries it may well be for an enlarged set.

Convergence and divergence in the industrial development paths in the light of OCA theory

One of the logical implications of the combined use of Mundell and Kenen's criteria is the instability of the exchange rate regime in the process of economic development characterised by structural changes. It can be shown that the application of the OCA criteria of Mundell and Kenen might lead to different conclusions about the long-run desirability of forming a monetary union, depending on the development phase in which the countries find themselves.

We will illustrate our point in a 2-country model.¹² Consider first a base scenario with time-consistent results. Initially, the two countries find themselves in the first stage of development characterised by the existence of a dominant economic activity (mono-crop economies). If they have similar activities (cases A and B in Table 4.1), they could form a monetary union, although in this case the efficiency gains (related to the greater liquidity of money) would normally be small, due to the low transaction levels. If they are not characterised by similar activities (cases C and D), they should not form a monetary union. Now, if both countries initiate a parallel process of economic development, characterised first by a moderate degree of diversification of their activities, in order to finally reach a high level of diversification, the criteria that point to maintaining fixed exchange rates will continue to be valid with initially similar activities (case A). With initially dissimilar activities, there will come a moment in

¹¹ According to Kenen (1969), the labour mobility issue should be related also to the interindustry differences in labour intensities.

this development process, in which the degree of diversification and the reduction of the potential impact of specific shocks will be such that, following Kenen, it is justified to fix the exchange rates ‘forever’ (case C).

¹² Including more countries in the model does not invalidate our thesis. The model becomes just more complex and the probability of finding time-inconsistencies simply increases.

Table 4.1. Time-consistency of policy recommendations in a 2-country model

	Phase II: convergence	Phase II: divergence
Phase I: similar activities	<i>Case A:</i> countries form a monetary union from phase I on (time-consistent result)	<i>Case B:</i> countries form a monetary union in phase I, not in phase II, but again in phase III (time-inconsistent result)
Phase I: dissimilar activities	<i>Case C:</i> countries form a monetary union from phase II on (time-consistent result)	<i>Case D:</i> countries form a monetary union from phase III on (time-consistent result)

However, when starting from the initial situation with a similar dominant activity but following a different path of industrial development, different conclusions are reached. If the development paths and the diversification patterns do not show structural convergence, the OCA theory would imply the formation of a currency area in the first phase, to leave the exchange rate flexible in the second phase, and then again form a currency union (case B). The inconsistency of these results has to do with the partially irreversible character of the formation of monetary unions. On the one hand, the cost of disintegration in a monetary union is likely to be high, and on the other hand, the apparent collapse of the arrangement after the first stage might make it difficult to revive and reinstall a similar arrangement after the second stage. An implication of this might be that for countries that find themselves in the early stages of development, the formation of a monetary union might be counterproductive. Finally, when countries are characterised by different dominant activities in phase I and divergent development paths in phase II, they should consider fixing the exchange rate and forming a monetary union only when both of them reach high levels of diversification (case D). Monetary integration would be justified, in this case, because of the fact that specific asymmetric shocks would lose much of their importance and because of the (expected) high transaction levels.

Monetary integration as a process, the choice of the OCA criteria, and the choice of the empirical methods: the predictive power of OCA theory

The literature on OCAs offers a range of criteria that are empirically measurable, in order to establish the desirability of monetary integration between a set of countries. The relative degree of compliance with the different criteria establishes a ranking of countries, showing the theoretically optimal sequence of accession to a monetary union (viewed as a process).

Theoretically, most of the criteria are interchangeable. Factor mobility, intra-industry trade, diversified industrial structures, synchronicity of the business cycles, synchronicity of external shocks, and so on, are all supposed to measure the same: the absence of harmful country-specific shocks or the symmetry of the economic shocks between countries.¹³

Empirically, however, there is sufficient evidence to conclude that the utilisation of different criteria and different empirical methods may lead to inconsistent results in terms of the extension of monetary union and the ranking of countries according to the optimal moment of entry.

In the case of the European Union, several empirical studies of the *ex ante* type about the synchronisation of the business cycles, the convergence of the macroeconomic variables and the degree of symmetry of external shocks have been published in the years leading up to monetary unification. The importance of these studies is related to the fact that the adequate functioning of the unified monetary system depends on the nature of the shocks and how they can be absorbed in the absence of an independent exchange rate and monetary instruments. The conclusions of these *ex ante* studies on convergence were not unanimous. Westbrook (1998) established convergence in the inflation rates but not in monetary policy. Bai, Hall and Shepherd (1997) identified common patterns in the time series of GDP, exchange rates and

nominal interest rates – short-term convergence – for the large countries in the EU. The series of real interest rates did not show convergence.¹⁴

Many studies reached the conclusion that the optimal size of the EMU was/is in fact different (smaller) than its actual size. Classifying the European countries in a ‘core’, an intermediate group, and a peripheral group, these studies also suggested a scenario of monetary integration in a process of gradual inclusion.¹⁵ Table 4.2 presents the results of a number of studies that tried to define empirically the extent of a European OCA around Germany (the ‘core’), and to indicate its path of expansion (through the incorporation of the countries belonging to the intermediate group, and the peripheral group, respectively).¹⁶ The countries that formed part of the intermediate group showed asymmetries for some of the variables.

¹³ Although it might make sense, as suggested by the European Commission (1990), to take the growing importance of intra-industry trade as an indicator of the symmetry of external shocks, one should beware of inverting the logic of the argument and considering the existence of important levels of intra-industry trade as a necessary condition for shock symmetry. As shown by the case of the Caribbean, the absence of intra-industry trade does not mean that the economic structures are not similar. In the Caribbean, the flows of intra-regional trade are marginal, and therefore, they are bad indicators of the underlying structures. On the other hand, the flows of extra-regional trade are indeed important and the analysis of their composition does reveal a great similarity between the economic activities of the different countries (De Lombaerde, 1999; see also Griffith 1998).

¹⁴ Following Frankel and Rose, these findings may tell little about ex post convergence, due to the endogenous character of the criteria.

¹⁵ Former Belgian Prime Minister Marc Eyskens proposed the formation of a ‘pre-monetary union’ within Benelux. See Eyskens (1996) and De Lombaerde (1997).

¹⁶ Other empirical studies about the EMU or about larger sets of European countries, using Mundell’s conceptual framework, include: Karras (1996), Bayoumi and Eichengreen (1997), Dibooglu and Horvath (1997), Sørensen and Yosha (1998).

Table 4.2. Optimal composition of the EMU according to the (a)sym-metrical character of the shocks: review of empirical results

Reference	Method	Core (\approx OCA)	Periphery	Intermediate
Von Hagen & Neumann (1994)	Variability of the real exchange rate	Germany, Austria, Belgium, the Netherlands, France		Italy, Denmark, U.K.
DeSerres & Lalonde (1995)	Variability of the exchange rate	Germany, Belgium, the Netherlands	Sweden, France, Italy	U.K., Spain
Helg <i>et al.</i> (1995)	Sector data, VAR cointegrated	Germany, Belgium, the Netherlands, Denmark, France, U.K.	Italy, Spain	Greece, Ireland, Portugal
Bayoumi & Eichengreen (1992)	Structural VAR	Germany, Belgium, the Netherlands, Denmark, France		U.K., Italy, Spain, Ireland, Portugal, Greece
Artis & Zhang (1995)	Correlation between cyclical components	Germany, Belgium, the Netherlands, France, Spain, Portugal, Italy	Ireland	U.K.
Boone (1997)	VAR and dynamic correlation	Germany, Belgium, the Netherlands, France	U.K., Greece	Italy, Spain, Ireland, Denmark
Beine & Hecq (1997)	Co-dependence	Germany, Belgium, the Netherlands, Italy	Spain, Portugal	France, U.K., Denmark

Sources: Beine and Hecq (1997), Boone (1997).

In a recent analysis of the conditions of monetary integration in the Andean region, similar conclusions were reached (De Lombaerde *et al.*, 2002). The utilisation of different criteria, all inspired by the OCA literature, produced inconsistent paths for gradual monetary integration among CAN member countries. The Colombian economy was taken as the central economy (the ‘core’), because of its size, the structure of its trade relations, and the leadership role it has played in regional integration.¹⁷ The other member countries (Bolivia, Ecuador, Peru and Venezuela) were classified according to their compliance with the OCA criteria, or, their ‘probabilities’ of forming a monetary union with the central country.

The first criterion that was used was the Mundell criterion, referring to factor mobility, as proposed by Mundell in his original article (Mundell, 1961).¹⁸ The next two indicators are based on Kenen’s bilateral similarity arguments: one based on the production structure (‘Kenen 1’), another on the export composition (‘Kenen 2’).¹⁹ The fourth criterion, based on the same logic as the previous ones, takes the importance of intra-industry trade in the bilateral economic relations as an indicator of the desirability of monetary integration. This criterion is called the ‘European Commission criterion’ as it was suggested in European Commission (1990).²⁰ Finally, consistent with the recent tendencies in the empirical analysis of OCAs, two criteria were used that directly show the (a)symmetry of the external shocks: the correlation between the GDP growth rates, and the correlation between the inflation rates (index of consumer prices, CIP).²¹

The results of the calculations are presented in Table 4.3. It can easily be observed that there are clear inconsistencies in the different country classifications (showing, for each country, the relative desirability of forming a monetary union with Colombia), using different criteria. This shows the limited predictive capacity of OCA theory in relation to gradual processes of

¹⁷ CAN stands for ‘Comunidad Andina de Naciones’.

¹⁸ For data reasons, this criterion was only applied to capital flows.

¹⁹ Additionally Hirschmann-Herfindahl index numbers were calculated for production and exports. The results showed relatively high degrees of diversification of the production structures (values close to the minimum value $1/n$, n being the number of industries or categories) for all countries; and a relatively low variation around the mean for the CAN countries.

monetary integration. The results are very sensitive to the choice of the criteria, and there are no obvious ways available for weighting them. There is a need for additional econometric research capable of establishing a hierarchy among the criteria, according to their respective relevance, enhancing in this way the predictive capacity of OCA theory.

Table 4.3. Appropriateness of forming a monetary union with Colombia: classification of the countries according to the different criteria

Criterion	Bolivia	Ecuador	Peru	Venezuela
Mundell	4	2	3	1
Kenen 1	1	2	3	4
Kenen 2	1	2	3	4
European Commission	4	2	3	1
GDP correlation	3	4	1	2
CIP correlation	1	2	3	4

Source: De Lombaerde *et al.* (2002).

²⁰ The Grubel-Lloyd index was used (Grubel and Lloyd, 1975), using data from Pombo (2000).

²¹ The correlation was calculated between the deviations from the trend in the original series for the period 1970-99.

CONCLUSION

In this contribution, we analysed the phenomenon of gradual monetary integration, and evaluated the usefulness of optimum currency area (OCA) theory in order to predict the path of integration.

We found that the idea of a monetary union with an incremental number of participating countries is not a logical outcome of OCA theory. Consistent with Kenen's thesis, a gradual process of monetary integration among economies with given industrial structures might not be optimal because currency areas may require a minimum scale (a minimum number of members) in order to guarantee interindustry labour mobility.

We also found that for a group of economies characterised by divergent industrial development patterns, the theory of optimum currency areas does not yield time-consistent recommendations about the suitability of monetary integration.

Finally, we established that the OCA theory weakly predicts gradual processes of monetary integration. The empirical tests on the optimality of currency areas seem to be very sensitive to the choice of criteria. Taking into account that OCA theory suggests various valid criteria, there is a need for additional econometric research capable of establishing a hierarchy among them, according to their relevance.

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