On the optimality of a currency area of a given size

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Abstract

A currency area of a given size is an OCA if all its members are better off with a common currency rather than without it. In terms of cooperative game theory this implies that a currency area is an OCA if the benefits of its constituent members are in the core. It is argued in this paper that the existence of the core is independent of the degree of similarity of the constituent members, implying that the criteria proposed by the received theory of OCA for a successful monetary union may not constitute a safe policy guide, and that free factor mobility in the presence of international economies of scale may enhance the case for a common currency. © 2001 Society for Policy Modeling. Published by Elsevier Science Inc.

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1. Introduction

The traditional theory of optimum currency areas (OCA) attempts to define the domain for a simple currency based on the importance of free factor mobility (Lerner, 1944), a criterion that was later adopted by Mundell (1961), and the importance of openness of the economies in connection with the exchange rate regime (McKinnon, 1963).
Mundell (1961) observed that the costs of a currency area stem from asymmetric shocks that however are absorbed through the existence of free factor mobility across national boundaries. Under these circumstances, a flexible exchange rate becomes unnecessary and possibly harmful. McKinnon (1963) stressed that the benefits of a currency area rise with openness defined as the value-added of trade in total output; then the significance of the exchange rate adjustment to equilibrate trade rests on the lower propensity to import.

To these considerations, one may add the importance of fiscal integration, i.e., the extent to which policy at the federal level can serve as an alternative to the use of monetary policy to foster asymmetric shocks (Goodhart, 1995; McKinnon, 1995). The recent literature emphasizes the weaknesses of the traditional theory of OCA on the ground that the criteria of free factor mobility, openness, and fiscal integration are incomplete in the sense that they emphasize only some of the elements present in the adjustment processes under various exchange rate regimes (Artis, 1994; De Graauwe, 1997; Krugman, 1990; Tavlas, 1993) and secondly, and more important, that the old theory lacks a formal analysis for the determination of the optimum domain of currency areas divorced from policy aspects (Melitz, 1995a, 1995b, 1996).

In Krugman and Obstfeld’s (1991) analysis, the costs and benefits of a currency area are treated as a function of its size. As the currency area expands, the benefits from adopting a single currency increase, while the costs increase at an increasing pace as new countries subject to their own macroeconomic adjustment problems join the currency area. The OCA occurs when marginal costs equal marginal revenues. This suggestion was taken up by Demopoulos and Yannacopoulos (1995) who gave a geometrical interpretation of the Krugman and Obstfeld model. They suggested that under the conditions referred to in this model the monetary union cannot survive (it is unstable) because every member can improve its position by withdrawing from it. The stability property suggested by Demopoulos and Yannacopoulos is analogous to the core concept of the game theory.

The most complete formal model of a monetary union is due to Melitz (1995b, 1996). Melitz adopts a marginal analysis to the problem (we name it the marginalistic approach) which is similar to the analysis suggested by Krugman and Obstfeld (1991). The marginalistic approach seeks to determine the optimum size of the currency area from the point of view of a single country. The optimum size occurs when the welfare function of this particular country (defined in the appropriate way) is maximized. Melitz concludes, however, that the determination of an OCA is “not an optimisation exercise in the usual sense. It requires concertation” (Melitz, 1995b, p. 294). The second approach adopted by Melitz (1995b, 1996) defines a currency area of a given size and membership, and then raises the question of whether this area is optimal. A criterion for optimality may be that the constituent members of the currency area are better off with a common currency rather than without it, implying that no member has the incentive to abandon the monetary union.
The existence of the two approaches to the OCA problem raises the issue of which of them is the most appropriate to form the basis for the discussion of a monetary union resulting from an agreement of its members to abolish their own currencies and central banks and adopt a new currency and a new central bank, as it is the case of the EMU.

We argue in this paper that the first approach discussed extensively in Melitz (1995b, 1996) is not the most appropriate for the case of the EMU. The fact that a currency area is optimal from the point of view of a single country does not necessarily guarantee that it is optimal from the point of view of its partners. We argue that the second approach is more suitable for cases like the EMU. Our findings lead to a number of conclusions on the desirability of EMU.

In Section 1, we provide the theoretical framework of the marginalistic approach, drawing on Melitz’s work, to whom we owe the most systematic analysis on the subject. In Section 2, we present an alternative view of the OCA based on the cooperative game theory. Section 3 presents the conclusions.

2. The marginalistic approach to the OCA theory

The marginalistic approach to the OCA theory, discussed extensively by Melitz (1995b, 1996) seeks to determine the optimum size of a currency area from the point of view of a single country. It is assumed that the currency area is too small to be optimal, and it has to be enlarged in order to reach its optimal size. Melitz treats the currency area as a continuous variable \( u \) ranging from zero to one and corresponding to the percentage of trade of this particular country in the currency area. When \( u = 0 \) the currency area does not extend beyond the national borders of the country in question. A positive value of \( u \) corresponds to the percentage of trade in the currency area.

The enlargement of \( u \) brings both benefits and costs. As the currency area is enlarged, transaction costs progressively disappear leading to an increase in trade within the currency area, and therefore to the increase of the benefits derived from it. The costs of the currency area are seen by Melitz (1996) as a decrease in the speed of adjustment of the terms of trade to their long run equilibrium level. This of course implies that the degree of price and wage flexibility is relatively low, as otherwise the terms of trade could adapt as smoothly with fixed as with flexible exchange rates.

This speed of adjustment depends on the composition of \( u \). If the countries are structurally similar having a high degree of intra-industry trade, fewer changes in the terms of trade could be required and the currency area will

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1 Melitz (1995b,1996) uses the formal tools of economic analysis in studying issues of the subject. According to Melitz the current impasse in the research on optimum currency areas is due to unwillingness of the economists “to adopt a formal analysis to the subject divorced from political aspects” (Melitz, 1995a, p. 492).
cause less impairment of trade adjustment: the cost of the currency area will, therefore, be lower.

Assume now that the enlargement of the currency area $u$ starts by admitting one partner at a time. The best partner is selected first, leading to a composition of $u$ characterized by a high degree of intra-industry trade. This composition keeps the speed of adjustment of the terms of trade relatively high. Enlarging further the currency area will therefore mean having to admit partners of lower quality (Melitz, 1995b, 1996). The share of the intra-industry trade within the currency area declines, and with it the speed of adjustment of the terms of trade slows down. On the other hand, the benefits from the expansion of the currency area, seen as a reduction in the transaction costs leading thus to an increase in trade, increase too but at a lower rate than the increase of the costs. The optimum occurs when the marginal benefits from the expansion of the currency area just equal the marginal costs due to the slowing down of the speed of adjustment of the terms of trade to their long run equilibrium level.

The main drawback of the marginalistic approach is that it cannot be used as a basis for the discussion of the problems of a monetary union resulting from an agreement of the member parties, as it is the case of the EMU. In fact, the determination of the OCA for the home country does not necessarily imply that this area is optimal from the point of view of its partners. If it is not optimal, the partners may refuse to join a currency area in which their benefits are not maximized. In a monetary union resulting from the agreement of its members to use a common currency, we have to take into account not only the welfare function of the home country but also the welfare functions of its partners. This is emphasized by Melitz (1995a) but he does not pursue this matter further.

3. The optimality of a currency area of a given size

The second approach to the OCA theory starts from the assumption that a currency area of a given size and therefore of a given membership is given (Melitz, 1995b, 1996). The question is under what conditions this area is optimal. A criterion for optimality is that all its members are better off with a common currency rather than without it, so that no country, or group of countries, have the intention to abandon it.\(^2\)

A formal model may be constructed for this case borrowing concepts from the cooperative game theory in characteristic function form and transferable utility. For this reason we consider a finite set of $N$ countries intending to form a currency area. A currency area of size $N$ is defined by $(N,v)$, where $N$ is the

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\(^2\) This criterion was suggested by Melitz. In his own words “Since we take the membership (and therefore the size) of the currency union as given, the only question we can really ask is whether the currency area would be welfare improving for everyone” (Melitz, 1995a, p. 496).
set of countries participating in it and \( v(.) \) a function, called characteristic function, that assigns to every coalition \( S \subseteq N \) a utility possibility set \( v(S) \in \mathbb{R}^S \). The utility possibility set may be interpreted as the welfare function of every coalition \( S \subseteq N \), i.e., every subset of countries participating in the currency area. The value of \( v(S) \in \mathbb{R}^S \) depends on the composition of the coalition (currency area). Assume that:

\[
w = (w_1, w_2, \ldots, w_n)
\]

is the utility outcome stemming from the use of a single currency that is feasible for the currency area \( N \) [i.e., \( w = v(N) \)]. The currency area \( N \) is optimal if all countries belonging to the set \( N \) are better off with a common currency. This means that the utility outcome (1) cannot be improved upon by a set of countries \( S \subseteq N \), using an independent monetary policy. These benefits can be improved upon by a set \( S \) if and only if \( \sum w_i < v(S) \). The definition therefore of an OCA implies the existence of a utility outcome that cannot be improved upon by any country. Since such an outcome is in the core, it follows that a currency area \( N \) is optimal if the utility vectors of the constituent members are in the core.²

In general, a currency area \((N,v)\) is an OCA if the utility outcome (1) is in the core. The utility outcome (1) is in the core if the following conditions are satisfied:

\[
\begin{align*}
\sum w_i &\geq v(S) \quad S \subseteq N \text{ (condition of individual rationality).} \quad (2) \\
\sum w_i &= v(N) \quad \text{ (Pareto optimality requirement).} \quad (3)
\end{align*}
\]

Suppose that Eq. (2) failed to hold for some \( S \subseteq N \). This means that these countries will be better off by following an independent monetary policy rather than accepting a common currency. Condition (3) says that the sum of each country’s benefits should be equal to the total benefit achievable. Therefore, \( w \) is Pareto optimal in that it is impossible for any country to do better without at least one country being worse off.

Given that the benefits stemming from the use of a single currency must be in the core, we have to determine the properties of the characteristic function that guarantee its existence. We start with the simplest case of a currency area the welfare of which depends on its size. This may imply that its constituent members are structurally similar (i.e., they are similar in technology, factor endowments and tastes), and therefore the costs of the currency area in question are very small or negligible.⁴ This means that the cooperative game describing

³ The core as a solution concept to the cooperative game theory with transferable utility is not an entirely unknown concept in Economics as it is connected with Edgeworth’s contract curve. This connection was recognized by Shubik (1959) who discussed Edgeworth’s ideas in the framework of cooperative games with transferable utility.

⁴ The fact that currency areas of the same size offer to their members the same benefits is an indicator of structural similarity between countries.
the currency area is symmetric, and therefore we can map the characteristic function against the size of the coalition. In a symmetric game, the core exists, and therefore the currency area is an OCA, if and only if,
\[ v(S) < (s/N)v(N) \]  \hspace{1cm} (4)
where \( s \) denotes the number of countries participating in the coalition \( S \) (Ponssard, 1981). Otherwise, the core is empty. If the inequality (4) is reversed, the currency area \( s \) is not an OCA because it is not welfare improving for everyone: the welfare of some of its constituent members increases if they stay out of the currency area.

The main conclusion to be drawn from the symmetric case is that the conditions required by the conventional theory of OCA, i.e., that structurally similar countries are more likely to form an OCA, are necessary but not sufficient. Sufficiency requires that the characteristic function must exhibit non-decreasing returns with respect to the size of the currency area.\(^5\)

This result is important for the more general case, i.e., for currency areas the constituent members of which are structurally dissimilar, i.e., in the non-symmetric case. In this case, a core exists, and therefore the currency area \((N,v)\) is an OCA, if its characteristic function \( v \) exhibits non-decreasing marginal returns to the coalition size. An example of such a characteristic function is the following:
\[ v(SU\{i\}) - v(S) \leq v(TU\{i\}) - v(T) \]  \hspace{1cm} (5)

What condition (5) states is that an OCA exists if the benefits derived by the structurally dissimilar members of a currency area of a given size are greater than the benefits obtained by staying outside it.

That economically dissimilar countries may form an OCA is not an impossibility. In fact, suppose that the currency area consists of two countries called home and foreign. Suppose further that these two countries have identical homothetic tastes and technologies, and that their economies of scale in production are international rather than national. The two countries, however, differ sufficiently in factor endowments so that they specialize completely. Then, all trade is inter-industry. Now suppose that factors become mobile. Inter-industry trade declines as trade in factors substitute for it (Ethier, 1982). Both countries will eventually begin to produce both products and therefore intra-industry trade emerges implying that their potential shocks will now be symmetric rather than asymmetric. But in the presence of symmetric shocks monetary unions may deliver a better policy compared to monetary policy of independent monetary authorities.

\(^5\) That structural similarity may not suffice for the determination of an OCA is emphasized by Frankel & Rose (1996). They suggested that although Sweden satisfies the conventional criteria required by the theory of OCA, it should be unwise to join EMU now; this implies, in terms of the core concept, that the condition for individual rationality is not satisfied for Sweden.
4. Conclusions

The following conclusions are derived from the previous analysis.

First, a currency area of a given size is an OCA if the benefits derived by its constituent members are in the core (i.e., all members are better off with a common currency). The existence of the core is independent of the degree of economic similarity (of dissimilarity) of the countries participating in a currency area.

Second, free factor mobility may strengthen the case for a simple currency in the presence of international economies of scale even if the member countries are structurally dissimilar. In the case of intra-industry trade and therefore of symmetric shocks, a monetary union may deliver a better monetary policy for its members by avoiding the incompatible attempts of independent monetary authorities to improve their own position that may yield inferior outcomes for everyone (Melitz, 1996).

The present tendency for less independent currencies and more currency areas cannot be attributed only to monetary factors (i.e., the impossibility of coexistence of free capital mobility, fixed exchange rates, and independent national monetary policies). Another factor strengthening the case for a common currency, emphasized in this paper, is the emergence of intra-industry trade caused by free factor mobility in the presence of international economies of scale.

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