

Abstract

Emerging-market countries are being urged to choose between freely floating exchange rates and firmly fixed rates supported by strong institutional arrangements—currency boards, monetary unions, or formal dollarization. This paper assesses the benefits and costs of institutionalizing fixed rates by synthesizing and supplementing the theory of optimum currency areas (OCA theory). It shows that (1) OCA theory and related empirical work have been excessively influenced by the special case used originally by Robert Mundell, where exogenous shocks display *mirror-image* asymmetry; (2) OCA theory ignores a vital difference between the domains of monetary policy under a monetary union and other institutional arrangements; (3) because it neglects the way in which a monetary union reduces the debt-creating effects of fiscal stabilizers, OCA theory understates the strength of the case for combining a monetary union with a fiscal federation. The paper also criticizes recent work by Jeffrey Frankel and Andrew Rose in which they claim to show that monetary union reduces asymmetric shocks and thus makes monetary union less costly. The paper suggests that their results may reflect the effects of monetary union on the transmission of shocks rather than their incidence.

Currency Areas, Policy Domains, and the Institutionalization of Fixed Exchange Rates

Peter B. Kenen

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This paper was written during my tenure as a Visiting Scholar at the Centre for Economic Performance. I am grateful to colleagues in London and Princeton for conversations and comments. The paper will appear in a volume of essays honoring Benjamin Jerry Cohen.

Peter B. Kenen is a Professor of Politics and International Affairs in the Department of Economics, Princeton University, New Jersey, USA.

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Introduction

Benjamin Jerry Cohen has devoted much of his career to the study of the international monetary system and has contributed importantly to our understanding of it. Furthermore, his writings have evolved in a manner resembling the evolution of the system itself. In 1977, shortly after the Jamaica Agreement, which formally ratified the shift from pegged to floating exchange rates, he published *Organizing the World's Money*, which examined the roles of nation states in the design and management of the monetary system. In 1998, he published *The Geography of Money*, which examined the role of market forces in the evolution of the monetary system and in the creation of currency domains whose boundaries rarely coincide with those of nation states. In both of those books, moreover, and much of his other work, he has explored the complex interplay between dimensions of national power and dimensions of monetary sovereignty.

This paper is also concerned with the evolution of the monetary system, but it is narrowly normative. It stresses the roles of *policy* domains, not *currency* domains, and aims in part at answering a specific question:

How should a government decide whether to replace its national currency with a foreign currency—to opt unilaterally for *de jure* dollarization—or join with other countries in a full-fledged monetary union with a single currency and monetary policy?

To answer this question, the paper will draw on the theory of optimum currency areas (hereafter, OCA theory), its use in assessing the benefits and costs of European monetary union (EMU), and the problems faced by European governments in designing EMU. Conditions and problems are different elsewhere, but there is much to learn from the European case.¹

The evolution of the monetary system

Exchange rate arrangements and views about their merits have changed dramatically in the last half century, reflecting the joint influence of actual experience with various exchange rate regimes, changes in the character of macroeconomic theory, and changes in the ordering of policy priorities.

The design of the Bretton Woods system - the regime of pegged but adjustable exchange rates that prevailed in the 1950s and 1960s - reflected the dominant interpretation of inter-war experience, as well as Keynesian suppositions about the nature of the macroeconomy. As wages and prices were deemed to be sticky, nominal exchange rates were thought to be valuable policy instruments. Changes in nominal rates would be reflected in real rates and could therefore be used to switch expenditure between domestic and foreign goods (or, in a different analytic framework, between traded and non-traded goods).

¹ I confess to another, personal motive for asking what lessons we can learn from EMU. After writing a book about EMU a few years ago, I turned to other matters, and I have wanted an excuse to revisit EMU. For that same reason, incidentally, this paper concentrates on the most recent literature; for reviews of the earlier literature, see Kenen (1995) and Gros and Thygesen (1998).

The shift to floating exchange rates in the early 1970s, after the collapse of the Bretton Woods system, was seen first as temporary—a way of buying time to put in place a system of “stable but adjustable rates” and a more symmetric balance-of-payments adjustment process. That project failed, however, and the Articles of Agreement of the International Monetary Fund (IMF) were therefore amended to accommodate floating rates and permit each member country to adopt the exchange-rate arrangement best suited to its needs. But new ideas also influenced that outcome.

Monetarist views about the functioning of the macroeconomy suggested a seductively simple way to model exchange-rate behavior and compare the merits of floating and pegged rates. As the nominal exchange rate is, by definition, the price of one money in terms of another, it must depend on demand and supply in the money market and cannot affect the real exchange rate, which must depend instead on demand and supply in the goods market. Furthermore, new views about the conduct of monetary policy, stressing expectations and credibility, provided a new rationale for exchange-rate pegging. A pegged exchange rate could be used to constrain and improve the quality of monetary policy. More importantly, the same new views about monetary policy gave strong backing to the case for central bank independence.

By the mid-1980s, three sorts of exchange rate regimes had emerged: floating rates connecting the dollar, the deutsche mark, and the yen; the increasingly rigid pegged rates of the European Monetary System (EMS); and a wide variety of exchange-rate arrangements in the developing world, ranging from *de jure* and *de facto* pegging to full flexibility, but with a discernable drift toward flexibility. This mixed system, however, was soon threatened by a rapid liberalization of international capital movements.

The threat was recognized first in Europe, where the Single European Act required the rapid abolition of capital controls and exposed the EMS to speculative pressures. Europe was thus made to choose between floating exchange rates and a full-fledged monetary union. In the event, of course, it chose to move to monetary union. Before it got there, however, the EMS was beset by acute currency crises. In 1992, speculative attacks on the lire and the pound drove those two currencies out of the EMS. In 1993, an attack on the French franc forced the remaining EMS countries to widen their exchange-rate bands and move temporarily to quasi-floating rates.

These events were followed by virulent currency crises in emerging-market countries that had also liberalized their capital-account transactions – the Mexican crisis of 1994-95 and the Asian crisis of 1997-98. At the end of the 1990s, it was widely agreed that countries with open capital markets must choose decisively between floating exchange rates on the one hand and immutably fixed rates on the other. They can no longer regard the exchange rate as a policy instrument. It cannot be pegged today if there is reason to believe it could be altered tomorrow. An exchange rate cannot be fixed immutably, however, unless the commitment to fix it is “institutionalized” by legislation. And even that may not suffice, as countries can change their own laws. Immutable fixing may therefore require the obliteration of the nominal exchange rate – *de jure* dollarization or the creation of a monetary union.

In brief, capital mobility is seen to have chopped up the continuum of exchange rate regimes that economists used to contemplate. The continuum has been replaced with a binary choice. Exchange rates must float or be given up completely. In Eichengreen’s words:

“Policymakers will ... be forced to choose between floating exchange rates and monetary union. Floating rates can still be managed – governments will still be able to pursue policy rules in which exchange rate changes trigger policy responses. What will not be feasible is a rule defined in terms of an exchange rate target that is to remain inviolable under all but exceptional circumstances.” (Eichengreen, 1994, p. 78)

Similar views have been expressed by the official community. The IMF cannot require a

country to adopt a particular exchange-rate regime or force it to abandon its national currency by unilateral dollarization or participation in a monetary union. Nevertheless, the G-7 finance ministers have declared that:

“... the international community should not provide large-scale official financing for a country intervening to support a particular exchange rate level, except where that level is judged sustainable and certain conditions have been met, such as where the exchange rate policy is backed by a strong and credible commitment with supporting arrangements, and by consistent domestic policies.” (G-7 Finance Ministers, 1999, para. 33)

There are, of course, dissenters. Williamson (1998) continues to argue cogently that wide-band target zones are viable and sensible. Frankel (1998) and Larrain and Velasco (1999) warn that no single exchange-rate regime can be right for every country or for every situation. And Rodrik makes the same point:

“Some countries (Argentina being the most significant example) have given up on a domestic lender of last resort by replacing their central bank with a currency board. The Argentine calculation is that having a central bank that can *occasionally* stabilize the economy is not worth running the risk that the central bank will *mostly* destabilize it. Argentine history gives plenty of reason to think that this is not a bad bet. But can the same be said for Mexico or Brazil, or for that matter, Turkey or Indonesia? ... The debate over currency boards and dollarization illustrates the obvious, but occasionally neglected fact that the institutions needed by a country are not independent of that country’s history.” (Rodrik, 1999, p. 9)

Yet the institutionalization of fixed rates is too often recommended without close attention to the complex economic issues involved, let alone the histories and problems of the particular countries involved. The growing interest of emerging-market countries in immutable exchange rate fixing is in large part a reflection of their strong revealed preference for exchange-rate stability, what Calvo and Reinhart (2000) describe as “fear of floating,” and their vulnerability to future currency crises—no one can attack them if they don’t have exchange rates. Compare the situation fifteen years ago, before the opening up of capital markets, with the situation now, after the currency crises of the late 1990s.

A number of high-inflation countries experienced *de facto* dollarization in the 1980s, and there is a large analytical literature on the process of currency substitution that drove that process; for a recent survey, see Mizen and Pentacost (1996). But very few countries had chosen formally to replace their own national currencies with other countries’ currencies. Panama is the best-known case, but it was a special case, because the US dollar was the domestic currency of the Canal Zone. Many countries did form monetary unions, but most of the unions were post-colonial manifestations involving very small countries; see the list in Rose (1999). The case for monetary union was being debated in Europe, but had been debated for many years without material consequence.

Matters are different today. Ecuador has adopted legislation to replace the *sucre*, its domestic currency, with the US dollar, and dollarization is being considered by larger Latin American countries, notably Argentina, which took a big step in that direction when it converted its central bank into a currency board. Other countries have also established currency boards, including Hong Kong and Bulgaria. Most importantly, of course, EMU is up and running, and this has produced a flurry of talk about the creation of monetary unions for other regional trading blocs—for the members of NAFTA in North America, for the members of MERCOSUR in South America, and for the ASEAN countries of Southeast Asia.

What lies ahead

This paper will not weigh comprehensively the comparative merits of floating and fixed rates. It will concentrate instead on the narrower choice between unilateral dollarization and a monetary union. It starts by asking what we can learn from OCA theory and how it might be modified to compare those two regimes. We will find that they differ crucially in a way not adequately emphasized by OCA theory – the scope of the monetary-policy domain. Finally, the paper will argue that a monetary union does not require a fiscal union, but it will also show that a monetary union can raise the effectiveness of a fiscal union – that built-in fiscal stabilizers may be more powerful when they operate at the union level rather than the national level.

The first part of the paper sets out the core of OCA theory, following Mundell (1961), and shows how it reflects assumptions and concerns that dominated macroeconomic theory in the 1950s and 1960s. It then looks at the subsequent evolution of OCA theory, the way in which it was applied to the European case, and the reasons for paying close attention to the definition of the policy domain in a monetary union.

Thereafter, the paper turns to fiscal policy. It begins by summarizing the debate in Europe about the need to insulate monetary policy from the profligate practices of national governments, but it focuses thereafter on another set of questions that has played a major role in OCA theory. Why does the creation of a monetary union raise the importance of fiscal policy? Why would a fiscal federation raise the effectiveness of fiscal policy? And why would a comprehensive economic union, one with a single monetary policy as well as a unified fiscal system, make fiscal policy even more effective?

Finally, the paper takes up the question posed at the start of this introduction. What are the advantages and disadvantages of unilateral dollarization, compared to those of a monetary union, viewed from the special standpoint of emerging-market countries?

2. The Theory of Optimum Currency Areas

To understand OCA theory, we must go back to its birth and contemporaneous exchange-rate theory. It was a by-product of Keynesian macroeconomics, which assumed that wages and prices are sticky and that capital mobility is too low to exert any appreciable influence on the functioning or targeting of domestic policies. Under these assumptions, used by Meade (1951) and many others, the nominal exchange rate determines the real exchange rate, which in turn determines the current-account balance. Therefore, a government can use the nominal exchange rate to maintain *external balance* (ie, the desired state of the current-account balance), while using monetary or fiscal policy to maintain *internal balance* (ie, the highest levels of output and employment consistent with price stability). In language used by Johnson (1962), the exchange rate is an expenditure-switching instrument, and a change in the exchange rate is thus the optimal response to an expenditure-switching shock, while monetary and fiscal policies are expenditure-changing instruments, and a change in one of those policies thus is the optimal response to an expenditure-changing shock.

With little or no capital mobility, moreover, there is little analytical difference between a pegged-rate regime, in which the nominal exchange rate is adjusted periodically, whenever there is a permanent expenditure-switching shock, and a floating-rate regime, in which the nominal exchange rate is adjusted automatically by market forces. Under both regimes, the behavior of the nominal rate is governed primarily by the state of the current-account balance. A floating rate will be more volatile, however, if the inhabitants of the foreign-exchange market cannot distinguish clearly and promptly between transitory and permanent shocks.

This is a simplified summary of the story told by the open-economy version of the basic Keynesian model, but it captures the principal features and policy implications. We will soon see, moreover, that it can be used to make several important points about the functioning of monetary unions. It is, indeed, the framework used by Mundell in his seminal paper on OCA theory and thus influenced the subsequent development of that theory.² To see what Mundell said, and did not say, let's set out the framework formally.

A two-country Keynesian framework

Define the income of country i ($i = 1, 2$) as the sum of income-dependent expenditure, income-autonomous expenditure, and exports *less* imports:

$$Y_i = (1 - s_i - \mathbf{t})Y_i + E_i + X_i - M_i, \quad i = 1, 2$$

where s_i is country i 's marginal propensity to save and J is its income-tax rate. Note that taxes affect spending, not saving, and that the tax rate J is not subscripted, because it is the same in both countries. The income-autonomous expenditure term, E_i , includes both government and private spending, and some of the private spending is assumed to depend on the interest rate.

Country i 's exports are country j 's imports, which consist of income-dependent imports and an income-autonomous component, Z_j , defined so that an increase in Z_j denotes a switch in expenditure from country j 's good to country i 's good:

$$X_i = M_j = m_j Y_j + Z_j$$

where m_j is country j 's marginal propensity to import.

Solving simultaneously the income equations for countries 1 and 2, and using lower-case letters to denote deviations from initial values,

$$\begin{aligned} y_1 &= \left(\frac{1}{D}\right)[(s_2 + m_2 + \mathbf{t})e_1 + m_2 e_2 + (s_2 + \mathbf{t})u] \\ y_2 &= \left(\frac{1}{D}\right)[m_1 e_1 + (s_1 + m_1 + \mathbf{t})e_2 - (s_1 + \mathbf{t})u] \end{aligned} \tag{1}$$

where $D = (s_1 + m_1 + J)(s_2 + m_2 + J) - m_1 m_2$, and $u = z_2 - z_1$.

Note that eqs. (1) contain the two sorts of shocks mentioned above and both sorts are *asymmetric*. The terms e_1 and e_2 are expenditure-changing shocks. They are asymmetric in origin and in their effects on the two countries' incomes; when $s_1 + m_1 > m_2$, (which is assumed to be true hereafter) an expenditure-changing shock originating in country 1 affects that country's income by more than it affects country 2's income. But the income changes are same-signed. The term u is an expenditure-switching shock. It can be due to a switch by country 1's residents (i.e., $z_{12} \dots 0$) or

² Because it uses this framework, Buitert (1999) regards OCA theory as "one of the low points of post-World War II monetary economics." That is cruel but not utterly wrong. As early OCA theory paid no attention to capital mobility, it neglected the problem of policy domains, which is the focus of this paper.

country 2's residents (ie, $z_{21} \dots 0$). Its effects on the two countries' incomes, however, do not depend on its origin, and they are not same-signed (nor will they be equal in absolute size unless $s_1 = s_2$). Note finally that all shocks are real. An expenditure-changing shock may come from the money market, reflecting a change in the demand for money or the supply of money. But with sticky prices and no capital mobility, it manifests itself as a change in real expenditure.³

Finally, use eqs, (1) to define the current-account balance seen from the standpoint of country 1:

$$c = \left(\frac{1}{D}\right)[m_2(s_1 + \mathbf{t})e_2 - m_1(s_2 + \mathbf{t})e_1 + (s_1 + \mathbf{t})(s_2 + \mathbf{t})u] \quad (2)$$

It is now easy to see why expenditure-changing policies are the optimal response to an expenditure-changing shock and why expenditure-switching policies are the optimal response to expenditure-switching shocks.

Consider an increase of expenditure in country 1 (i.e., $e_1 > 0$). It will raise both countries' incomes, and country 1's current-account balance will deteriorate. These will be "bad things" if, initially, both countries enjoyed internal and external balance. But they can be restored to that blissful state if country 1 adopts an expenditure-reducing policy. Furthermore, all other policy responses are second-best in one way or another. If, for instance, country 1 fails to respond appropriately, country 2 can adopt an expenditure-reducing policy for internal balance, but that will not take country 1 back to internal balance, and it will take both countries further from external balance. Alternatively, either country can adopt an expenditure-switching policy for external balance, changing the exchange rate between their currencies, but that will drive country 1 further from internal balance. (It will restore internal balance in country 2, however, illustrating the familiar proposition that a flexible exchange rate offers insulation from imported shocks.)

Consider a switch in expenditure from country 2's good to country 1's good (i.e., $u > 0$). Country 1's income will rise, and it will experience inflationary pressures; country 2's income will fall, and it will experience unemployment; and country 1's current-account balance will improve, producing reserve flows from country 2 to country 1. But both countries can return to their initial states by adopting an expenditure-switching policy - a devaluation of country 2's currency. If, instead, they pursue expenditure-changing policies for internal balance, they will amplify the gap in the current-account balance, and if they pursue expenditure-changing policies for external balance, each country will move further from internal balance.

OCA theory in the Keynesian framework

Suppose, now, that countries 1 and 2 fix their bilateral exchange rate irrevocably, without adopting a single currency or replacing their national central banks with a new supranational central bank. In effect, they create what Corden (1972) called a pseudo-monetary union. In the absence of capital mobility, both countries can still pursue independent monetary policies, at least in the short run, and can thus deal as they should with expenditure-changing shocks. But they can no longer use the nominal exchange rate to neutralize expenditure-switching shocks. And they must still pay attention

³ With perfect capital mobility and a fixed exchange rate, a shock originating in the money market can have no effect whatsoever on domestic expenditure; it leads instantaneously to a change in reserves and a one-to-one change in the money supply. That is why the members of a currency union cannot have independent monetary policies when capital is perfectly mobile between them.

to the current account balance, because they cannot count on endogenous capital flows to finance imbalances; they must use reserves or set up reserve credit lines to mimic the financing of interbank imbalances that takes place endogenously in a full-fledged monetary union.⁴

This, then, is the problem considered by Mundell (1961): How can these two countries cope with an expenditure-switching shock when they undertake to keep their exchange rate fixed? It is, indeed, the main case studied in his paper, and the peculiarities of that case exerted a powerful influence on the subsequent evolution of OCA theory. And here is how Mundell analyzed the problem:

With a switch in expenditure from country 2's good to country 1's good, country 1 will run a current-account surplus; there will be an excess supply of country 2's good and excess supply in its labor market; and there will be an excess demand for country 1's good and excess demand in its labor market. If prices and wages were perfectly flexible and thus responsive to excess demands and supplies, the price of country 2's good would fall, the price of country 1's good would rise, and the increase in the relative price of country 1's good would reverse the switch in demand, eliminating the disequilibria in both countries' markets and the imbalance in their bilateral trade. If prices and wages were perfectly rigid, but the nominal exchange rate were flexible, the switch in demand to country 1's good would raise the demand for its currency and cause it to appreciate. This, in turn, would raise the relative price of country 1's good and reverse the switch in demand.

When prices and wages are rigid, however, and the nominal exchange rate is fixed, the two countries face an intractable problem unless they have another way to clear their labor markets - a transfer of labor from country 2 to country 1. Such a transfer, moreover, removes the imbalance in their trade. Workers who move to country 1 continue to consume both countries' goods. But their demand for country 1's good is *domesticated*; it becomes part of domestic demand in country 1 and ceases to be part of import demand coming from country 2. Conversely, their demand for country 2's good is *internationalized*; it becomes part of import demand coming from country 1, and ceases to be part of domestic demand in country 2. These changes in the locus of demand rebalance trade between the countries. Therefore, perfect labor mobility automatically resolves the intractable problem posed by an expenditure-switching shock, and the domain of labor mobility becomes the defining characteristic of an optimum currency area. An OCA can contain many countries but only one unified labor market.⁵

Note that Mundell's story has three special features:

1. Because the model with which he worked allows the members of a currency union to conduct independent monetary policies, expenditure-changing shocks play no role in defining an optimum currency area, although they may be asymmetric in origin and impact. When high capital mobility prevents the members of a union from conducting independent monetary policies, those shocks become important.
2. Because Mundell dealt with a two-country currency union, the expenditure-switching shock he studied evinces a unique sort of *mirror-image* asymmetry, raising output in one

⁴ Ingram (1959) was the first to describe the endogenous financing of bilateral imbalances in a monetary union; see also Ingram (1973) and my treatment in Kenen (1995, ch. 2).

⁵ Mundell used "region" to describe a unified labor market and thus said that "the optimum currency area is the region." In subsequent OCA literature, however, especially in recent studies comparing European countries with various federal states, "region" is used to denote a sub-national unit, and I will use it that way here—which is why I did not quote Mundell's formulation in the text.

country and reducing output in the other country.⁶ That would not be characteristic of an expenditure-switching shock involving a member of the currency union and a third, outside country.⁷

3. Because of the same mirror-image asymmetry, a unified, union-wide fiscal system can cushion the impact of an expenditure-switching shock with little effect on the stance of the fiscal system as a whole. When $s_1 = s_2$ in eqs. (1), the increase in tax revenue collected from country 1 when $u > 0$ exactly equals the decrease in tax revenue collected from country 2, and the former offsets the latter in a unified fiscal system. I made this point in both of my papers on OCA theory (Kenen, 1967, 1969) but did not realize that the self-balancing fiscal outcome was due to the special nature of the shock that Mundell had analyzed. This matter will come up again in a different context.

Mundell went on to note, however, that optimality is not uni-dimensional and that, for this reason, his labor-market criterion “hardly appeals to common sense.” Were we to apply it strictly, we would treat every pocket of unemployment due to imperfect labor mobility as an optimum currency area. Therefore, we must weigh the benefits of macroeconomic stability, which calls for a multiplicity of currency areas, even sub-national areas, against the efficiency costs of hugely increasing the number of currencies. The larger the number of currencies, the smaller the domain of each one, and the usefulness of a currency as a unit of account and medium of exchange depends on its domain. From a microeconomic perspective, indeed, “the optimum currency area is the world,” although it may comprise many separate labor markets.⁸

Completing the core of OCA theory

Two other papers are frequently cited together with Mundell’s as being early building blocks of OCA theory. Both were concerned in one way or another with the implications of country size

⁶ For that same reason, incidentally, Mundell argued that non-optimal currency unions are likely to have a macroeconomic bias. A union containing two countries and two labor markets is apt to display a deflationary bias. The country experiencing the fall in output and employment will also run a current-account deficit and cannot finance it forever. It must therefore tighten its expenditure policies eventually or risk running out of reserves. Its partner, however, cannot be forced to change its policies, because it can continue to accumulate reserves. Conversely, a currency union containing one country and two labor markets is apt to display an inflationary bias, as it will ease its expenditure policies to combat unemployment in the region (labor market) adversely affected by an expenditure-switching shock, and that will impose inflation on the other region.

⁷ Faced with such a shock, a currency union can change its external exchange rate, but that will affect output in the rest of the union. This complication led Méltz (1995) to suggest that the optimality of a union diminishes when its members are differently involved with the outside world, and a similar point is made by Maloney and Macmillen (1999). It can also be shown, however, that expenditure-switching shocks coming from outside a currency union resembling those of asymmetric expenditure-changing shocks originating inside the union. Appendix I uses a three-country model where external shocks are contained in an omnibus variable (w_i) that also includes expenditure-changing shocks originating inside a currency union. The impact of external shocks on each member of the union can therefore be offset by expenditure-changing policies.

⁸ Cohen (1997) stresses the same point in his paper on OCA theory, but Dowd and Greenaway (1993) introduce a qualification. They offer a model in which network benefits and economic welfare increase with the domain of a currency, but a world currency may not develop endogenously and may not increase welfare, because of switching costs.

and structure for the optimality of a currency area.

McKinnon (1963) pointed out that a small open economy cannot count on using the nominal exchange rate to neutralize expenditure-switching shocks. A devaluation or depreciation of the country's currency will have large effects on the domestic price level, and that will have two consequences. First, it will reduce the real wage and thus generate pressure to raise the nominal wage; those pressures, in turn, will vitiate the effect of the devaluation or depreciation on the real exchange rate. Second, it will tend to reduce the usefulness of the domestic currency as unit of account and store of value. Accordingly, a small open economy, by itself, will not be an optimum currency area. Putting the point in McKinnon's own terms, an optimum currency area must be big enough to have a large body of non-tradable goods, the prices of which are defined in domestic currency and thus serve to stabilize the purchasing power of the currency in the eyes of the inhabitants of the area.

Kenen (1969) dealt with several issues, including the complex connections between the fiscal domain and the currency domain. If the fiscal domain were larger, difficult questions would arise. How would taxes be collected if a single fiscal system were to span a number of currency areas, each of them entitled to alter its exchange rate? How would a treasury maintain the desired distribution of total tax collections? In which currency would the government pay for goods and services? Which one would it use to pay its civil servants? Goodhart (1995) points out that the complexities and inefficiencies produced by having two or more currencies within a single fiscal domain may explain why we rarely ask whether regions within countries should have separate currencies. Currency unions do not usually break up unless their countries break up too.

I also argued that a fiscal system spanning several regions can contribute to internal balance and thus compensate in part for the macroeconomic disadvantage of having a currency area that spans several labor markets - one that is non-optimal in the Mundellian sense. This is what I wrote:

“It is a chief function of fiscal policy, using both sides of the budget, to offset or compensate for regional differences, whether in earned income or in unemployment rates. The large-scale transfer payments built into fiscal systems are interregional, not just interpersonal, and the rules which regulate many of those transfer payments relate to the labor market, just like the criterion Mundell has employed to mark off the optimum currency area.”

And I went on to quote my earlier paper (Kenen, 1967). When a region experiences an adverse expenditure-switching shock,

“... its federal tax payments diminish at once, slowing the decline in its purchasing power and compressing the cash outflow on its balance of payments. There is also an inflow of federal money—of unemployment benefits.”

Credit or blame for raising this point is often assigned to the MacDougall Report (Commission 1977), which said that a European monetary union would require a large increase in the budget of the European Community, in order to make room for endogenous fiscal transfers. Others attribute the point to Mundell. But Sala-i-Martin and Sachs (1992) ascribe it to me, and when I reviewed the OCA literature before writing this paper, I found no mention of it prior to my own.

My paper is cited more frequently, however, for stressing the relevance of domestic

diversification for OCA theory. Diversification is relevant for three reasons:

First, a diversified economy will not have to undergo large changes in its real exchange rate as often as a single-product economy. Although each of its exports may be subject to shocks, whether due to changes in external demand or in technology, the law of large numbers will come into play if the shocks are independent. At any point in time, an economy can expect to experience reversals in export performance, but also to enjoy successes. Its aggregate exports, then, will be more stable than those of an economy less thoroughly diversified.

Second, when an economy does experience a fall in the demand for its principal export, the size of the required change in its real exchange rate depends on the degree of diversification. In a completely specialized economy, workers who lose their jobs due to a fall in exports have nowhere to go, and the real exchange rate must change by enough to offset the fall in demand completely. In a two-product economy, with an export good and an import-competing good, the real exchange rate need not change by enough to offset fully the fall in demand for the export good; a depreciation of the real rate will also stimulate demand for the import-competing good.

Third, the links between external and domestic demand, especially the link between exports and investment, are likely to be weaker in a diversified economy. The fall in output and employment caused by a fall in the demand for one of its exports will not be greatly amplified by a corresponding fall in aggregate capital formation.

I did not say that diversification should be the sole criterion for deciding whether a group of countries should form a currency union. In fact, the subtitle of my paper described it as an “eclectic” approach to OCA theory. Yet Frankel and Rose (1998) seem to believe that I regarded diversification as the only appropriate OCA criterion, and they go on to argue that the criterion crumbles when it is applied:

- Stipulate that the joining of two or more regions forms a larger unit that tends to be more highly diversified as a whole than are the regions considered individually. Then if an individual region is sufficiently diversified to pass the Kenen test for pegging its currency to a neighbor, it follows that the larger (more diversified) unit that is thereby created will pass the test by an even wider margin. It thus will want to peg to other neighbors, forming still larger units ... The process will continue until the entire world is on one currency.
- What if the individual regions are not sufficiently diversified to pass the Kenen criterion to begin with? Then, under the OCA logic, they should break up into smaller currency units (say, provinces) that float against each other. But these smaller units will be even less diversified, and thus will fail the Kenen criterion by an even wider margin, and will thus decide to break up into still smaller units (say, counties). The process of dissolution will continue until the world is down to the level of the (fully-specialized) individual.

The first half of the Frankel-Rose argument holds, but only up to a point. Enlarging a currency area by adding more entities - countries, provinces, or counties - will, of course, tend to diversify its output but will also make it bigger geographically and more heterogeneous culturally. It is therefore likely to reduce labor mobility within the area, which Mundell rightly identified as being crucially important for low-cost adjustment to expenditure-switching shocks. But to the extent that the first half of the Frankel-Rose argument has any validity whatsoever, it undermines the validity of the second half. If a particular entity is too small and thus too specialized to be an optimum currency area, chopping it up into smaller entities will make

matters worse, as well as reduce the usefulness of the new entities' currencies.

The lean years

Although there was a flurry of interest in European monetary integration in the wake of the Werner Report (Council, 1970), there were few contributions to OCA theory in the 1970s. Tower and Willett (1976), who surveyed and sought to synthesize OCA theory by examining the influence of economic openness on the benefits and costs of currency unification, cite more than 160 papers, but only a quarter of them have titles referring explicitly to currency areas or monetary integration. Of those that do, moreover, several have been cited here and several more were published in a single conference volume (Johnson and Swoboda, eds, 1973). For a similar exercise based on the number of papers having "optimum currency areas" in their titles, see Bayoumi and Eichengreen (1998a).

Interest in OCA theory did not revive until the Delors Report (Commission, 1988), but much of the new work thereafter tried to apply the framework developed by Mundell and others in the 1960s. There was a rush to measurement – to ask whether Europe can be regarded as an optimum currency area – rather than an effort to rework the original framework to reflect intervening innovations in open-economy macroeconomics.⁹

3. OCA Theory and EMU

Empirical work on the optimality of a European monetary union has dealt with four issues. A large body of work has sought to assess the cost to European countries of giving up exchange rate changes by measuring the co-variation of the exogenous shocks affecting those countries and thus the extent to which those countries (or subsets of those countries) are subject to symmetric or asymmetric shocks. Another body of work has tackled the same question by examining the degree of domestic diversification in European countries or decomposing output shocks into those that are place-specific and those that are industry-specific.¹⁰ A third body of work has looked at the role of labor mobility in international and inter-regional adjustment. And there is now a rapidly growing literature on the ways which a monetary union might itself affect the size and nature of exogenous shocks, the extent of labor mobility, and so on. This is not the place to examine all of that work in detail. But it is worth drawing attention to some of the conceptual problems involved and to the unanswered questions.

⁹ There was some new analytic work, including the paper by Canzoneri and Rogers (1990), which warned that a monetary union could prevent the optimal use of seigniorage for tax smoothing, and the papers by Dowd and Greenaway (1993) and Mahoney and Macmillan (1999), already cited. There was, in addition, a large volume of theoretical work on the ways in which a monetary union might affect national fiscal policies; some of it is cited later in this paper. By and large, however, there was a strangely uncritical acceptance of the earlier framework. (But see the warning in Emerson *et al.*, 1990, p. 46, that "the optimum currency area approach provides useful insights but cannot be considered a comprehensive framework in which the costs and benefits of EMU can be analyzed.")

¹⁰ Unless otherwise indicated, I speak of "place-specific" shocks when describing comparisons between region-specific shocks in the United States and country-specific shocks in Europe.

The characteristics of shocks

The earliest work on the measurement of shocks looked mainly at the cross-country co-variation of changes in real GDP or in real exchange rates; see, eg, Cohen and Wyplosz (1989), Weber (1991), and De Grauwe and Vanhaverbeke (1993).¹¹ But these are endogenous variables, and the cross-country co-variation in them depends on the co-variation of the truly exogenous shocks, on the endogenous and policy-induced responses to those shocks, and on the “thickness” of the various channels through which shocks travel from country to country. (These include both real channels, whose thickness depends in part on the extent of trade integration, and monetary channels, whose thickness depends in part on the exchange-rate regime itself.) This methodology, moreover, cannot distinguish between expenditure-changing shocks, which may be asymmetric in origin and impact but can be offset by expenditure-changing policies, and expenditure-switching shocks and productivity shocks, which cannot be offset without altering real exchange rates or moving factors of production from one country to another.

Bayoumi and Eichengreen (1993) sought to address some of these problems by adapting a technique devised by Blanchard and Quah (1989). It allows one to disentangle exogenous shocks from their effects on endogenous variables and, by imposing appropriate restrictions, to identify two types of shocks: “supply” shocks, which have permanent effects on output, and “demand” shocks, which do not. This distinction does not correspond precisely to the distinction used above, between expenditure-changing shocks and expenditure-switching shocks, although they are not orthogonal.¹² But the differences between supply shocks and demand shocks, in size and cross-country co-variation, is less striking than the difference between the shocks affecting European countries and the shocks affecting US regions. Supply shocks are somewhat larger for European countries than for US regions, and demand shocks are smaller for European countries than for US regions. But the cross-country correlations for both types of shocks are smaller for European countries than the cross-regional correlations for US regions, which suggests that European countries are further from being an optimum currency area.¹³

The earliest work on domestic diversification was done by Bini Smaghi and Vori (1992) and

¹¹ For a thorough survey and critique of this literature, as well as new results, see Bayoumi and Eichengreen (1999). See also Kletzer (1997), who points out that some apparently exogenous shocks may be artifacts of the exchange-rate regime or, more precisely, the fact that foreign and domestic asset-market shocks impinge directly on goods markets under flexible exchange rates.

¹² If prices are sticky but not permanently rigid, a large expenditure-changing shock will tend to be manifest eventually as a change in the price level, but a large supply shock, though it will have long-lasting effects on relative prices, may also have long-lasting output effects. Elsewhere, Eichengreen (1992) describes these shocks more neutrally as temporary and permanent shocks. It should be noted, however, that the extraction of shocks from single-country vector autoregressions cannot successfully distinguish between shocks originating in a particular country and those that are imported from another country. The thicker the channels of transmission, the greater the risk that asymmetric shocks will show up as common shocks in cross-country correlations.

¹³ In the case of supply shocks, the correlations of countries’ shocks with those in Germany averaged only 0.33, whereas the correlations of US regions’ supply shocks with those in the mid-eastern region averaged 0.46. In the case of demand shocks, the average correlation was only 0.18 for European countries, compared with 0.37 for US regions. Furthermore, with two exceptions (Spain and the Netherlands), the correlations between countries’ supply and demand shocks with those in Germany were themselves closely correlated. See Eichengreen (1992). Using the same technique to compare shocks affecting German regions with those affecting European countries, Funke (1997) obtains a similar result—that the correlations for both types of shocks are higher across German regions than across European countries.

Krugman (1993), who found that European countries are less specialized than US regions and, by implication, less vulnerable to industry-specific shocks. Further work was done by Bayoumi and Eichengreen (1998a and 1998b) in the context of a broader effort to demonstrate the explanatory power of OCA theory - the degree to which countries' actual exchange-rate policies appear to reflect the characteristics featured in OCA theory. They find that those country characteristics "have economically important and statistically significant effects on exchange rate behavior" (Bayoumi and Eichengreen, 1998b, p. 185). They also find, however, that the variables used to represent exchange-rate policies are less heavily influenced by the dissimilarity of exports—their proxy for vulnerability to industry-specific shocks—than by the variability of output, economic openness, or economic size.¹⁴

Various methods have been used to decompose output fluctuations—to separate aggregate shocks, industry-specific shocks, and place-specific shocks. The results, however, are not very sensitive to the methods used. Examining fluctuations in US output growth, Bayoumi and Prasad (1995) find that country-wide shocks account for a slightly larger part than industry-specific shocks, while place-specific shocks have been somewhat less important (and are even less important within manufacturing). Turning to Europe, they find the same ordering. In fact, the results are strikingly similar. In both cases, industry-specific shocks account for about one-third of the explained variation in output growth, with aggregate shocks explaining slightly more and place-specific shocks explaining slightly less. In a broader study of the OECD countries, using a different methodology, Funke, Hall, and Ruhwedel (1999) find that country-specific shocks have been far more important in explaining output changes than common international shocks or industry-specific shocks, which have been about equally important. They also find common shocks have become more important over time relative to country-specific shocks (but do not report any trend in the relative importance of industry-specific shocks).

The role of labor mobility

Research on the size and character of shocks has revealed significant differences between European countries and US regions. But I do not believe that those differences, by themselves, are big enough to raise grave doubts about the long-run viability of European monetary union. That view is reinforced by results just reported, that industry-specific shocks are not to blame for most of the variability in total output. In other words, my earlier work on OCA theory may have attached too much importance to diversification.

There may be more reason to worry about another set of findings, regarding the role of labor mobility in the United States and the lack of labor mobility in Europe. In their well-known study of regional adjustment in the United States, Blanchard and Katz (1992) find that interregional labor mobility plays a crucial role in shaping responses to regional shocks:

"We find very similar results across states. A negative shock to employment leads initially to an increase in unemployment and a small decline in participation. Over time, the effect on employment increase, but the effect on unemployment and participation disappears after approximately five to seven years. Put another way, a state typically returns to normal after an adverse shock not because employment picks up, but because workers leave the state."

¹⁴ Their measure of dissimilarity, however, looks only at the shares of manufactures, food, and minerals in total exports and at export composition, not output composition. Furthermore, their proxy for vulnerability to asymmetric shocks is the variability of GDP, which does not distinguish between exogenous shocks and endogenous responses to them.

(Blanchard and Katz, 1992, p. 3)

Turning to the roles of wages and prices, they find that nominal wages fall strongly after an adverse shock and take some ten years to return to normal. The fall in nominal wages contributes to the gradual recovery of employment, but by not enough to offset fully the initial shock. Furthermore, consumption wages do not decline very much because housing prices respond strongly to employment shocks. Hence, Blanchard and Katz conclude that the outward migration of labor, which takes up the remaining slack, must be ascribed to the lack of job opportunities - to unemployment itself - rather than the influence of relative consumption wages.

It is, of course, impossible to know what would happen if labor were less mobile in the United States; whether we would see longer-lasting increases in unemployment rates or much larger changes in relative consumption wages. We do know, however, that labor mobility is lower within Europe countries, that changes in relative wages are not much larger, and that labor-market shocks tend thus to last longer.¹⁵ We also know that labor is far less mobile between European countries than between US regions.

On the endogeneity of optimality

When Krugman (1991) pointed out that the economies of European countries are less intensively specialized than those of US regions, he also pointed out that the joint effects of the single European market and monetary union might lead more specialization in Europe, increasing the vulnerability of European countries to industry-specific shocks.¹⁶ This far, the empirical evidence supports Krugman's supposition. Using what they call the Krugman specialization index, Midelfart-Knarvik *et al.* (2000) examine trends in the location of European industry from 1970-73 to 1994-97. These are their chief findings:

- Most European countries showed significant convergence of their industrial structure during the 1970s, but this trend was reversed in the early 1980s. There has been substantial divergence from the early 1980s onward, as countries have become more different from ... from most of their EU partners.

¹⁵ On labor mobility, see Eichengreen (1993), who shows that changes in wages and levels of unemployment have larger effects on labor movements in the United States than they do in Britain or Italy. On the persistence of labor-market shocks, see Obstfeld and Peri (1998), who provide a review and critique of other labor-market studies, including the paper by Décessin and Fatás (1995), who apply the Blanchard-Katz methodology to European countries, ascribe a great deal of importance to labor mobility, and find that labor-market shocks are not more persistent in European countries.

¹⁶ See also De la Dehesa and Krugman (1993) and Eichengreen (1992). The point is often made by predicting that the growth of inter-industry specialization will dominate the growth of intra-industry specialization; see *eg*, Frankel and Rose (1998). But this formulation may be misleading. It assumes implicitly that exogenous shocks affect broad product groups rather than individual products. A switch in demand from road travel to plane travel will adversely affect all car producers and will benefit aircraft producers. With this sort of switch in mind, it makes sense to ask whether monetary union will lead to more specialization in the production of cars and aircraft. But a switch in demand from passenger cars to sports utility vehicles will harm all passenger-car producers (although it will not necessarily harm large automotive firms that have plants in several countries making different sorts of cars). This second example, however, raises another question. How easily and rapidly can a particular firm or plant switch between similar products? Substitutability in production may be more important than labor mobility or wage flexibility for achieving low-cost adjustment to various sorts of shocks, including the entry of new competitors and the advent of new technologies.

- The most dramatic changes in industry structure have been the expansion of relatively high technology and high skill industries in Ireland and in Finland. However, the specialization process has occurred more generally, with nearly all countries showing increasing difference from the early 1980s onward (Midelfart- Knarvik *et al.*, 2000, p. 1).

They also find interesting changes in the location of individual industries. Some that were spatially dispersed initially have become more concentrated; these are mainly slow-growing industries using low-skilled labor, whose relative contraction has been accompanied by spatial concentration. Of those that were spatially concentrated initially, many have remained that way, but significant dispersion has occurred in several medium and high-technology industries, and in relatively high-growth sectors.

These trends began too early to be attributable to the single market, let alone monetary union. Furthermore, the effects predicted by Krugman and others may not be too worrisome. Studies summarized above suggest that industry-specific shocks have not been the principal cause of output fluctuations, nor have they differed hugely in relative importance. Whatever the reason for it, however, the increase in specialization calls into question the inference drawn by Frankel and Rose (1998) that the OCA criteria are endogenous.

Working with data for 21 industrial countries, Frankel and Rose find that the degree of economic integration, measured by the size of the trade links between pairs of countries, is strongly associated with the correlation between fluctuations in their economies. The tighter the trade links between two countries, the higher the time-series correlation between de-trended changes in output and employment. Their results are quite robust, but their interpretation of them is somewhat confusing. At times, they seem to be saying that openness *per se* is an OCA criterion, and it was indeed the variable used by Tower and Willett (1976) in their attempt to synthesize OCA theory. For the purpose at hand, however, openness must be deemed to measure the extent of economic integration—the exogenous variable that is driving something else. And the “something else” at issue, the correlation between fluctuations in activity, must be deemed to measure the endogeneity of the OCA criterion. I noted earlier, however, that the correlation between levels of activity depends on the size and characteristics of the exogenous shocks, on the endogenous responses to those shocks, and on the thickness of the channels through which they travel between countries. Although Frankel and Rose are fully aware of these complications and refer repeatedly to the importance of the transmission process, they interpret their results to mean that the underlying shocks are becoming more symmetric under the influence of closer integration – that countries which have opted for closer integration have as a result become better candidates for close integration.

Appendix I suggests that their results should be interpreted cautiously. It uses the simple Keynesian model represented by eqs. (1) above to show that the correlation between two countries’ output changes increases unambiguously with the thickness of the channels linking their economies (and that this relationship is reinforced when the thickening of the channels occurs at the expense of trade with the outside world). Appendix I also shows, however, that the correlation between output changes does not necessarily increase on account of a reduction in the sizes of the asymmetric shocks affecting the countries involved. The outcome depends on the characteristics of the exogenous shocks.¹⁷ In short, Frankel and Rose are too quick to conclude that closer integration reduces the cost

¹⁷ For the effect of trade integration (ie, the thickening of trade channels), see eqs. (A-3) and (A-6) of Appendix I, which show that closer trade integration raises the correlation between two countries’ output levels. For the effects of changes in the sizes of shocks, see eqs. (A-4) and (A-5), which show that the effect

of integration by reducing the dissimilarity between the countries involved.

Unanswered questions

There are reasons to believe that a monetary union will lead to closer integration and that it may indeed be needed to achieve and sustain “deep integration” of the sort taking place in the European Union.

Many attempts have been made to measure the effects of exchange-rate risk on trade, production, and investment. Some of them have found trade-depressing effects but not very large effects.¹⁸ Several recent papers, however, have shown that national borders matter, even for countries belonging to free-trade areas. More generally, international markets appear to be far less tightly integrated than domestic markets. Using a simple gravity model, McCallum (1995) has shown that trade between two Canadian provinces is twenty times larger on average than trade between a Canadian province and a US state, after controlling for size and distance. Furthermore, Engel and Rogers (1996) have shown that price differences between pairs of Canadian cities are smaller and less volatile price differences between Canadian and US cities, after controlling for distance and for fluctuations in the nominal exchange rate between the two countries’ currencies. Turning from goods markets to asset markets, several recent papers show that private capital flows between regions within countries play a significant role in smoothing income fluctuations within individual regions, whereas capital flows between OECD countries are far less important in smoothing income fluctuations within individual countries.¹⁹

It must be noted, however, that none of these studies seeks to ascertain whether the results obtained reflect the presence or absence of a monetary union. Comparisons between inter-regional and international outcomes, whether they pertain to goods or assets, reflect the presence or absence of many institutional arrangements. Rose (1999) has tried to isolate the influence of monetary unions and finds that they are quite important. Pairs of countries that have the same currency trade three times as much as pairs of countries that have different currencies. But the countries involved in those currency unions are, for the most part, very small.²⁰

We may know more in a few years, once Europe has adjusted to the euro, but we will not be

on the correlation between two countries’ output levels depends on the type of shocks involved; eq. (A-7), which shows that the effect can be ambiguous for a particular shock; and eq. (A-8), which shows that an increase in the cross-country correlation between country-specific expenditure shocks raises the correlation between two countries’ income levels.

¹⁸ For citations and comments, see Kenen (1995).

¹⁹ See Asdrubali, Sørensen and Yosha (1996), Sørensen and Yosha (1998), Helliwell and McKittrick (1998), and Méliitz and Zumer (1999). Méliitz and Zumer find, however, that portfolio diversification and capital flows are more important for risk sharing in European countries than in the larger group of OECD countries. Kalemli-Ozcan, Sørensen, and Yosha (1999) show that regions and countries which engage in substantial risk sharing tend to be more specialized and that causation runs from risk sharing to specialization. As the ability to engage in risk sharing by portfolio diversification depends on the extent of capital mobility, these authors suggest that the financial integration induced by monetary union will intensify specialization but will also serve to protect the participants from the resulting increase in vulnerability to industry-specific shocks.

²⁰ It must be noted, however, that the currency-union effect survives even when Rose omits the smallest countries, pairs of countries with unusually large differences in income or income per capita, and pairs whose bilateral trade is unusually large relative to their total trade.

able to measure precisely the contribution of EMU to the significant structural changes that are occurring in Europe.²¹ Nor will we know what would have happened without EMU - whether the EMS could have been preserved in one form or another and whether, as Eichengreen (1996) and Goodhart (1995) suggest, trade tensions resulting from exchange rate changes might have halted or reversed progress toward the single market.

4. The Domain of Monetary Policy

Much of the early contributors to OCA literature dealt with *currency* unions, not with full-fledged *monetary* unions. They could do that analytically because they assumed that capital mobility was low, and they could make that assumption realistically because it was indeed quite low when OCA theory was born. Countries might fix their exchange rates immutably without giving up their ability to pursue independent monetary policies. That is no longer the case. Until recently, however, there was not much analytical work on the effects of forming a full-fledged monetary union - of transferring control over monetary policy to an institution like the European Central Bank (ECB).²² The problem can be posed in several ways, but one formulation is especially relevant to the choice between unilateral dollarization and a monetary union. How does the *domain* of monetary policy affect the way that exogenous shocks impinge on individual members of a union? We answer this question by looking at three policy regimes:

- Under the first regime, capital mobility is low, and each member of a two-country union can conduct an independent monetary policy.
- Under the second regime, capital mobility is too high for that, and there can be no more than one monetary policy. But one of the two countries' central banks makes all of the monetary-policy decisions as a *national* policy domain. It seeks to stabilize its own country's output. This leader-follower regime is a stylized representation of the EMS under German leadership and of unilateral dollarization.
- Under the third regime, capital mobility is likewise high, but a new institution replaces the members' central banks and adopts a *union-wide* policy domain. It seeks to stabilize output in the union as a whole. This supranational regime is a stylized representation of EMU and the ECB.²³

²¹ For a provocative interpretation, see Burda (1999).

²² See, however, Bofinger (1994), who argued that EMU might benefit all of its members, not merely high-inflation countries, insofar as the transfer of responsibility to the ECB diminished the influence of politicians on the conduct of monetary policy. See also the brief discussions of policy domains in Kenen (1995, 1998).

²³ In the simple Keynesian framework adopted again in this section, stabilizing output is, of course, a proxy for maintaining price stability; recall the assumption made earlier that the pursuit of *internal balance* involves the stabilization of output and employment at levels compatible with the maintenance of price stability. The issue that worried Corden (1972) and others, whether members of a monetary union might have different Phillips curves or different policy preferences, does not arise below, although it is still germane to the formulation of monetary policy in a monetary union. (It lurks in the question often asked about EMU—whether a single monetary policy can ever “fit” all of its members' needs.) In what follows, moreover, we pay no attention to the current-account balance between the members of the union. Under the low-mobility regime,

We begin with the low-mobility regime, which is useful as a benchmark.

A monetary union with low capital mobility

To represent monetary policies explicitly, rewrite eqs. (1), above, dividing each e_i into a truly exogenous component, e_i' , and a policy dependent component, e_i^* , reflecting the response of interest-sensitive expenditure to a change in monetary policy:

$$\begin{aligned} y_1 &= \left(\frac{1}{D}\right)[(s_2 + m_2 + \mathbf{t})(e_1' + e_1^*) + m_2(e_2' + e_2^*) + (s_2 + \mathbf{t})u] \\ y_2 &= \left(\frac{1}{D}\right)[m_1(e_1' + e_1^*) + (s_1 + m_1 + \mathbf{t})(e_2' + e_2^*) - (s_1 + \mathbf{t})u] \end{aligned} \quad (3)$$

With an expenditure-raising shock in country 1, the first-best policy response is, as we saw earlier, a tightening of monetary policy by country 1's central bank: $e_1^* = -e_1'$. It stabilizes country 1's income and also stabilizes country 2's income. The second-best policy response is a tightening of monetary policy by country 2's central bank sufficient to stabilize country 2's income. The requisite policy change is

$$e_2^* = -\left(\frac{m_1}{s_1 + m_1 + \mathbf{t}}\right)e_1'$$

so that

$$y_1 = \left(\frac{1}{s_1 + m_1 + \mathbf{t}}\right)e_1' \quad (4)$$

which is, of course, smaller than the change in country 1's income without any policy change whatsoever. An analogous ranking of policy changes obtains for an expenditure-raising shock in country 2.

With an expenditure-switching shock, both central banks must modify their policies, and they will wind up with $e_1^* = -e_2^* = -u$, whether they cooperate or act independently. Furthermore, they will stabilize both countries' incomes. If one central bank does nothing, however, the change in its country's income will be amplified by the policy response of the other central bank.

Monetary unions with high capital mobility

Under both high-mobility regimes, there is only one monetary policy, and we will assume that it can be represented by a single monetary-policy variable, e^* . In effect, we assume that an interest-rate increase has the same expenditure-reducing effect in both members of the monetary union. Therefore,

this amounts to assuming that they have reserves or reserve-credit lines large enough to finance current-account imbalances. Under the high-mobility regimes, it amounts to assuming that endogenous capital movements finance those imbalances.

$$\begin{aligned}
y_1 &= \left(\frac{1}{D}\right)[(s_2 + m_2 + \mathbf{t})e_1' + m_2e_2' + (s_2 + \mathbf{t})u + (s_2 + 2m_2 + \mathbf{t})e^*] \\
y_2 &= \left(\frac{1}{D}\right)[m_1e_1' + (s_1 + m_1 + \mathbf{t})e_2' - (s_1 + \mathbf{t})u + (s_1 + 2m_1 + \mathbf{t})e^*]
\end{aligned}
\tag{5}$$

Here and hereafter, we use y_i' to denote the income changes that occur when $e^* = 0$ (ie, without any policy change), y_i^S to denote the changes that occur when e^* is set to stabilize country 2's income, and y_i^U to denote the changes that occur when e^* is set to stabilize the sum of the two countries' incomes.

To represent the leader-follower regime, set $y_2 = 0$ and solve country 2's income equation for the policy change imposed by country 2:

$$e^* = -\left(\frac{1}{s_1 + 2m_1 + \mathbf{t}}\right)[m_1e_1' + (s_1 + m_1 + \mathbf{t})e_2' - (s_1 + \mathbf{t})u]$$

Substituting into country 1's income equation,

$$y_1^S = \left(\frac{1}{s_1 + 2m_1 + \mathbf{t}}\right)(e_1' - e_2' + 2u) \tag{6}$$

which yields these results:

- An expenditure-raising shock in country 1 has a relatively small effect on country 2, so the change in monetary policy by country 2's central bank is too small to stabilize country 1's economy. It merely reduces the increase in country 1's income ($y_1' > y_1^S > 0$).
- An expenditure-raising shock in country 2 has a relatively large effect on country 2, so the change in monetary policy by country 2's central bank is too large to stabilize country 1's economy. It causes country 1's income to fall ($y_1' > 0 > y_1^S$).²⁴
A switch in demand to country 1's good drives the two economies in opposite directions, so the change in monetary policy by country 2's central bank destabilizes country 1's economy. It causes country 1's income to rise by more than it would have risen if there had been no policy change whatsoever ($y_1^S > y_1' > 0$).

In brief, this regime is unsatisfactory from the standpoint of country 1. Why then did we hear so much about the advantages of “tying one’s hands” by joining an EMS led by the Bundesbank? Because, it was said, there was no better way for central banks in other European countries to acquire the credibility needed to combat inflation.²⁵ The choice they faced was not the one implicit in this exercise, between following sensible policies on one’s own and following those of the

²⁴ Note the resemblance between this outcome and the one faced by several EMS countries in 1991-92, when the Bundesbank pursued a tight monetary policy to combat the direct and fiscal-policy effects of German unification and its EMS partners experienced severe recessions.

²⁵ The relevant literature is surveyed briefly in Kenen (1995) and more extensively in Gros and Thygesen (1998).

Bundesbank. It was instead the choice between the deplorable effects of following home-grown policies and “importing” the unsatisfactory side effects of the Bundesbank’s policies.²⁶

To represent the supranational regime, use eqs. (5) to obtain the sum of y_1 and y_2 , set that sum equal to zero, and solve for the union-wide monetary policy:

$$e^* = -\left(\frac{1}{H^U}\right)[(s_2 + m_1 + m_2 + \mathbf{t})e_1' + (s_1 + m_1 + m_2 + \mathbf{t})e_2' + (s_2 - s_1)u]$$

where $H^U = s_1 + s_2 + 2(m_1 + m_2) + 2J$. Substituting into the income equations,

$$y_1^U = -y_2^U = \left(\frac{1}{H^U}\right)(e_1' - e_2' + 2u) \quad (7)$$

with these results:

- An expenditure-raising shock in country I calls for a tightening of union-wide monetary policy to stabilize union-wide income, but not by enough to stabilize country I 's income and by too much to stabilize country 2 's income ($y_1' > y_1^U > 0$, but $y_2' > 0 > y_2^U$).
- An expenditure-raising shock in country 2 likewise calls for a tightening of union-wide monetary policy. In this instance however, there is not enough tightening to stabilize country 2 's income but too much to stabilize country I 's income ($y_2' > y_2^U > 0$, and $y_1' > 0 > y_1^U$).
- As always, a switch in spending to country I 's good drives the two countries' incomes in opposite directions, and there is not much that a monetary union can do about it. The sign of the requisite change in union-wide monetary policies depends on the difference between s_1 and s_2 , and so does the ordering of outcomes. When $s_1 = s_2$, there should be no policy change whatsoever because the effect of the shock on country I 's income is equal in absolute size to the effect on country 2 's income ($e^* = 0$, so that $y_1^U = y_1' > 0$ and $y_2^U = y_2' < 0$). When $s_1 > s_2$, by contrast, the effect of the shock on country I 's income is larger absolutely than its effect on country 2 's income, so monetary policy must be tightened to stabilize union-wide income. Therefore, the increase in country I 's income is reduced and the decrease in country 2 's income is raised until the two income changes are equal in absolute size ($e^* < 0$, so that $y_1' > y_1^U > 0$ and $y_2' < y_2^U < 0$). And when $s_1 < s_2$, the ordering of outcomes is reversed.

Clearly, a supranational regime is always better for country I than a leader-follower regime

²⁶ You may wonder why country I 's income falls when country 2 's central bank acts to offset an expenditure-raising shock in country 2 . Why doesn't the stabilization of country 2 's income also stabilize country I 's income, as it does in the low-mobility benchmark model? The answer resides in a subtle difference between the formal domain of the policy *target* adopted by country 2 's central bank and the effective domain of its policy instrument. In the high-mobility model, country 2 's central bank seeks to stabilize country 2 's income. But it knows that country I 's central bank will mimic its interest-rate policy and takes that fact into account when setting its own interest rate to stabilize its income. It behaves as a Stackelberg leader. Accordingly, a change in country 2 's interest rate affects expenditure in country I as well as expenditure in country 2 , which was not true with low capital mobility.

led by country 2. With an expenditure-raising shock in country 1, $y_1' > y_1^S > y_1^U > 0$. With an expenditure-raising shock in country 2, $y_1' > 0 > y_1^U > y_2^S$. And with a switch in expenditure to country 1's good, $y_1^S > y_1^U$ (although y_1^S and y_1^U can both be larger or smaller than y_1' , depending on the sign of the difference between s_1 and s_2).

A supranational monetary union does not obviate the need for built-in fiscal stabilizers to cushion the effects of expenditure-changing shocks. But it reduces the work they must do whenever y_1^S is larger absolutely than y_1^U . Furthermore, it imparts to the income effects of *all* shocks a mirror-image quality much like the one characteristic of expenditure-switching shocks. (In fact, it perfects that characteristic by equalizing fully the absolute sizes of the income changes due to an expenditure-switching shock, even when s_1 does not equal s_2 .) Therefore, it strengthens the case for installing a union-wide system of built-in fiscal stabilizers. As the income changes given by eq. (7) always add up to zero, the corresponding changes in income-tax receipts must also add up to zero and a union-wide system of built-in stabilizers is not likely to produce big budget deficits affecting the stock of debt.²⁷ For reasons discussed shortly, this is, by itself, an attractive feature of a supranational monetary union—one that has a union-wide policy domain.

5. Fiscal Policy in a Monetary Union

Debate on the implications of a monetary union for the conduct and functioning of fiscal policy has focused on two questions: Does the formation of a monetary union increase the need to constrain or coordinate national fiscal policies? Does it require a centralized, union-wide system of built-in fiscal stabilizers? Efforts to answer the first question have spawned a large body of theoretical work and some empirical work on the fiscal policies of US states and of sub-national entities in other countries. Efforts to answer the second question have spawned empirical work on the extent to which national fiscal systems having built-in stabilizers reduce fluctuations in output or income in individual regions.

On the need to constrain or coordinate national policies

The Delors Report (Commission, 1988) called for the coordination of national fiscal policies and for binding limits on national budget deficits. Without coordination, it said, Europe might not be able to maintain an appropriate policy mix or play its proper role in the global adjustment process. The Maastricht Treaty, however, paid scant attention to the coordination of fiscal policies. It focused mainly on the need to limit budget deficits, and the provisions of the treaty were reinforced thereafter by the Stability and Growth Pact.²⁸

Two sets of arguments are made on behalf of these constraints. Let us consider them

²⁷ This mirror-image feature will be attenuated if the members of a monetary union differ in size. An expenditure-changing shock originating in a small country will trigger a rather small change in the monetary policy of the union as a whole, which will not offset much of the shock in the small country itself but will not cause large changes in the other members' incomes. The income changes, however, will still sum to zero, given the policy rule—stabilization of union-wide income—and the changes in tax revenues will still sum to zero. There will not be debt creation.

²⁸ The relevant provisions of the treaty are examined by Kenen (1995); those of the Stability and Growth Pact are examined by Artis and Winkler (1997), who also provide a balanced critique of the case for constraining national policies.

briefly.²⁹ One set of arguments is based on the supposition that governments will always borrow too much unless they are constrained, but that the effects of their profligacy are different and more damaging in a monetary union. The other set argues that participation in a monetary union may strengthen the temptation to borrow too much.

There is no simple, objective way to ascertain whether a government is borrowing too much. It is easy enough to *define* the long-run solvency constraint for a particular government; the present value of its future spending and its interest payments, added to its debt, must not exceed the present value of its future revenues. But spending and revenues are policy-dependent, not predetermined. Therefore, the effects of deficits depend on the expectations of households, firms, and others - whether they *believe* that a government will raise taxes or cut spending to bring down its deficit and keep its debt under control. If they do not trust it to do so, they must expect it to default eventually or use the printing press to inflate away its debt. And if they expect one of those outcomes, they will begin to act in ways that force it to default or start immediately to generate inflation.³⁰ In a monetary union, however, some of the costs will be shifted to the other member countries. A financial crisis due to an imminent default may spread through the payments system and other channels, becoming a union-wide crisis, and the union's central bank may be forced to intervene - to put financial stability ahead of price stability. Alternatively, political pressures may force it to generate inflation, even though governments have promised solemnly to respect its independence.

Similar sorts of cost-shifting may occur in less extreme cases. A government starting to borrow heavily will face higher interest rates—reflecting the higher risk of future inflation and currency depreciation, as well as the higher risk of future default.³¹ This will be true even when bond markets are tightly integrated. If the country belongs to a monetary union, its government will still face those higher rates, and some of the increase in rates – the part reflecting the higher risk of future inflation and currency depreciation – will occur throughout the union, insofar as an increase in one country's borrowing raises the risk of future inflation in the union as a whole and depreciation of the union's currency. The union-wide increase in nominal interest rates need not crowd out investment; if it is due entirely to the expectation of higher inflation, it will not affect the real interest rate. Nevertheless, the governments of other member countries will have to pay more to service their debts and must make compensating adjustments in their budgets.³²

There are several ways in which a monetary union could encourage excessive borrowing, not merely affect the distribution of the adverse consequences. First, individual governments may be led to neglect the side-effects of their own fiscal policies and borrow more than they would if they were made to internalize the full effects of their policies. Each government will readily recognize the effect of its policies on the default-risk premium it faces, but it may not readily recognize its responsibility for the union-wide increase in the inflation-risk premium or the larger

²⁹ For a more thorough treatment along similar lines, see Buiter, Corsetti, and Roubini (1993).

³⁰ See Canzoneri and Diba (1999) for a different formulation using the fiscal theory of price determination.

³¹ For evidence that fiscal policies, especially debt levels, are reflected in default-risk premia, see Goldstein and Woglom (1992), who also show that U.S. states with strict self-imposed limits on their budget deficits pay lower interest rates than those without such limits.

³² But Eichengreen and Wyplosz (1998) argue that these spillover effects may be small. Using Granger causality tests, they find that world interest rates affect European rates, including German rates. When they control for world rates, however, they find that “innovations in German interest rates do not affect interest rates in the rest of Europe, and innovations in rest-of-Europe rates do not affect German rates.” The data they use, however, pertain to the pre-EMU period, and the effects at issue here are those of EMU itself.

burden put on monetary policy by lax fiscal policies. The constraints imposed by the Maastricht Treaty and the Stability Pact may, therefore, be viewed as ways of internalizing the effect of relieving national governments of responsibility for the conduct of monetary policy but letting them retain responsibility for their fiscal policies.³³ Goodhard (1995) points out, moreover, that a monetary union may raise factor mobility, especially capital mobility, which would make it harder for national governments to impose the taxes necessary to avoid large budget deficits.³⁴

On the need for a centralized system of built-in stabilizers

Under the Maastricht Treaty, a government can be found to have an excessive deficit if its deficit exceeds 3 percent of GDP, unless the deficit is falling “substantially and continuously” and has reached level close to that reference value or, alternatively, the excess over the reference value is “exceptional and temporary” and the deficit is close to the reference value. Furthermore, a country with an excessive deficit was at risk of being excluded from participation in the monetary union.³⁵

In 1991, when the treaty was drafted, six of twelve EU countries had deficits larger than 3 percent, and four of those had deficits more than twice that size. Five years later, seven EU countries had deficits larger than 3 percent, including three of the four largest countries (France, Italy, Spain, and the United Kingdom). By 1998, when decisions had to be made about the eligibility of EU countries to join the monetary union, some of those countries had managed to reduce their deficits to or below the reference value. But there were serious concerns about the future. Some countries had used creative accounting or one-time measures to bring down their deficits, and several countries, moreover, were at risk of running larger deficits for demographic reasons - the large size of their unfunded pension liabilities.

For these and other reasons, the EU countries adopted the Stability and Growth Pact to tighten the fiscal provisions of the treaty. They quantified the exceptions and qualifications quoted above, accelerated the process set out in the treaty for deciding whether a country has an excessive budget deficit, and agreed in principle that EU countries would cut their deficits further. If they could balance their budgets on average, they could run bigger deficits during recessions without running foul of the fiscal constraints and could then give free rein to the automatic stabilizers built in to their fiscal systems.³⁶

³³ See Beetsma and Uhlig (1999) for a model in which this occurs. But see also Beetsma and Bovenberg (1998), where, in the absence of fiscal constraints, governments would coordinate their fiscal policies in order to extract a higher inflation rate from the central bank. What you get from a model always depends on what you put into it.

³⁴ Eichengreen and von Hagen (1996) find that fiscal constraints on sub-national governments are more common when those governments have little control over their own revenues. In Europe, of course, national governments control its own tax bases and can therefore raise taxes to deal with debt problems. Eventually, however, factor mobility might limit their freedom to do that.

³⁵ There was an analogous reference value for the stock of debt, which was seen at the time as posing a formidable obstacle to Italian entry. But Belgium had a huge debt too, relative to its GDP, with the result that the debt criterion received diminishing emphasis in discussions of eligibility, and debt levels receive no attention whatsoever in the Stability Pact.

³⁶ For retrospective analyses of European experience, drawing attention to instances in which the Stability Pact might have required individual governments to short-circuit the functioning of their built-in stabilizers, see Buti, Franco, and Ongena (1997) and Eichengreen and Wyplosz (1998). Buti, Franco, and Ongena found

It is, of course, important to have a way of stabilizing national economies in a monetary union when member countries are exposed to large asymmetric shocks. One such method was proposed by the MacDougall Report (Commission, 1977), devising a system of union-wide built-in fiscal stabilizers that would automatically transfer funds from prosperous countries or regions to less fortunate countries or regions - those that are the victims of adverse asymmetric shocks. The transfers could occur intergovernmentally; they could also occur between households or firms, which would pay higher taxes when they prospered and get smaller transfer payments from the central government.³⁷

Many attempts have been made to measure the amount of income stabilization resulting from inter-regional flows of this sort. The results differ from country to country and also from study to study. The first such study, by Sala-i-Martin and Sachs (1992), found that regional tax payments to the US government fall by about 34 cents when regional income falls by a dollar, while transfers to the region rise by about 6 cents. Hence, the net change in the federal "take" offsets about 40 cents of each one-dollar fall in regional income. Von Hagen (1992) pointed out, however, that this very large number contains two elements: re-distributional transfers from high-income regions to low-income regions, and stabilizing transfers from regions experiencing beneficial shocks to regions experiencing adverse shocks. To draw this distinction operationally, he used cross-sectional regressions to measure the re-distributional transfers and time-series regions to measure the stabilizing transfers, and he found that the change in the federal take due to stabilization offsets no more than 10 cents of each one-dollar fall in income.³⁸

Subsequent studies have followed von Hagen in trying to distinguish between the two types of transfers, and they find that the change in the federal take lies somewhere between the high number obtained by Sala-i-Martin and Sachs and the low number obtained by von Hagen.³⁹ It must be pointed out, moreover, that the distinction drawn by von Hagen between redistribution and stabilization is rather arbitrary. Recall the finding by Blanchard and Katz (1992) that it may take several years for a region to recover fully from an adverse shock and that emigration plays a major role in the process of adjustment. The methods usually used to separate redistribution from stabilization are bound to ascribe much of the fall in the federal take to redistribution. Consider, however, a case in which an adverse shock does not reduce wages but raises unemployment. Per capita income will fall, along with the federal take, and it will not return to its initial level until the redundant workers have left the region. Should the fall in the federal take be ascribed to

that European countries were at risk of violating the Stability Pact during protracted recessions even when they started with a sound budgetary position. Sørensen, Wu, and Yosha (1999), however, find that U.S. states, including those with strict balanced-budget rules, make significant fiscal contributions to income stabilization; they accumulate cash in prosperous times and run them down during recessions. The amount of stabilization, however, is inversely related to the strictness of the balanced-budget rule.

³⁷ Intergovernmental schemes for the EU countries are discussed in Kenen (1995); a recent scheme devised by Obstfeld and Peri (1998) seeks to minimize the moral-hazard problems raised by Goodhart and Smith (1993).

³⁸ Note, however, that von Hagen focused entirely on taxes, not the difference between tax and transfer payments.

³⁹ See the survey in Goodhart and Smith (1993) and more recent papers by Mélitz and Zumer (1995) and Bayoumi and Masson (1995), all of which suggest that the net change in the federal take amounts to about 20 cents of each one-dollar fall in income or output. But Gros and Jones (1994) and Fatás (1998) come up with numbers closer to von Hagen's figure using methods different from the method he employed—and different from each other's.

redistribution or to stabilization?

A number of countries are committed explicitly to making re-distributional transfers between sub-national governments. Canada does that extensively, and the effects show up clearly in some of the studies cited above, where the re-distributional effects of the fiscal system are far larger than the stabilization effects. Many transfers, however, including those most closely identified with stabilization, are the by-products of fiscal centralization – the fact that the tax revenues of the central government fluctuate endogenously with the incomes of households and firms and that certain transfer payments, especially unemployment-insurance payments, also vary endogenously with the recipients' incomes. Regional incomes are stabilized to the extent that personal incomes are stabilized. By implication, redistribution requires social cohesion but stabilization does not.

Yet stabilization requires more centralization and, therefore, a greater loss of local control over both sides of the budget.⁴⁰ For this reason, if no other, European governments have been unwilling to contemplate the requisite centralization, and those like Obstfeld and Peri (1998), who have tried to devise systems of built-in fiscal stabilizers for the EU as a whole, have usually proposed single-purpose schemes, such as the centralization of unemployment insurance. For the same reason, moreover, other groups of governments that might form monetary unions are not apt to entertain the possibility of forming fiscal unions.

There is, however, a strong reason for favoring fiscal centralization. It has different debt effects. First, it may lead to less debt creation. Second, it may lead to a different distribution of debt burdens and, therefore, a different distribution of the resulting “Ricardian” debt effects. This point has been stressed by Buiter and Kletzer (1997), and its relevance has been confirmed empirically. Working with Canadian data, Bayoumi and Masson (1998) have shown that fiscal transfers to the Canadian provinces, that impose province-specific debt burdens, have weaker effects on consumption and thus contribute less to the stabilization of income and output than the fiscal transfers that do not impose those burdens. In short, there are strong economic reasons for favoring a fiscal union, and they are particularly strong when the countries involved are members of a monetary union.

6. The Domain of Fiscal Policy

The effects of fiscal policies on household behavior, output, and income cannot be analyzed rigorously in a simple Keynesian model. They must be studied in an inter-temporal model of the type used by Buiter and Kletzer (1997), where households optimize consumption over time, given the present discounted values of their future incomes and future tax payments, their freedom to borrow and lend for consumption smoothing, and their utility functions. But the simple Keynesian model used in this paper can be made to show how the income-stabilizing effects of national tax systems differ from those of a centralized tax system.

To approximate the outcomes obtainable from an optimizing model, suppose that the shocks e_i and u are too small and short-lived to have significant effects on the present discounted value of a household's income stream. If the household could borrow and lend to smooth its consumption, it would borrow to offset an income-reducing shock. When it cannot borrow, however, the government can borrow for it, which is what governments do automatically when income tax collections fall with a fall in income and governments borrow to cover the resulting budget deficit.

⁴⁰ For indirect evidence to this effect, see Fatás and Mihov (1999), who find a strong inverse correlation between the size of government and the instability of output; it holds for both national governments and sub-national governments.

In both cases, however, households must allow for the need to repay debt; their own debt when they borrow individually and the government's debt when it borrows for them.

Modeling a fiscal union without a monetary union

To represent the way that households make allowance for the need to repay debt, define the change in tax payments resulting from a change in income:

$$g_i = \mathbf{t}y_i$$

Then use a simple expression for the allowance that households make for the change in the tax payments they must make in the future due the resulting change in the government's debt:

$$q_i = -\mathbf{d}g_i = -\mathbf{d}\mathbf{t}y_i$$

where $0 \neq \mathbf{d} \neq 1$. Note that q_i is negative when tax payments rise today; because larger tax payments today reduce the government's debt and thereby reduce the households' future tax payments, households will spend more today. Subtracting q_i from the corresponding e_i in eqs. (1) and solving those equations again for y_1 and y_2 ,

$$\begin{aligned} y_1^N &= \left(\frac{1}{D^N}\right)\{[s_2 + m_2 + (1 - \mathbf{d})\mathbf{t}]e_1 + m_2e_2 + [s_2 + (1 - \mathbf{d})\mathbf{t}]u\} \\ y_2^N &= \left(\frac{1}{D^N}\right)\{m_1e_1 + [s_1 + m_1 + (1 - \mathbf{d})\mathbf{t}]e_2 - [s_1 + (1 - \mathbf{d})\mathbf{t}]u\} \end{aligned} \quad (8)$$

where $D^N = D - J^*[(s_1 + m_1 + J) + (s_2 + m_2 + J) - J^*]$.

Suppose, next, that countries 1 and 2 a full-fledged fiscal union, so that both countries' households must allow for the need to repay in the future debt incurred by the whole union. This is the change in the tax receipts of the whole union:

$$g_F = \mathbf{t}(y_1 + y_2) \quad (9)$$

and these are the allowances that households make to serve the government's debt:

$$\begin{aligned} q_1 &= -\mathbf{a}\mathbf{d}\mathbf{t}(y_1 + y_2) \\ q_2 &= -(1 - \mathbf{a})\mathbf{d}\mathbf{t}(y_1 + y_2) \end{aligned}$$

where \mathbf{a} is the share of the increase in future tax payments borne by country 1's households and $(1 - \mathbf{a})$ is the share borne by country 2's households. Subtracting the q_i from the corresponding e_i in eqs.(2) and solving those equations once more,

$$\begin{aligned} y_1^F &= \left(\frac{1}{D^F}\right)\{[(s_2 + m_2 + \mathbf{t}) - (1 - \mathbf{a})\mathbf{d}\mathbf{t}]e_1 + (m_2 + \mathbf{a}\mathbf{d}\mathbf{t})e_2 + [s_2 + (1 - \mathbf{d})\mathbf{t}]u\} \\ y_2^F &= \left(\frac{1}{D^F}\right)\{[m_1 + (1 - \mathbf{a})\mathbf{d}\mathbf{t}]e_1 + [(s_1 + m_1 + \mathbf{t}) - \mathbf{a}\mathbf{d}\mathbf{t}]e_2 - [s_1 + (1 - \mathbf{d})\mathbf{t}]u\} \end{aligned} \quad (10)$$

where $D^F = D^N + \alpha J[s_1 + (1 - \alpha)s_2 + (1 - \alpha)J]$.

The effects of the fiscal union can now be identified by subtracting the income changes given by eqs. (10), where the fiscal union services all debt, from the changes given by eqs (8), where individual governments service their own debts.

Beginning with an expenditure-changing shock in country 1,

$$y_1^N - y_1^F = \left(\frac{1}{D^F}\right)\left(\frac{1}{D^N}\right)dt[s_2 + (1 - d)t]\{(1 - a)[s_2 + m_2 + (1 - d)t] - am_1\}e_1$$

$$y_2^N - y_2^F = \left(\frac{1}{D^F}\right)\left(\frac{1}{D^N}\right)dt[s_2 + (1 - d)t]\{(1 - a)m_2 - a[s_1 + m_1 + (1 - d)t]\}e_1$$

Hence, $y_1^N > y_1^F$ and $y_2^N < y_2^F$ whenever

$$\left[\frac{m_2}{s_1 + m_1 + (1 - d)t}\right] < \left(\frac{a}{1 - a}\right) < \left[\frac{s_2 + m_2 + (1 - d)t}{m_1}\right]$$

This condition always holds when countries 1 and 2 do not differ much in size. Analogous results obtain for an expenditure shock in country 2, and the two sets of outcomes, taken together, can be put this way: when, with a fiscal union, the debt burden is distributed more uniformly than the income effects of the shock producing the debt, the union reduces the impact of the shock on the country in which it originated but raises its impact on the other country.

Turning next to an expenditure-switching shock,

$$y_1^N - y_1^F = \left(\frac{1}{D^F}\right)\left(\frac{1}{D^N}\right)dt[s_2 + (1 - d)t][as_1 + (1 - a)s_2 + (1 - d)t]u > 0$$

$$y_2^N - y_2^F = -\left[\frac{s_1 + (1 - d)t}{s_2 + (1 - d)t}\right](y_1^N - y_1^F) < 0$$

when $u > 0$, country 1's income rises by less with a fiscal union and country 2's income falls by less. These results hold unambiguously. They do not depend on the relative sizes of the two countries, as they did with an expenditure-changing shock, as debt behaves differently here. With an expenditure-changing shock, the two governments' budgets move in the same direction, and the only effect of a fiscal union is to redistribute the resulting debt burden. With an expenditure-switching shock, by contrast, the governments' budgets move in opposite directions, and the principal effect of a fiscal union is to reduce the size of the debt burden. When $s_1 = s_2$, in fact, there is no debt creation with a fiscal union.

Modeling a fiscal union with a monetary union

The debt-reducing effect of a fiscal union derives from the mirror-image asymmetry displayed by expenditure-switching shocks. We have also seen, however, that a monetary union imparts the same characteristic to expenditure-changing shocks when the union's central bank aims at stabilizing union-wide income. From eqs. (7) and (9) above, $g_F = 0$ with a supranational monetary union, and the income changes in countries 1 and 2 are those given by eq. (7) itself.

The tax term J does not appear explicitly in eq. (7) but is contained in H^U , where it has the effect of compressing the income changes in countries 1 and 2 when they belong to a monetary union having a single central bank that aims at stabilizing union-wide income. Therefore, eq. (7) can be deemed to describe the effects of a monetary union in two situations: one with built-in stabilizers and no Ricardian debt effects, and one with built-in stabilizers and Ricardian debt effects but no debt creation.

As we have just shown that the second case represents the result of combining a fiscal union with a monetary union, it is also easy to show that this sort of comprehensive union is superior to a monetary union without a fiscal union. We have merely to derive the counterpart of eq. (7) for a monetary union with Ricardian debt effects and no fiscal union. This is done by returning to eqs. (8), defining the income changes in countries 1 and 2 when there are Ricardian debt effects and no fiscal union, and following the same steps taken to derive eq. (7). First, replace each e_i with $e_i' + e^*$, where, as before, e_i' stands for a truly exogenous expenditure-changing shock and e^* stands for the effect of a change in monetary policy. Next, use the two countries' income equations to obtain the change in union-wide income and solve for the value of e^* that prevents any change in union-wide income:

$$e^* = -\left(\frac{1}{H^{UN}}\right)\{[s_2 + m_1 + m_2 + (1-d)t]e_1' + [s_1 + m_1 + m_2 + (1-d)t]e_2' + (s_2 - s_1)u\}$$

where $H^{UN} = H^U - *J$. Substituting into the income equations,

$$y_1^{UN} = -y_2^{UN} = \left(\frac{1}{H^{UN}}\right)(e_1' - e_2' + 2u) \quad (11)$$

But $H^{UN} < H$. In the presence of Ricardian debt effects, then, the combination of a monetary union with a fiscal union leads to smaller income changes than a monetary union by itself. The presence of those debt effects is, in fact, the chief rationale for the centralization of built-in fiscal stabilizers in a monetary union.⁴¹

7. The Institutionalization of a Fixed Exchange Rate

Much of this paper has dealt with the application of OCA theory to European monetary union. But the issues examined and the framework used are equally relevant to a comparative evaluation of arrangements that might be adopted by countries wishing to move from ordinary pegged-rate regimes to firmly fixed exchange rates or to abolish the exchange rate completely by *de jure* dollarization. Those issues can be grouped under three headings:

1. Governance and accountability
2. Currency domains, policy domains, and optimality
3. The need for fiscal and financial discipline.

Before reviewing these issues, however, let us compare two regimes that are very similar

⁴¹ Kletzer (1997) draws the same conclusion from a more sophisticated model.

in most respects but differ in two crucial ways—a currency-board regime and *de jure* dollarization.

Comparing a currency board with formal dollarization

Under a currency-board regime, a country retains its own currency but gives up the ability to run its own monetary policy. An ordinary central bank holds assets denominated in its own currency, as well as foreign-currency assets, and can raise or reduce its domestic-currency assets in order to influence the liquidity of the banking system and short-term interest rates. A currency board does not hold domestic-currency assets; the monetary base is backed entirely by its holdings of foreign-currency assets. Furthermore, a currency board must buy or sell foreign-currency assets at a fixed exchange rate whenever anyone else wants to swap foreign currency assets for domestic currency. Although these transactions affect the liquidity of the banking system, they are initiated by the public, not by the currency board. Therefore, a currency board cannot have any discretionary influence on bank liquidity or short-term interest rates, not even for the limited purpose of “sterilizing” the money-supply effects of its own transactions in foreign-currency assets.⁴² For the same reason, moreover, a currency board cannot serve as lender of last resort to the banking system, nor can it help to finance a budget deficit by making loans directly to the government or making funds available to banks and others with which they can make loans to the government.

Williamson (1995) notes that the revival of interest in currency boards reflects the same concerns that has led to widespread support for central-bank independence – concerns about the subordination of monetary policy to the financing of big budget deficits. But a currency-board regime goes further. An independent central bank is not usually obliged to maintain a rigidly fixed exchange rate. In fact, independent central banks are suspicious of any suggestion that they intervene in the foreign-exchange market, because intervention interferes with the pursuit of an independent monetary policy. Furthermore, independent central banks are not normally made to refrain from serving as lenders of last resort to the banking system. In fact, critics of EMU frequently complain that the Statute of the European Central Bank is insufficiently explicit in assigning that responsibility to the ECB.

Giving independence to a central bank in order to insulate monetary policy from political influence and irresponsible fiscal policies is very different from tying its hands completely by denying it any discretion and turning it into a currency board. There are, however, two distinct reasons for establishing a currency board. The first was invoked by Rodrik (1999) in a passage quoted at the start of this paper. When a particular country’s history suggests that an ordinary central bank is more likely to produce economic instability than promote stability, a currency board may make sense. The second reason derives from the new “binary” view of exchange rate regimes, that exchange rates may either float or be firmly fixed but cannot be firmly fixed without institutionalization.

Unfortunately, currency boards are not immortal. Some have been abandoned after a few years. Like other governmental arrangements, including central-bank independence, they are put in

⁴² On the workings of currency boards and their history, see Hanke and Schuler (1994) and Williamson (1995). Hanke and Schuler quote my parody on the first verse of Genesis, composed for a central-bank conference in West Africa; although I gave them permission to quote it, I do not share their enthusiasm for currency boards. I am especially skeptical of the assertion in Hanke and Schuler (1999) that the severe “tequila effect” experienced by Argentina was due to the differences between Argentina’s currency-board regime and an “orthodox” currency board.

place by legislation and can be abolished by legislation.⁴³ This is the advantage of *de jure* dollarization. A country having a currency board retains its own currency and can abandon the currency board without taking the steps and time required to introduce a new domestic currency. A country that has dollarized fully and formally is in a more awkward situation and may be very vulnerable to capital flight and financial disruption during the time that must elapse between the decision to introduce a domestic currency and its actual introduction. There will be uncertainty, for example, about the continuity of debt contracts. In which currency will they be payable after the move to the new domestic currency?⁴⁴ For this same reason, of course, the interest rate is apt to be higher under a currency-board regime than under *de jure* dollarization. A currency-board country may have to pay a larger currency-risk premium when it “imports” its interest rate from the key-currency country to which it has tied its own currency.

There is a price to be paid, however, for the more durable and credible exchange-rate commitment conferred by dollarization. A currency-board country must hold foreign-currency reserves and will earn interest on them. A country choosing dollarization must use its reserves to redeem its own currency, and it may have to borrow foreign currency if its reserves are not large enough to redeem the entire monetary base. Therefore, it must forgo the interest income it had earned before.⁴⁵

Having identified the main differences between a currency-board regime and formal dollarization, let consider the differences between those two arrangements, taken together, and a full-fledged monetary union.⁴⁶

Governance and accountability

When the time came to draft the Maastricht Treaty, it was convenient, even essential, to have the Rome Treaty at hand. It would have been very hard to produce a workable plan for monetary union if the institutions of the European Union were not already up and running—the Commission, the Council, and the European Parliament. Those institutions were required to make decisions about the membership of the monetary union, to adopt the legislation needed to introduce the Euro, to choose the President and Executive Board of the ECB, and provide for a modicum of accountability to balance the independence of the ECB. It is, indeed, hard to believe that monetary union would have occurred absent the influence of the political and economic imperatives that produced the

⁴³ The independence of the ECB is exceptional in this respect, as its Statute is appended to the Maastricht Treaty and cannot be altered without the consent of all EU countries, even those that have not joined the monetary union.

⁴⁴ Calvo (1999) notes, however, that “liability dollarization” is already common in emerging-market countries and occurs in currency-board countries, such as Argentina. It is, he says, a major reason for the widespread “fear of floating” and a strong reason for favoring *de jure* dollarization.

⁴⁵ It has been suggested that the United States should compensate countries for that loss of interest income; see, *eg* Hanke and Schuler (1999). Barro (1999) actually suggests that the United States should print the necessary dollars and hand them over *gratis*, and this is an intriguing idea. It would cost the United States nothing, and the dollarizing country could keep its reserves. Therefore, its government could act in a limited way as a lender of last resort in the event of a banking crisis.

⁴⁶ For a comparison similar to this one, see Buiter (1999). He also attaches great importance to the unique constitutional arrangements in Europe and to the difference between the monetary-policy domain under a currency board or dollarization and under a full-fledged monetary union.

Common Market and the Single European Act. Had they not been members of the EMS, moreover, European governments might have resisted monetary union as involving an unacceptable sacrifice of monetary autonomy.⁴⁷

It is hard to believe that other groups of countries, such as the members of NAFTA or MERCOSUR, could agree to create the decision-making bodies needed to run and oversee a full-fledged monetary union. Would the US Senate ratify a treaty under which it would have to share with the Canadian Parliament and Mexican Congress the power to choose the Chairman and Board of Governors of the Federal Reserve System? Would those bodies ratify a treaty that did not give them a decision-making role or, for the matter, the right to insist that the Chairman testify before their committees?

It is tempting to stop right here. Political considerations are, I believe, sufficient reason to believe that we will not see a proliferation of monetary unions in the next few years, despite the awakening of interest in them that largely due to EMU. Political prognostication is perilous, however, and it is thus useful to compare the merits of monetary unions with those of other, less symmetrical arrangements that countries can adopt unilaterally to make a strong institutional commitment to a fixed-rate regime.

Currency domains, policy domains, and optimality

Advocates of currency boards and *de jure* dollarization invariably recommend that emerging-market countries back or replace their own currencies with one of the key currencies, the dollar, the euro, or, less frequently, the yen. This is a sensible strategy when the main aim of the regime change is to prevent future currency crises. It would be silly from this standpoint to tie Ecuador's *sucre* to Brazil's *real* or substitute the *real* for the *sucre*.

The use of a key currency also makes sense from another standpoint—reducing domestic financial fragility. Hausmann (1999) notes that governments and firms in emerging-market countries have trouble issuing long-term debt in their own currencies; expectations of future inflation and currency depreciation have inhibited the development of debt markets. Therefore, those countries have to choose between issuing foreign-currency debt or relying heavily on short-term debt—options which tend to perpetuate financial fragility and condemn emerging-market countries to periodic crises, whether they have floating or pegged exchange rates. The solution, Hausmann says, is *de jure* dollarization, which would promote the development of domestic debt markets and thus reduce vulnerability to financial crises as well as currency crises.⁴⁸

Two more arguments are adduced for using a key currency. As a currency board and dollarization both transfer to a foreign country the responsibility for monetary policy, it makes sense

⁴⁷ This point is stressed by Goodhart (1995), and I would stress another. Without the prior acceptance of central-bank independence, the EU governments would have had great difficulty designing an efficient monetary union. Although the institutions of the EU have important roles to play under the Maastricht Treaty, they could not have been given responsibility for the day-to-day conduct of monetary policy. It is hard for central banks to decide when they should change short-term interest rates. It would have been far harder for the Council of Ministers to take on that task—and virtually impossible for its members, who represent national governments, to formulate a monetary policy appropriate for the whole euro area.

⁴⁸ Hausmann's paper is often cited in tandem with a paper by Larrain and Sach (1999), which strongly opposes dollarization. But it does not address Hausmann's main argument that emerging-market countries face a self-perpetuating vulnerability to financial and currency crises because their debt markets are underdeveloped. It argues that flexible exchange rates are vital shock absorbers and serve as deterrents to excessive foreign-currency borrowing.

to choose a foreign currency and thus a foreign country that can be expected to provide a credible and sensible monetary policy. Furthermore, several emerging-market countries have already experienced *de facto* dollarization and several more countries pursue exchange-rate policies that “track” the dollar closely, even some countries that do not trade heavily with the United States.⁴⁹ Such countries are least likely to face strong political opposition to the introduction of a currency board or to *de jure* dollarization using the key currency with which they already have close ties. In brief, the case for dollarization does what Cohen (1997) has recommend, bringing the market back into the debate on the formation of currency areas by stressing financial relationships rather than trade relationships or structural characteristics.

At the start of this paper, however, I drew a distinction between positive and normative considerations. Market forces help to explain why key currencies play important roles in the economies and economic policies of emerging-market countries. But they are not sufficient to judge whether the consequences constitute first-best or second-best solutions to those countries’ problems. That is the role of OCA theory.

The two-country models commonly used in OCA theory are not entirely satisfactory for this purpose. They do pose an important question: Should a particular pair of countries form a monetary union by fixing the exchange rate between their currencies or adopting a new common currency? And they help us to answer that question by posing another: Are those countries apt to experience large asymmetric shocks and, if so, is there enough labor mobility between them - or wage flexibility within them - to cease using the nominal exchange rate to offset or reduce the impact of those shocks? But a two-country model inevitably draws our attention to expenditure-changing shocks arising within those countries and to expenditure-switching shocks between those countries’ goods. We are thus led to ignore or pay little attention to shocks from the outside world, including shocks arising from exchange rate changes involving third countries’ currencies, those of major trading partners and those of close competitors.

Such changes can occur because of developments in individual partners or competitors. The rapid spread of the Asian crisis in 1997-98 was due in part to changes in dollar exchange rates within Southeast Asia that impaired the competitive positions of individual countries in each others’ markets and in world markets. The recent recession in Argentina was due in part to the sharp depreciation of the Brazilian *real*. Such changes can also occur because of more distant developments, changes in exchange rates between the key currencies. The Asian crisis was due in part to the sharp change in the yen-dollar rate in the mid-1990s, which impaired the competitiveness of the region’s exports in the Japanese market and left them with excess capacity in their export industries. It thus contributed to the sharp decline in Asian stock markets and undermined the creditworthiness of heavily indebted domestic firms.

Unlike a currency board or formal dollarization, a full-fledged monetary union cannot protect its members completely from future currency crises. It has an external exchange rate of its own, which may be vulnerable to attack.⁵⁰ But there are ways in which a monetary union could reduce their vulnerability. For reasons given earlier, a monetary union must have an independent central bank, and it is likely to conduct a better monetary policy than those pursued individually by its

⁴⁹ See Honohan and Lane (1999). Some of the countries they study, however, trade heavily with other dollar trackers or compete with them intensively in third markets. Countries that track the euro, moreover, have close economic or political links with the euro area.

⁵⁰ A North-American monetary union would protect Mexico from currency crises, and large changes in dollar exchange rates *vis-a-vis* third currencies would not have strong effects on Mexico’s economy, because the United States is by far its most important trading partner.

member countries. Furthermore, a monetary union is less likely than its members to adopt a pegged exchange rate. It can be more tolerant of exchange rate changes, because fluctuations in the union's exchange rate will not have differential effects on its members' exports, except to the extent that those exports are differentially vulnerable to exchange rate changes *vis-a-vis* third currencies.⁵¹ Market forces reinforced by monetary policies and by prudent intervention might mitigate the impact of large fluctuations in key-currency exchange rates.

A flexible exchange rate can be attacked, but an attack on a flexible rate may be less damaging than an attack on a pegged rate. As governments tend to defend pegged rates until they run out of reserves, they can rarely engineer a modest devaluation; by the time they are ready for that, they have insufficient reserves to defend the new pegged rate. They are then forced to let the rate float, and it depreciates precipitously. That is what happened to the lira in 1992, when Italy left the EMS, what happened to several Asian countries in 1997, and what happened to Russia and Brazil when they abandoned pegged rates in 1998 and 1999. Furthermore, a flexible rate may discourage domestic banks and others from assuming large, unhedged foreign-currency debts of the sort that played a major role in precipitating the Asian crisis and led, thereafter, to a huge fall in output, because insolvent banks faced insolvent borrowers and there was a sharp contraction of essential credit flows.

Finally, currency boards and dollarization are intrinsically asymmetric in their monetary policy domains. The monetary policy of the key-currency country is aimed at the stabilization of its own economy or at price stability within that economy. Its central bank might not behave as a Stackelberg leader, which is what it did in the model used above, where it asked how its policies affected other countries and took account of the implications for its own economy. But one could not expect it to give any normative weight to the effects of its policies on those other countries. Its decisions would be based exclusively on domestic considerations.⁵² In a monetary union, by contrast, monetary-policy decisions would presumably be based on economic conditions in the entire union. As a practical matter, of course, a union between a big country and a small one cannot be fully symmetrical. When decisions are made on the basis of union-wide aggregates or averages weighted by country size, the results will be asymmetrical. Smaller countries will be under-represented in a monetary union, regardless of the number of seats they may have on the decision-making bodies of its central bank. But under-representation is better than no representation at all.

If ways can be found to solve the problems of governance and accountability raised in the previous section, monetary unions might be better for some groups of emerging-market countries than tight unilateral links to one of the key currencies. They might not be less optimal than EMU, given the *desiderata* suggested by OCA theory.⁵³

⁵¹ The effects of those fluctuations, moreover, might be mitigated if market forces, monetary policy, and prudent intervention stabilized the effective exchange rate of a monetary union defined in terms of a key-currency basket.

⁵² Summers (1999) has already said that it would not be appropriate for the U.S. authorities "to extend the net of bank supervision, to provide access to the Federal Reserve discount window, or adjust bank supervisory responsibility or the *procedures or orientation of U.S. monetary policy* in light of another country deciding to adopt the dollar (emphasis added). It should be noted, however, that Summers did not rule out some sort of compensation for the loss of interest income resulting from dollarization.

⁵³ For a test of this hypothesis, see Bayoumi and Eichengreen (1994).

The need for fiscal and financial discipline

The coming of EMU has raised two questions: Should other groups of countries set up similar arrangements? Must those that have already formed regional trade blocs go on to form monetary unions in order to reap the full benefits of regional free trade? This paper has given a long and agnostic answer to the first question. Other economists have already given a brief and decisive answer to the second. Eichengreen (1998) argues persuasively that countries content to form customs union or free trade areas need not form monetary unions.⁵⁴ A monetary union may be needed by countries that seek to pursue deep integration – the unification of capital markets, a common competition policy, and so on. It is not necessary for free trade.

But there is still a need to think about a related question: Is deep integration required to form and sustain a monetary union? Whatever one's doubts about the fiscal arrangements adopted by the EU countries - the Stability Pact and all that - they raise an important issue. Can a monetary union function efficiently or last very long if its members are free to manage, or mismanage, their own fiscal policies? Debate continues in Europe, moreover, about bank supervision - whether it should be conducted at the national level or transferred to the EU level - and about the ability and willingness of the ECB to serve as lender of last resort to the banking system of the euro area, and this debate will intensify as the consolidation of banking continues and enters its next phase, in which domestic mergers give way to transnational mergers.

Similar questions are raised by *de jure* dollarization. We have already seen that there can be no lender of last resort in a country that turns its central bank into currency board or adopts a key currency as its own. It cannot expect the central bank of the key-currency country to take on that task.⁵⁵ It is for this reason that advocates of dollarization often recommend that countries adopting another country's currency open up their banking systems to foreign ownership, which is, of course, another form of deep integration.⁵⁶

The institutionalization of a fixed exchange rate may sound simple. It is not. The best method for a particular country will necessarily depend on that country's circumstances and the availability of other methods. A group of very small countries may be too small collectively to form a monetary union. A more promising group of middle-sized countries, even those that belong to a free trade area, may be unable to solve the problems of governance and accountability required to form a monetary union. And many emerging-market countries may conclude that a flexible exchange rate is more satisfactory than the best possible way to institutionalize a fully fixed exchange rate.

⁵⁴ See also Goodhart (1995). But recall the warnings by Eichengreen (1996) and Goodhart (1995) that trade tensions arising from exchange-rate changes can undermine a regional trading arrangement by producing political pressures to impose new trade barriers or resort to the use of subsidies to provide covert protection. The depreciation of the Brazilian *real* in 1999 led to serious tensions within MERCOSUR, and Argentina erected new trade barriers against Brazilian exports.

⁵⁵ See the warning by Summers, quoted above, that the U.S. authorities cannot be expected to supervise other countries' banks or come to their aid in a crisis.

⁵⁶ But other, less drastic steps can be taken to safeguard domestic banks. Argentina was able to assist its crisis-stricken banks after the Mexican crisis of 1994-95; see Caprio *et al.* (1996) and Guidotti (1996). Furthermore, Argentina has set up contingent credit lines, allowing it to borrow dollars from foreign banks; it could presumably activate them in the event of a banking crisis. See also the proposal by Barro, cited above, which would let a country keep its foreign-exchange reserves instead of using them to buy up its own currency; those reserves, I suggested, would then be available to assist domestic banks in a crisis.

Appendix I: Income Correlations in a Three-Country Model

This appendix use a three-country version of the Keynesian model in the text to show how trade intensity and exogenous shocks affect the correlation between two countries' incomes – a matter germane to the work of Frankel and Rose (1998). The use of a three-country model allows one to distinguish between two types of changes in trade intensity. The underlying assumptions and notation are identical to those in the text, but the tax rate, J , is set at zero to simplify the algebra.

Country I 's income is defined as it was in the text, but it is now necessary to distinguish between its trade with country 2 and its trade with the rest of the world, represented by country 3:

$$\begin{aligned} X_1 &= M_{21} + M_{31} = (m_{21}Y_2 + Z_{21}) + (m_{31}Y_3 + Z_{31}) \\ M_1 &= M_{12} + M_{13} = (m_{12}Y_1 + Z_{12}) + (m_{13}Y_1 + Z_{13}) \end{aligned}$$

where Z_{ij} is defined so that an increase denotes a switch in expenditure from country i 's good to country j 's good ($i, j = 1, 2, 3$). Substituting into the usual income equation for country I and using lower-case letters to denote deviations from initial values,

$$(s_1 + m_{12} + m_{13})y_1 - m_{21}y_2 - m_{31}y_3 = e_1 + (z_{21} - z_{12}) + (z_{31} - z_{13})$$

Defining y_2 analogously, treating y_3 as exogenous, and solving for changes in the two countries' incomes,

$$\begin{aligned} y_1 &= \left(\frac{1}{J}\right)[(s_2 + m_{21} + m_{23})w_1 + m_{21}w_2 + (s_2 + m_{23})u] \\ y_2 &= \left(\frac{1}{J}\right)[m_{12}w_1 + (s_1 + m_{12} + m_{13})w_2 - (s_1 + m_{13})u] \end{aligned} \tag{A-1}$$

where

$$\begin{aligned} J &= (s_1 + m_{12} + m_{13})(s_2 + m_{21} + m_{23}) - m_{12}m_{21}, \\ w_1 &= e_1 + m_{31}y_3 + (z_{31} - z_{13}), \quad w_2 = e_2 + m_{32}y_3 + (z_{32} - z_{23}), \\ u &= z_{21} - z_{12} \end{aligned}$$

Note that the w_i contain three shocks: an expenditure change in country i , a change in the demand for country i 's exports due to a change in country 3's income, and the effect of a switch in expenditure from country 3's good to country i 's good. To simplify matters hereafter without much loss of generality, assume that $m_{12} = m_{21} = m$.

Setting $\text{cov}(w_1, w_2) = 0$ and $\text{cov}(w_1, u) = \text{cov}(w_2, u) = 0$, write

$$\text{cov}(y_1, y_2) = \left(\frac{1}{J}\right)^2 h_0, \quad \text{var}(y_1) = \left(\frac{1}{J}\right)^2 h_1, \quad \text{var}(y_2) = \left(\frac{1}{J}\right)^2 h_2$$

where

$$\begin{aligned}
h_0 &= m(s_2 + m_{23} + m) \text{var}(w_1) + m(s_1 + m_{13} + m) \text{var}(w_2) + (J + 2m^2) \text{cov}(w_1, w_2) \\
&\quad - (s_1 + m_{13})(s_2 + m_{23}) \text{var}(u) \\
h_1 &= (s_2 + m_{23} + m)^2 \text{var}(w_1) + (m)^2 \text{var}(w_2) + 2m(s_2 + m_{23} + m) \text{cov}(w_1, w_2) \\
&\quad + (s_2 + m_{23})^2 \text{var}(u) \\
h_2 &= (m)^2 \text{var}(w_1) + (s_1 + m_{13} + m)^2 \text{var}(w_2) + 2m(s_1 + m_{13} + m) \text{cov}(w_1, w_2) \\
&\quad + (s_1 + m_{13})^2 \text{var}(u)
\end{aligned} \tag{A-2}$$

The correlation between the two countries' incomes can then be written as

$$r(y_1, y_2) = k_0(k_1 k_2)^{-(1/2)}$$

and

$$\frac{dr(y_1, y_2)}{d\mathbf{w}} = (h_1 h_2)^{-(3/2)} [(h_1 h_2) \frac{dh_0}{d\mathbf{w}} - \left(\frac{1}{2}\right) h_0 (h_2 \frac{dh_1}{d\mathbf{w}} + h_1 \frac{dh_2}{d\mathbf{w}})]$$

where dT is an increase in the variance of a shock or in trade intensity.

An increase in trade intensity is represented by $dT = dm$ and by $dm_{13} = dm_{23} = -b dm$, where $0 \neq b \neq 1$. When $b = 0$, the increase in trade intensity resembles pure Vinerian trade creation (an increase in bilateral trade at the expense of higher-cost production in the partner country). But the welfare implications are less clear in the present context, so this sort of increase is described below as trade augmentation rather than trade creation. When $b = 1$, the increase in trade intensity resembles pure Vinerian trade diversion (an increase in bilateral trade at the expense of lower-cost production in the outside world), and this sort of increase is described below as trade displacement.

It would, of course, be convenient to work with one shock at a time, but that is impossible. When $\text{var}(w_2) = \text{var}(u) = 0$, so that w_1 is the only shock, then $r(y_1, y_2) = 1$; when, instead, $\text{var}(w_1) = \text{var}(w_2) = 0$, so that u is the only shock, then $r(y_1, y_2) = -1$. But we can still study two special cases.

Case A

Consider a combination of expenditure-changing shocks in country 1 ($w_1 \dots 0$) and expenditure-switching shocks ($u \dots 0$). To that end, set $\text{var}(w_2) = \text{cov}(w_1, w_2) = 0$,¹ so that

$$\begin{aligned}
h_0 &= m(s_2 + m_{23} + m) \text{var}(w_1) - (s_1 + m_{13})(s_2 + m_{23}) \text{var}(u) \\
h_1 &= (s_2 + m_{23} + m)^2 \text{var}(w_1) + (s_2 + m_{23})^2 \text{var}(u) \\
h_2 &= (m)^2 \text{var}(w_1) + (s_1 + m_{13})^2 \text{var}(u)
\end{aligned} \tag{A-2a}$$

An increase in trade intensity increases the correlation between the two countries' incomes:

¹ Note, however, that we cannot impose these assumptions without setting $\text{var}(y_3) = 0$, as a change in country 3's income appears in the definitions of w_1 and w_2 .

$$\begin{aligned} \frac{dr(y_1, y_2)}{dm} &= \text{var}(w_1) \text{var}(u) J(h_1 h_2)^{-(3/2)} \times \\ &\quad \{[(s_1 + m_{13} + mb)(s_2 + m_{23} + m) + (s_2 + m_{23} + mb)m_2] \text{var}(w_1) \\ &\quad + [(s_1 + m_{13} + mb)(s_2 + m_{23})^2 + (s_2 + m_{23} + mb)(s_1 + m_{13})^2] \text{var}(u)\} > 0 \end{aligned} \quad (\text{A-3})$$

where the values of h_1 and h_2 are those given by eqs. (A-2a). Note that the RHS of eq. (A-3) goes to zero when $\text{var}(w_1) = 0$ or $\text{var}(u) = 0$, because $r(y_1, y_2) = 1$ in the first case and $r(y_1, y_2) = -1$ in the second. Note further than an increase in trade intensity raises $r(y_1, y_2)$ whether the latter is positive or negative and that its effect is unambiguously larger with pure trade displacement ($b = 1$) than with pure trade augmentation ($b = 0$); this is because trade displacement reduces the extent to which shocks in countries 1 and 2 spill out to the rest of the world.

These are the effects of changes in the amplitude of shocks:

$$\frac{dr(y_1, y_2)}{d \text{var}(w_1)} = \left(\frac{1}{2}\right) \text{var}(u) J(h_1 h_2)^{-(3/2)} [m(s_1 + m_{13})h_1 + (s_2 + m_{23})(s_2 + m_{23} + m)h_2] > 0 \quad (\text{A-4})$$

$$\frac{dr(y_1, y_2)}{d \text{var}(u)} = -\left(\frac{1}{2}\right) \text{var}(w_1) J(h_1 h_2)^{-(3/2)} [m(s_1 + m_{13})h_1 + (s_2 + m_{23})(s_2 + m_{23} + m)h_2] < 0 \quad (\text{A-5})$$

An increase in $\text{var}(w_1)$ raises $r(y_1, y_2)$. It works to offset the negative influence of $\text{var}(u)$, which tends to drive the two countries' incomes in opposite directions. An increase in $\text{var}(u)$ reduces $r(y_1, y_2)$. It works to offset the positive influence of $\text{var}(w_1)$, which, although asymmetric in origin, tends to drive the countries' incomes in the same direction.

Case B

Consider a combination of expenditure-changing shocks in countries 1 and 2 ($w_1 \dots 0$ and $w_2 \dots 0$) and let them be positively correlated. To that end, set $\text{var}(u) = 0$, so that

$$\begin{aligned} h_0 &= m(s_2 + m_{23} + m) \text{var}(w_1) + m(s_1 + m_{13} + m) \text{var}(w_2) + (J + 2m^2) \text{cov}(w_1, w_2) \\ h_1 &= (s_2 + m_{23} + m)^2 \text{var}(w_1) + (m)^2 \text{var}(w_2) + 2m(s_2 + m_{23} + m) \text{cov}(w_1, w_2) \\ h_2 &= (m)^2 \text{var}(w_1) + (s_1 + m_{13} + m)^2 \text{var}(w_2) + 2m(s_1 + m_{13} + m) \text{cov}(w_1, w_2) \end{aligned} \quad (\text{A-2b})$$

An increase in trade intensity raises the correlation between the countries' incomes whenever $r(w_1, w_2)^2 < 1$. As in Case A, moreover, the effect larger with trade displacement than with trade augmentation:

$$\begin{aligned} \frac{dr(y_1, dy_2)}{dm} &= \text{var}(w_1) \text{var}(w_2) [1 - r(w_1, w_2)^2] J(h_1 h_2)^{-(3/2)} \times \\ &\quad \{2m[(s_1 + m_{13} + m)(s_2 + m_{23} + mb) + (s_2 + m_{23} + m)(s_1 + m_{13} + mb)] \text{cov}(w_1, w_2) \\ &\quad + [(s_2 + m_{23} + m)^2 (s_1 + m_{13} + mb) + m^2 (s_2 + m_{23} + mb)] \text{var}(w_1) \\ &\quad + [(s_1 + m_{13} + m)^2 (s_2 + m_{23} + mb) + m^2 (s_1 + m_{13} + mb)] \text{var}(w_2)\} \end{aligned} \quad (\text{A-6})$$

where the values of h_1 and h_2 are those given by eqs. (A-2b).

This is the effect of a change in $\text{var}(w_1)$:

$$\begin{aligned} \frac{dr(y_1, y_2)}{d \text{var}(w_1)} = & -\left(\frac{1}{2}\right) J^2 (h_1 h_2)^{-(3/2)} \times \\ & \{ [2m(s_2 + m_{23} + m) \text{cov}(w_1, w_2) + (J + 2m^2) \text{var}(w_2)] \text{cov}(w_1, w_2) \\ & + [m(s_1 + m_{13} + m) \text{var}(w_2) - m(s_2 + m_{23} + m) \text{var}(w_1)] \text{var}(w_2) \} \end{aligned} \quad (\text{A-7})$$

An increase in the amplitude of w_1 reduces $r(y_1, y_2)$ when $r(w_1, w_2) \leq \frac{1}{2}$ or when $\text{var}(w_1)/\text{var}(w_2) \leq [(s_1 + m_{13} + m)/(s_2 + m_{23} + m)]$. If neither condition is met, the effect on $r(y_1, y_2)$ is ambiguous. The effect of an increase in $\text{var}(w_2)$ is, of course, symmetrical to that of an increase in $\text{var}(w_1)$.

This is the effect of an increase in $\text{cov}(w_1, w_2)$:

$$\begin{aligned} \frac{dr(y_1, y_2)}{d \text{cov}(w_1, w_2)} = & J^2 (h_1 h_2)^{-(3/2)} \{ (J + 2m^2) \text{var}(w_1) \text{var}(w_2) + m[(s_2 + m_{23} + m) \text{var}(w_1) \\ & + (s_1 + m_{13} + m) \text{var}(w_2)] \text{cov}(w_1, w_2) \} > 0 \end{aligned} \quad (\text{A-8})$$

As one would expect, an increase in the covariance between country-specific expenditure shocks raises the correlation between two countries' incomes.

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