

CURRENCY UNIONS AND POLICY DOMAINS

Peter B. Kenen
Princeton University
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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 ratified the shift from pegged to floating exchange rates, he published *Organizing the World's Money*, which examined the role 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 system and in the creation of currency domains whose boundaries rarely coincide with those of nation states. In both books and much of his other work, he explored the interplay between the dimensions of national power and the dimensions of monetary sovereignty.

This paper is also concerned with the evolution of the monetary system, but it is narrowly normative. It stresses the role of the *policy* domain, not the *currency* domain, and argues that the nature of the policy domain—the way in which monetary policy is made—deserves more attention than it usually receives. The comparative merits of the various ways in which countries can fix their exchange rates—unilateral dollarization, a currency board, or a full-fledged monetary union—depend largely on the monetary-policy domains that correspond to those regimes. The case for reinforcing a monetary union with a fiscal federation also depends on the policy domain of the monetary union.

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 regimes, changes in the character of macroeconomic theory, and changes in the ordering of policy priorities.

The design of the Bretton Woods system—the network 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. Because wages and prices were deemed to be sticky, the nominal exchange rate was thought to be a useful policy instrument. A change in the nominal rate would affect the real rate and could therefore be used to switch expenditure between domestic and foreign goods.

The shift to floating exchange rates in the early 1970s, after the collapse of the Bretton Woods system, was seen at first as temporary—a way to buy time for putting 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 amended to

legitimize floating rates and let each country choose the exchange-rate regime best suited to its needs. But new ideas also influenced that outcome.

Monetarist views about the macroeconomy suggested a seductively simple way to model exchange-rate behavior and compare the merits of floating and pegged rates. As the nominal 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. Those new views about monetary policy also reinforced the case for central-bank independence.

Three exchange-rate regimes had emerged by the mid-1980s: floating rates connecting the dollar, deutsche mark, and yen; the increasingly rigid exchange rates of the European Monetary System (EMS); and a variety of exchange-rate arrangements in the developing world, ranging from *de jure* or *de facto* pegging to full flexibility, but with a discernable drift toward more flexibility. This mixed system, however, was soon to be threatened by the liberalization of international capital movements. The threat was seen clearly in Europe, where the Single European Act required the rapid abolition of capital controls, exposing the EMS to speculative pressures. Europe was thus made to choose between floating exchange rates and a full-fledged monetary union, and it chose to move to monetary union. Before it got there, however, the EMS was beset by virulent currency crises. In 1992, speculative attacks on the lire and 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 currency crises in emerging-market countries that had also liberalized their capital-account regimes—the Mexican crisis of 1994-95 and Asian crisis of 1997-98. By 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 cannot treat the nominal exchange rate as a policy instrument—a price to be pegged today but changed tomorrow—because it cannot be pegged today if there is reason to think it may be changed tomorrow. Exchange rate cannot be fixed immutably, however, unless the commitment to fix them is “institutionalized” by, say, legislation. And even that may not suffice, because countries can change their own laws. Immutable fixing may require the obliteration of the nominal exchange rate—*de jure* dollarization or a monetary union.

In brief, the familiar continuum of exchange-rate regimes has been replaced by a stark 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 member country to adopt a particular exchange-rate regime or abandon its national currency by unilateral dollarization or participation in a monetary union. But 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, 2000) 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 and for every situation. Unfortunately, the institutionalization of fixed exchange rates is often recommended without close attention to the basic economic issues. The growing interest of emerging-market countries in immutably fixed rates reflects their concern about vulnerability to future currency crises and their revealed preference for exchange-rate stability, what Calvo and Reinhart (2000) describe as “fear of floating.” Little is heard about the issues raised by the theory of optimum currency areas (hereafter, OCA theory) or the issues emphasized in this paper—those that arise from the nature of the monetary-policy domain.

What Lies Ahead

This paper will not compare the merits of floating and fixed exchange rates. It will focus on the narrower choice between unilateral dollarization and a monetary union. The first part of the paper sets out the core of OCA theory, following Mundell (1961), shows how it reflects assumptions and concerns that dominated macroeconomic theory in the 1950s and 1960s, and traces the subsequent evolution of OCA theory. The next part of the paper examines the way in which OCA theory was used to evaluate the benefits and costs of European monetary union (EMU). The third part turns to the role of the monetary-policy domain and demonstrates its relevance by contrasting the effects of monetary policies under unilateral dollarization and a monetary union. The remaining parts of the paper turn to fiscal policy. They begin by reviewing the European debate on the need to insulate EMU from the profligate practices of national governments, but they focus thereafter on another question: Are there important complementarities between a monetary union and a fiscal federation? The paper concludes with brief comments on the benefits and costs of a currency board or unilateral dollarization, compared to those of a monetary union.

The Theory of Optimum Currency Areas

To understand OCA theory, we must go back to its birth. It was a by-product of Keynesian macroeconomics, which assumed that wages and prices are sticky and that international capital mobility

is too low to influence the functioning of domestic policies. Under these assumptions, the nominal exchange rate determines the real exchange rate, which determines the current-account balance. Therefore, the nominal rate can be used to maintain *external balance* (i.e., the desired state of the current-account balance), while monetary and fiscal policies are used to maintain *internal balance* (i.e., 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 an exchange-rate change is thus the optimal response to an expenditure-switching shock, whereas monetary and fiscal policies are expenditure-changing instruments, and a change in one of them is the optimal response to an expenditure-changing shock.

This is a simplified summary of the story told by the open-economy version of the basic Keynesian model, but it captures the main features, and it can be used to make important points about the functioning of monetary unions. It is, indeed, the framework used by Mundell in his seminal paper on OCA theory, which had an extraordinary influence on the subsequent development of that theory. 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:

$$Y_i = (1 - s_i - \tau)Y_i + E_i + X_i - M_i, \quad i = 1, 2$$

where s_i is country i ’s marginal propensity to save and τ is its income-tax rate. Note that taxes affect spending, not saving, and that τ is not subscripted, because the tax rate 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 represents 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 $D = (s_1 + m_1 + \hat{\delta})(s_2 + m_2 + \hat{\delta}) - m_1 m_2$, and $u = z_2 - z_1$.

Note that eqs. (1) contain both types of shocks mentioned above, and they are *asymmetric*. The terms e_1 and e_2 are expenditure-changing shocks. They are asymmetric in origin and their effects on the two countries' incomes; when $s_i + m_i > m_j$, which is assumed hereafter, an expenditure-changing shock originating in country I 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 I 's residents ($z_{12} \dots 0$) or country 2's residents ($z_{21} \dots 0$). Its effects on the countries' incomes, however, do not depend on its origin, and they are *not* same-signed (nor will they be equal in absolutely 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 supply of money. With sticky prices, however, and no capital mobility, it is manifest as a change in real expenditure.

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

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

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

Consider an increase of expenditure in country I ($e_1 > 0$). It will raise both countries' incomes, and country I 's current-account balance will deteriorate. These will be "bad things" when both countries enjoy internal and external balance initially. But they can regain that blissful state if country I adopts an expenditure-reducing policy. Furthermore, all other policy responses are second-best from one standpoint or another. If, for instance, country I fails to respond appropriately, country 2 can adopt an expenditure-reducing policy for internal balance, but it will not bring country I back to internal balance and will drive both countries further from external balance. Alternatively, either country can adopt an expenditure-switching policy for external balance by changing the exchange rate between their currencies, but that will drive country I further from internal balance.

Consider a switch in expenditure from country 2's good to country I 's good ($u > 0$). Country I 's income will rise, and it will experience inflationary pressures; country 2's income will fall, and it will experience unemployment; and country I '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 adopt expenditure-changing policies for internal balance, they will move further from external balance, and if they adopt expenditure-changing policies for external balance, they will move further from internal balance.

OCA Theory in the Keynesian Framework

Suppose, now, that countries 1 and 2 fix their exchange rate irrevocably, without adopting a single currency or replacing their national central banks with a supranational central bank. In effect, they create what Corden (1972) called a pseudo-monetary union. In the absence of capital mobility, both countries can pursue independent monetary policies, at least in the short run, and can deal as they should with expenditure-changing shocks. But they cannot use the nominal exchange rate to offset expenditure-switching shocks. And they must pay attention to the current-account balance, because they cannot count on endogenous capital flows to finance a current-account imbalance; they must use reserves or set up reserve-credit lines to mimic the financing of interbank imbalances that occurs endogenously in a full-fledged monetary union.¹

This, then, is the problem considered by Mundell (1961): How can these countries cope with an expenditure-switching shock once they undertake to keep their exchange rate fixed? It is, indeed, the main case studied in his paper, and the peculiarities of that case had a profound influence on the evolution of OCA theory. This 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 could thus respond to these excess demands and supplies, the price of country 2's good would fall, the price of country 1's good would rise, and the change in relative prices would reverse the switch in demand, restoring equilibrium in each country's markets and ending the imbalance in their 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 there is another way to clear their labor markets—a movement of workers from country 2 to country 1. And that movement would also redress the imbalance in the countries' trade. Workers who moved to country 1 would continue to consume both countries' goods. But

¹Ingram (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).

their demand for country 1's good would be domesticated, becoming part of domestic demand in country 1 and ceasing to be part of the import demand coming from country 2. Conversely, their demand for country 2's good would be internationalized, becoming part of the import demand coming from country 1, and ceasing to be part of domestic demand in country 2. Therefore, perfect labor mobility can automatically resolve the intractable problem posed by an expenditure-switching shock, and the domain of labor mobility becomes the defining characteristic of an optimum currency area. It can contain many countries but only one unified labor market.

Note that Mundell's story has three special features:

(1) Because the model with which he worked allows each member of a currency union to pursue an independent monetary policy, 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 adopting independent monetary policies, those shocks become important.

(2) Because Mundell dealt with a two-country union, the expenditure-switching shock that he studied evinces a unique *mirror-image* asymmetry; it raises output in one country and reduces output in the other. That would not be true of an expenditure-switching shock involving a member of the union and a third, outside country.²

(3) Because of this 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 unified system. When $s_1 = s_2$ in eqs. (1), the increase in tax revenue collected in country 1 when $u > 0$ exactly equals the decrease in tax revenue collected in country 2, and the former offsets the latter in a unified fiscal system.³

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." If we applied it strictly, we would have to treat every pocket of unemployment due to imperfect labor mobility as an optimum currency area. It is

²Faced with such a shock, a currency union can change its external exchange rate, but that will affect output elsewhere in the union. This complication led Méliitz (1995) to suggest that the optimality of a currency union is diminished to the extent that its members are differently involved with the outside world, and a similar point is made by Maloney and Macmillen (1999). It can be shown, however, that an expenditure-switching shock coming from outside a currency union closely resembles an expenditure-changing shock originating inside the union—the e_1 in this paper. The appendix to Kenen (2000) sets out a three-country model in which an omnibus variable contains expenditure-switching shocks coming from outside a currency union as well as expenditure-changing shocks arising inside the union. It thus shows that the effects of the foreign shocks on each member of the union can be offset fully by expenditure-changing policies.

³I made this point in my papers on OCA theory (Kenen, 1967, 1969) but did not realize that the self-balancing fiscal outcome reflected the special nature of the shock Mundell had analyzed.

therefore necessary to weigh the macroeconomic benefit of having a great many currency areas, even sub-national areas, against the efficiency cost of reducing the domain of each currency and thus reducing its usefulness as a unit of account and medium of exchange. From a microeconomic perspective, indeed, “the optimum currency area is the world,” although it may comprise many separate labor markets.⁴

Completing the Core of OCA Theory

Two other papers are often cited along with Mundell’s as being early building blocks of OCA theory. Both were concerned with the implications of country size and structure.

McKinnon (1963) argued that a small open economy cannot use the nominal exchange rate to neutralize expenditure-switching shocks. A devaluation of a small country’s currency is bound to raise its domestic price level, which will have two consequences. First, it will reduce real wages, generating pressures to raise nominal wages; those pressures, in turn, will vitiate the effect of the devaluation on the real exchange rate. Second, it will reduce the usefulness of the domestic currency as unit of account and store of value. Accordingly, a small open economy, by itself, cannot be an optimum currency area. In McKinnon’s own terms, an optimum currency area must be big enough to have a large body of nontradable goods, the prices of which are defined in domestic currency and serve therefore to stabilize its purchasing power for the inhabitants of the area.

Kenen (1969) dealt with several issues, including connections between the fiscal domain and currency domain. If the fiscal domain were larger, complex questions would arise. How would taxes be collected if a single fiscal system spanned a number of currency areas, each of them entitled to alter its exchange rate? Which currency would the government use to buy goods and services? Goodhart (1995) suggests that the problems posed by having more than one currency within a single fiscal domain may explain why we rarely ask whether the regions of a single country 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 help to maintain internal balance and thus compensate in part for the macroeconomic disadvantage of having a currency area that spans many labor markets—one that is not 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

⁴Cohen (1997) stresses the same point, but Dowd and Greenaway (1993) offer an interesting qualification. In their model, network benefits and economic welfare increase with the domain of a currency, but a world currency may not develop endogenously and may not raise welfare, because of regime-switching costs.

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.

Credit or blame for making 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 I can find no mention of it prior to my own.

My paper is often cited, however, for stressing the relevance of diversification for OCA theory. First, a diversified economy will not have to undergo large changes in its real exchange rate. Each of its export goods may be subject to exogenous shocks, reflecting changes in foreign demand or changes in technology, but the law of large numbers will come into play if it exports many goods and the shocks are independent. Second, diversification reduces the change in the real exchange rate needed for adjustment to a single shock. In a completely specialized economy, workers who lose their jobs due to a fall in exports have nowhere to go, and the depreciation of the real exchange rate must offset the whole fall in demand. In a two-product economy, with an export good and an import-competing good, the depreciation of the real rate will also stimulate the demand for its import-competing good and can therefore be smaller.

I did *not* say that the degree of diversification should be the only OCA criterion; in fact, my paper set out to provide an “eclectic” approach to OCA theory. Yet Frankel and Rose (1998) appear to believe that I viewed diversification as the only appropriate OCA criterion, and they go on to argue that this criterion crumbles:

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 their 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. Hence, it is apt 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, it undermines the validity of the second half. If a particular entity is too small and specialized to be an optimum currency area, chopping it up into smaller entities will make matters worse, as well as reduce the usefulness of those new entities' currencies.

OCA Theory and EMU

Although there was a flurry of interest in European monetary integration after the Werner Report (Council, 1970), there were few contributions to OCA theory in the 1970s. Tower and Willett (1976), who surveyed and synthesized OCA theory by stressing the influence of economic openness on the benefits and costs of currency unification, cited more than 160 papers, but only a quarter of them had titles mentioning currency areas or monetary integration. Of those that did, moreover, several have been cited here and several more appeared in a single conference volume (Johnson and Swoboda, eds., 1973).

Interest in OCA theory did not revive until the Delors Report (Commission, 1989), but most of the new work thereafter tried to apply empirically the analytic framework provided by Mundell and others in the 1960s. There was a rush to measurement—to ask whether Europe constitutes an optimum currency area—rather than an effort to update the OCA framework by taking account of innovations in open-economy macroeconomics.⁵

This empirical work on EMU dealt with four issues. One body of work 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 so as to ascertain the extent to which they are subject to symmetric or asymmetric shocks. Another body of work tackled the same question by examining the degree of diversification in each European country or decomposing output shocks into place-specific and industry-specific shocks.⁶ A third body of work examined the role of labor mobility in international and interregional adjustment. And there is a growing literature on the ways which a monetary union might itself affect the size and nature of shocks, the extent of intra-European labor mobility, and so on. This is not the place to review all that work. But it is worth drawing attention to the conceptual problems involved and to unanswered questions.

The Characteristics of Shocks

⁵There was some new analytic work, including a paper by Canzoneri and Rogers (1990), which warned that a monetary union could interfere with the optimal use of seigniorage for tax smoothing, and the papers by Dowd and Greenaway (1993) and Mahoney and Macmillen (1999), cited above. By and large, however, there was a oddly uncritical acceptance of the original OCA framework.

⁶Unless otherwise indicated, I will refer to “place-specific” shocks when describing comparisons between region-specific shocks in the United States and country-specific shocks in Europe.

Early work on the measurement of shocks looked at the cross-country co-variation of changes in real output or real exchange rates.⁷ But these are endogenous variables, and their cross-country co-variation depends on the co-variation of the truly exogenous shocks, the endogenous and policy-induced responses to them, and the “thickness” of the various channels through which they travel from country to country. (These include both real channels, whose thickness depends in part on trade integration, and monetary channels, whose thickness depends in part on the exchange-rate regime itself.) This methodology, moreover, cannot distinguish expenditure-changing shocks, which may be asymmetric in origin and impact but can be offset by expenditure-changing policies, from expenditure-switching and productivity shocks, which can be offset only by altering real exchange rates or moving factors of production from one country to another.

Bayoumi and Eichengreen (1993) tried to deal with 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 output effects, and “demand” shocks, which do not. This distinction does not correspond fully to the distinction between expenditure-changing shocks and expenditure-switching shocks, although they are not orthogonal.⁸ But the differences between supply shocks and demand shocks, in size and cross-country co-variation, is less striking than the difference between shocks affecting European countries and those affecting U.S. regions. Supply shocks are somewhat larger for European countries, and demand shocks are smaller for European countries. Yet the cross-country correlations for both types of shocks are smaller for European countries than the cross-regional correlations for U.S. regions, which suggests that European countries are further from being an optimum currency area.

The earliest work on domestic diversification was done by Bini Smaghi and Vori (1992) and Krugman (1993), who found that European countries are less specialized than U.S. 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 test the explanatory power of OCA theory—the degree to which countries’ actual exchange-rate regimes match the predictions of theory. They found that the country characteristics featured in OCA theory have significant effects on actual exchange rate behavior. They also found, however, that exchange-rate policies are influenced less heavily by the

⁷See Cohen and Wyplosz (1989), Weber (1991), and De Grauwe and Vanhaverbeke (1993). For a thorough survey and critique of this and subsequent literature, see Bayoumi and Eichengreen (1999). See also Kletzer (1997), who notes that some apparently exogenous shocks may be artifacts of the exchange-rate regime—that asset-market shocks impinge directly on goods markets under flexible exchange rates.

⁸Nevertheless, the extraction shocks from single-country vector autoregression equations cannot distinguish clearly between domestic and foreign shocks. The thicker the channels of transmission, then, the larger the risk that asymmetric shocks will be misclassified as common shocks.

dissimilarity of exports—their proxy for vulnerability to industry-specific shocks—than by the variability of output, economic openness, or economic size.

Various methods have been used to decompose output fluctuations into aggregate shocks, industry-specific shocks, and place-specific shocks, but the results are not very sensitive to the methods used. Examining fluctuations in U.S. output growth, Bayoumi and Prasad (1995) found that country-wide shocks account for a slightly larger share than industry-specific shocks, while place-specific shocks are somewhat less important. Turning to Europe, they found the same ordering. In both cases, indeed, industry-specific shocks accounted for about a 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 OECD countries, using another methodology, Funke, Hall, and Ruhwedel (1999) found that country-specific shocks have been more important in explaining output changes than international shocks or industry-specific shocks (which have been about equally important). They also found, however, that international shocks have grown in importance relative to country-specific shocks. Hence, my earlier work on OCA theory may have attached too much importance to output diversification.

The Role of Labor Mobility

Research on the size and nature of shocks has identified significant differences between European countries and U.S. regions. But those differences, by themselves, are not big enough to raise grave doubts about the long-run viability of EMU. That view is reinforced by the results just cited, that industry-specific shocks do not account for much of the variability in total output. There is much more reason to worry about the lack of labor mobility in Europe.

In their well-known study of regional adjustment in the United States, Blanchard and Katz (1992) found that interregional labor mobility plays a crucial role:

A negative shock to employment leads initially to an increase in unemployment and a small decline in participation. Over time, the effect on employment increases, 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 (Blanchard and Katz, 1992, p. 3).

Turning to the roles of wages and prices, they found 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 not enough to offset fully the initial shock. Furthermore, consumption wages do not fall 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 impossible to know what would happen if labor were less mobile in the United States—whether there would be longer-lasting increases in unemployment or 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.⁹ We also know that labor is far less mobile between European countries than between U.S. regions.

On the Endogeneity of Optimality

When Krugman (1993) pointed out that European countries are less intensively specialized than U.S. regions, he also noted that the joint effects of the single European market and monetary union might lead more specialization, increasing the vulnerability of European countries to industry-specific shocks.¹⁰ Thus far, empirical evidence supports his supposition. Here are the main findings of recent work on trends in the location of European industry from 1970-73 to 1994-97:

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.

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).

⁹On labor mobility, see Eichengreen (1993), who shows that wages and unemployment have larger effects on labor movements in the United States than in Britain or Italy. On the persistence of labor-market shocks, see Obstfeld and Peri (1998), who also provide a critique of other studies, including one by Décessin and Fatás (1995), who applied the Blanchard-Katz methodology to European countries, found that labor-market shocks are not more persistent in Europe, and concluded that labor mobility plays a significant role in Europe.

¹⁰See 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 e.g., 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 harm car producers and benefit aircraft producers. With that sort of switch in mind, it makes sense to ask whether monetary union will induce a country to specialize in cars or aircraft. But a switch in demand from passenger cars to sport utility vehicles will not harm car producers that make all sorts of vehicles. This second example, however, raises another question: How rapidly can a firm or plant switch between individual products? Substitutability in production may be more helpful than labor mobility or wage flexibility in achieving low-cost adjustment to various shocks, including the entry of new competitors and the advent of new technologies.

This study also found interesting changes in the location of individual industries. Some that were spatially dispersed initially are now 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 stayed that way, but 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 may not be too worrisome. Studies summarized above suggest that industry-specific shocks have not been the main cause of output fluctuations. 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 really endogenous.

Working with data for 21 industrial countries, Frankel and Rose found that the degree of economic integration, measured by the size of the trade links between pairs of countries, is strongly associated with the size of time-series correlation between their output fluctuations. 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. For the purpose at hand, however, openness must be deemed to represent the extent of integration—the exogenous variable that is driving something else. And the “something else” at issue, the correlation between output fluctuations, must be deemed to represent the endogeneity of the OCA criterion. I noted earlier, however, that the correlation between output levels depends on the sizes and characteristics of the exogenous shocks, the endogenous responses to them, and the thickness of the channels through which they travel. Frankel and Rose are aware of these complications and refer repeatedly to the importance of the transmission process. Nevertheless, they interpret their results to mean that the underlying shocks are becoming more symmetric under the influence of closer integration—that countries which opt for closer integration become better candidates for close integration, and this is questionable.¹¹

Unanswered Questions

Although Frankel and Rose are too quick to conclude that closer integration reduces the cost of integration by reducing the dissimilarity between the countries involved, 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.

¹¹In Kenen (2000), I show why their results must be interpreted cautiously. Using a model similar to the one represented by eqs. (1) above, I show that the correlation between two countries’ output levels increases unambiguously with the thickness of the channels linking their economies (and this relationship is reinforced when the thickening occurs at the expense of trade with the outside world). But I also show that the correlation between the countries’ output levels is not always raised by reducing the sizes of the asymmetric shocks affecting their economies; the outcome depends on the particular characteristics of the shocks at issue.

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 ones. Yet several recent papers have shown that national borders matter, even for members of free-trade areas. More generally, international markets appear to be less tightly integrated than domestic markets. Using a 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 U.S. 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 than price differences between Canadian and U.S. 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 studies have shown that private capital flows between sub-national regions countries play a significant role in smoothing the regions' incomes, whereas capital flows between countries play a less important role in smoothing the countries' incomes.¹²

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 interregional and international outcomes, whether they pertain to goods or assets, reflect the presence or absence of many institutional arrangements. Rose (2000) has tried to isolate the influence of monetary unions and finds that they are very important. Pairs of countries having the same currency trade three times as much as pairs of countries having different currencies. But most of the countries involved in those unions are very small.¹³

We may know more soon, once Europe has adjusted to the euro, but we will not be able to measure precisely the contribution of EMU to the significant structural changes that are occurring in Europe. Nor will we ever know what would have happened if EMU had not happened—whether the EMS could have survived in one form or another to maintain a modicum of exchange-rate stability or whether, as Eichengreen (1996) and Goodhart (1995) suggest, trade tensions resulting from exchange-rate changes would have halted or reversed Europe's progress toward a single market.

The Domain of Monetary Policy

¹²See, e.g., Sørensen and Yosha (1998) and Helliwell and McKittrick (1998). See also Kalemli-Ozcan, Sørensen, and Yosha (1999), who found that regions and countries that engage in substantial risk sharing tend to be more specialized and that causation runs from risk sharing to specialization. Because the ability to engage in risk sharing *via* portfolio diversification depends on the extent of capital mobility, these authors suggest that a monetary union will intensify specialization by raising capital mobility and portfolio diversification.

¹³It should be noted, however, that this currency-union effect survives even when Rose omits the smallest countries, pairs of countries with unusually large differences in incomes or incomes per capita, and pairs whose bilateral trade is unusually large relative to their total trade.

Most of the early contributions to OCA theory dealt with *currency* unions, not 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 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).¹⁴ 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 in which exogenous shocks impinge on individual members of a currency union? We can answer this question by looking at three policy regimes:

Under the first regime, capital mobility is low, and each member of a two-country currency union can conduct an independent monetary policy. This is the regime studied by Mundell.

Under the second regime, capital mobility is too high for that, and there can be no more than one monetary policy in the currency union. But one country's central bank makes all of the monetary-policy decisions and has a *national* policy domain. It seeks to stabilize its own country's output. This leader-follower regime is a stylized representation of unilateral dollarization (and of the EMS under German leadership).

Under the third regime, capital mobility is also high, but a new institution replaces the members' central banks and has 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.¹⁵

A Currency Union with Low Capital Mobility

To represent monetary policies explicitly, rewrite eqs. (1), above, dividing each e_i into a truly

¹⁴See, however, Bofinger (1994), who argued that EMU might benefit all its members, not merely high-inflation countries, as transferring responsibility to the ECB could reduce the influence of politicians on the making of monetary policy. See also the discussions of policy domains in Kenen (1995, 1998).

¹⁵In the simple Keynesian framework adopted again in this section, stabilizing output is a proxy for maintaining price stability; recall the assumption made earlier that pursuing *internal balance* involves stabilizing output at a level compatible with price stability. The issue raised by Corden (1972) and others, whether the members of a monetary union might have different Phillips curves or policy preferences, does not arise here, although it is still germane to the conduct of monetary policy in a monetary union. (It lurks in a question often asked about EMU—whether a single monetary policy can “fit” of its members.) In what follows, moreover, we ignore the current-account balance between the members of the union. Under low capital mobility, this amounts to assuming that they have reserves or reserve-credit lines with which to finance current-account imbalances. Under high capital mobility, it amounts to assuming that endogenous capital movements and interbank settlements finance those imbalances.

exogenous component, e_1' , and a policy-dependent component, e_1^* , representing 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 before, 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 response is a tightening of monetary policy by country 2's central bank sufficient to stabilize country 2's income. We obtain the requisite policy change from eqs. (3) by setting $y_2 = 0$, solving for e_2^* , and using that value of e_2^* to obtain the resulting change in country 1's income:

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

which is, of course, smaller than the change in country 1's income without any policy change whatsoever. An analogous ranking 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.

Currency Unions with High Capital Mobility

Under both high-mobility regimes, there can be only one monetary policy, and we represent it by a single monetary-policy variable, e^* . In effect, we assume that an interest-rate change has the same expenditure-changing effect in both members of the union. (This is, of course, a strong assumption, requiring, *inter alia*, that the interest-sensitive components of the E_i be about equal in size and interest sensitivity. Returning to eqs. (3) and replacing e_1^* and e_2^* with e^* , we obtain:

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

Here and hereafter, we use y_1' to denote the income changes that occur when $e^* = 0$ (i.e., without any policy change), y_1^S to denote the changes that occur when e^* is set to stabilize country 2's income, and y_1^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, we set $y_2 = 0$, solve country 2's income equation for the value of e^* imposed by country 2, and use that value of e^* to obtain the resulting change in country 1's income:

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

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 income. 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 income. Instead, it causes country 1's income to fall ($y_1' > 0 > y_1^S$).¹⁶

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 country 1's standpoint. 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

¹⁶Note 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. (Note further that this result differs from the one obtained in the low-mobility case, where the stabilization of country 2's income served also to stabilize country 1's income. The reason resides in a difference between the domain of the policy *target* of country 2's central bank and the effective domain of its *instrument*. In the high-mobility case, country 1's interest rate changes whenever country 2's interest rate changes. Hence, a change in country 2's interest rate affects expenditure in country 1 as well as country 2. That did not happen in the low-mobility case. Note finally that country 2's central bank acts as a Stackelberg leader. When setting its own interest rate to stabilize its own country's income, it takes account of the resulting change in country 1's expenditure and the impact on country 2's income.)

inflation.¹⁷ 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 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.

To represent the supranational regime, we use eqs. (5) to obtain the sum of y_1 and y_2 , set that sum equal to zero, solve for the value of e^* resulting from the requisite change in union-wide monetary policy, and use that value of e^* to obtain the changes in the two countries' incomes:

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

where $H^U = s_1 + s_2 + 2(m_1 + m_2) + 2\hat{\alpha}$. Therefore:

An expenditure-raising shock in country 1 calls for a tightening of union-wide monetary policy to stabilize union-wide income, but not by enough to stabilize country 1'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 case, however, there is not enough tightening to stabilize country 2's income but too much to stabilize country 1's income ($y_2' > y_2^U > 0$, and $y_1' > 0 > y_1^U$).

As always, a switch in expenditure to country 1's good drives the two countries' incomes in opposite directions, and not much can be done about it. The sign of the requisite change in union-wide monetary policy 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, as the effect of the shock on country 1'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 shock raises country 1's income by more than it reduces country 2's income, so monetary policy must be tightened to stabilize union-wide ($e^* < 0$, so that $y_1' > y_1^U > 0$ and $y_2' < y_2^U < 0$). When $s_1 < s_2$, of course, the ordering of outcomes is reversed.

As the supranational regime does not stabilize either country's income completely, it is inferior to a leader-follower regime from country 2's standpoint. But it is better than a leader-follower regime from country 1's standpoint. The signs of the changes in country 1's income are the same as they were under the leader-follower regime, but all of the changes are smaller absolutely.¹⁸ Furthermore, the supranational regime has

¹⁷Gros and Thygesen (1998) survey the relevant literature.

¹⁸With an expenditure-raising shock in country 1, $y_1' > y_1^S > y_1^U > 0$. With an expenditure-raising

an attractive property. Although it does not stabilize either country's income in the face of an expenditure-changing or expenditure-switching shock, it imparts to the income effects of *all* shocks the mirror-image feature characteristic of an expenditure-switching shock. (In fact, it perfects that feature by equalizing fully the absolute sizes of the income changes caused by an expenditure-switching shock, even when s_1 and s_2 are not equal.) This attribute of a supranational union has important implications for fiscal arrangements and policies. It strengthens the case for installing a union-wide system of built-in stabilizers. As the income changes given by eq. (7) always sum to zero, the corresponding changes in income-tax collections will also sum to zero, and a union-wide system of built-in stabilizers cannot affect the stock of debt.

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 raise the need to constrain or coordinate national fiscal policies? Does it require a centralized, union-wide system of built-in fiscal stabilizers? The first question spawned a large body of theoretical work and a great deal of empirical work on the fiscal policies of U.S. states and of sub-national entities in other countries. The second question spawned empirical work on the extent to which national fiscal systems having built-in stabilizers reduce fluctuations in output or income in individual regions.

The Need to Constrain or Coordinate National Policies

The Delors Report (Commission, 1989) 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 policy coordination. It focused mainly on the need to limit budget deficits, and the provisions of the treaty were then reinforced by the Stability and Growth Pact.

Two sets of arguments are made for these constraints.¹⁹ One set derives from the supposition that governments will always borrow too much if they are not constrained but that the effects are different and more damaging in a monetary union. The other set predicts that 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

shock in country 2, $y_1' > 0 > y_1^U > y_2^S$. With a switch in expenditure to country 1's good, $y_1^S > y_1^U$, but 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 .

¹⁹For a more thorough treatment along similar lines, see Buiter, Corsetti, and Roubini (1993).

easy enough to *define* a government's long-run solvency constraint; 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 the government will raise taxes or cut spending to reduce its deficit and thus keep its debt under control. If they do not trust it to do that, 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 start to act in ways that force it to default or start immediately to generate inflation.²⁰ In a monetary union, however, some of the costs will be shifted to the other members. 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 obliged to intervene—to put financial stability ahead of price stability. Alternatively, political pressures may force it to generate inflation, even though national 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.²¹ 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 exclusively 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 offsetting adjustments in their budgets.²²

There are several ways in which a monetary union might 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 to borrow more than they would if they internalized fully the effects of their own fiscal policies. Each government will readily recognize the effect of its policies on the default-risk premium it faces but may not readily recognize its responsibility for the union-wide increase in the inflation-risk premium. The constraints imposed by the Maastricht Treaty and the Stability Pact may therefore be viewed as ways to internalize the consequences of removing from national

²⁰See Canzoneri and Diba (1999) for a formulation using the fiscal theory of price determination.

²¹See Goldstein and Woglom (1992) for evidence that deficits and debt affect default-risk premia.

²²But Eichengreen and Wyplosz (1998) find that these effects are small. Using Granger causality tests, they show that world interest rates affect European interest rates, including German rates. But when they control for world interest rates, they find that innovations to German interest rates do not affect other European rates and that innovations in other European rates do not affect German rates. But their data pertain to the pre-EMU period, and the effects at issue here are those of EMU itself.

governments the responsibility for monetary policy but leaving them with the responsibility for fiscal policy. Goodhard (1995) points out, moreover, that a monetary union may raise factor mobility, especially capital mobility, making it harder for national governments to impose the taxes necessary to avoid large budget deficits.²³

The Need for a Centralized System of Built-in Stabilizers

Under the Maastricht Treaty, a government having a budget deficit larger than 3 percent of GDP or a public debt larger than 60 percent of GDP can be found to have an excessive deficit. If it does not act to rectify the situation, various sanctions can be imposed. Furthermore, a country with an excessive deficit was at risk of being barred from entering the monetary union.²⁴

In 1991, when the treaty was drafted, six E.U. countries had deficits larger than 3 percent of GDP, and four of those had deficits more than twice that size. Five years later, seven E.U. countries had deficits larger than 3 percent, including three of the four biggest countries. By 1998, when a decision had to be made about each country's eligibility for EMU, most of those countries had cut back their deficits to the permissible level, but there were serious concerns about the future. Some countries had used creative accounting or one-time measures to bring down their deficits, and some were at risk of running larger deficits over the long run because of unfunded pension liabilities.

For these and other reasons, the E.U. countries adopted the Stability and Growth Pact to tighten the fiscal provisions of the treaty. They quantified the various exceptions and qualifications contained in the treaty, streamlined the process for deciding whether a country has an excessive budget deficit, and agreed in principle that they would continue to reduce their deficits. If they could balance their budgets on average, they could run afford to run larger deficits during recessions without violating the fiscal constraints and could give free rein to the automatic stabilizers built in to their own fiscal systems.²⁵

²³Eichengreen and von Hagen (1996) find that fiscal constraints on sub-national governments are more common when the governments have little control over their own revenues. In Europe, however, a government is free to raise taxes when facing a debt problem.

²⁴The debt criterion was seen initially as a formidable obstacle to Italian entry. But Belgium had a huge debt, too, relative to GDP, with the result that the debt criterion received diminishing emphasis in the debate about eligibility, and debt levels receive no attention at all in the Stability Pact.

²⁵For retrospective analyses of European experience, identifying instances in which the Stability Pact might have forced some governments to short-circuit their built-in stabilizers, see, e.g., Buti, Franco, and Ongena (1997), who found that several European countries were at risk of violating the Stability Pact during deep recessions, even when they started with sound fiscal positions. But Sørensen, Wu, and Yosha (1999) found that U.S. states, including states with strict balanced-budget rules, contribute significantly to income stabilization; they accumulate cash in prosperous years and run them down during recessions. The

It is, of course, important to have a way of stabilizing national economies in a monetary union if the members are exposed to large asymmetric shocks. That is why the MacDougall Report (Commission, 1977) proposed a system of union-wide built-in fiscal stabilizers to transfer funds automatically from prosperous countries or regions to less fortunate countries or regions—those that are the victims of adverse asymmetric shocks. Such transfers might be made between governments; alternatively, they might be made between households or firms, which would pay higher taxes when they prospered and would get smaller transfer payments from the central government.²⁶

Many attempts have been made to measure the extent of income stabilization resulting from interregional fiscal flows. The results differ from country to country and from study to study. The first such study, by Sala-i-Martin and Sachs (1992), found that regional tax payments to the U.S. government fall by 34 cents when regional income falls by one dollar, while transfers to the region rise by 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 large number has two parts; it combines redistributive transfers from high-income to low-income regions with stabilizing transfers from regions experiencing beneficial shocks to those experiencing adverse shocks. To distinguish between the two parts, he used cross-sectional regressions to measure the redistributive transfers and time-series regressions to measure the stabilizing transfers, and he found that the latter offset no more than 10 cents of every one-dollar fall in income.

Subsequent studies followed von Hagen in trying to distinguish between the two types of transfers. They found 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.²⁷ It must be noted, moreover, that the distinction between distribution and stabilization is somewhat 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 large role in the adjustment process. The methods usually used to separate redistribution from stabilization are bound to ascribe much of the fall in the federal take to redistribution when it could equally well be ascribed to stabilization.

Some countries are committed explicitly to making redistributive transfers between sub-national governments. Canada does that extensively, and the effects show up clearly in some of the studies cited

amount of stabilization, however, varies inversely with the strictness of the balanced-budget rule.

²⁶On intergovernmental schemes for Europe, see Kenen (1995); a scheme devised by Obstfeld and Peri (1998) seeks to address the moral-hazard problem raised by Goodhart and Smith (1993).

²⁷See the survey in Goodhart and Smith (1993) and more recent papers by Bayoumi and Masson (1995) and Méltz and Zumer (1998), 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 although they use different methods.

above, where the redistributive effects of the fiscal system exceed 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 transfers, especially unemployment-insurance payments, also vary endogenously with the recipients' incomes. Regional incomes are stabilized to the extent that personal incomes are stabilized. Hence, redistribution requires social cohesion but stabilization does not.

Yet stabilization requires more centralization, which entails a larger loss of local control over both sides of the budget.²⁸ For this reason, if no other, European governments have been unwilling to contemplate the requisite centralization. Hence, those who have sought to devise built-in fiscal stabilizers for the E.U. have tended to favor single-purpose schemes, such as the centralization of unemployment insurance. For that same reason, moreover, other groups of governments that might form monetary unions will have reservations about forming fiscal unions.

There is a strong case for fiscal centralization, however, and it is especially strong when the countries involved are members of a monetary union, because a monetary union alters the debt effects of built-in fiscal stabilizers. First, it may cause less debt creation. Second, it may produce a different distribution of debt burdens and thus a different distribution of the resulting Ricardian effects on private-sector spending. This point has been stressed by Buiter and Kletzer (1997), and its relevance has been confirmed by Bayoumi and Masson (1998). Examining fiscal transfers to Canadian provinces, they show that transfers which impose province-specific debt burdens have smaller effects on consumption and thus do less to stabilize income and output than transfers which do not impose those debt burdens.

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 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, and their utility functions. But the simple Keynesian model used in this paper can still be used 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_t and u_t are too small and short-lived to have significant effects on the present 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. If it cannot borrow, however, the government can borrow for it—which is what governments do automatically when tax collections fall with a fall in income and governments borrow to cover the resulting budget deficit. In both cases, however, households must allow for the need to repay

²⁸For indirect evidence, see Fatás and Mihov (1999), who find a negative correlation between the size of government and the instability of output; it holds for both national and sub-national governments.

debt—their own or that of the government.

To represent the way that households allow for the need to repay debt, define the change in debt due to the change in income and the resulting change in the government's tax revenues:

$$g_i = -ty_i$$

Then use it to define the amount by which households in country i adjust their spending today when facing a change in their future tax payments due to a change in their government's debt:

$$q_i = dg_i = -dty_i \quad (8)$$

where $0 \neq \ddot{a} \neq 1$. Note that q_i is negative when tax payments rise today; as larger tax payments today reduce the government's debt, households' future tax payments fall, so they spend more today.

In a fiscal union, however, both countries' households must adjust their spending today when facing a change in future tax payments due to a change in the union's debt, which is defined by:

$$g_F = -t(y_1 + y_2) \quad (9)$$

We have already seen, however, that $g_F = 0$ with a supranational monetary union, because the sum of the income changes always add up to zero. Therefore, eq. (7), can be deemed to describe the effects of a monetary union in two quite different cases: the case considered earlier, with built-in fiscal stabilizers and no Ricardian debt effects, and the case considered here, with built-in fiscal stabilizers and Ricardian debt effects but no debt creation.

It is worth asking, however, how the income changes given by eq. (7) compare with those that would obtain in another case—one with a supranational monetary union and Ricardian debt effects but no fiscal union.²⁹ To do that, we have merely to return to eqs. (5), which defined the income effects of a monetary union when there were no debt effects, and take these steps: introduce the Ricardian debt effects by subtracting the q_i given by eq. (8) from the corresponding e_i' in eqs. (5); solve again for the y_i ; then set the sum of those y_i equal to zero to obtain 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 $H^{UN} = H^U - \ddot{a}\hat{\delta}$. Substituting into the modified versions of eqs. (5),

²⁹The appendix to this paper examines the functioning of a fiscal union in the absence of a monetary union after having introduced Ricardian debt effects

$$y_1^{\text{UN}} = -y_2^{\text{UN}} = \left(\frac{1}{H^{\text{UN}}}\right)(e_1' - e_2' + 2u) \quad (10)$$

But H^{UN} in eq. (10) is unambiguously smaller than H^{U} in eq. (7). Therefore, the income changes given by eq. (10), for a supranational monetary union with Ricardian debt effects, are larger absolutely than those given by eq. (7), for a comprehensive union with Ricardian debt effects but no debt creation. 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 centralizing built-in fiscal stabilizers in a monetary union.

The Institutionalization of a Fixed Exchange Rate

Much of this paper has dealt with applications of OCA theory to European monetary union, but the issues examined and framework used are also relevant to a comparative evaluation of arrangements that might be adopted by a country wanting to move from an ordinary pegged exchange rate to a firmly fixed exchange rate or to abolish the exchange rate completely by *de jure* dollarization. We start with two unilateral arrangements—a currency board and dollarization—and then compare the two together with a full-fledged monetary union.

Comparing a Currency Board with Dollarization

A country adopting a currency board retains its national currency but relinquishes the ability to pursue its own monetary policy. An ordinary central bank holds assets denominated in its own currency, as well as foreign-currency assets, and it can raise or reduce its domestic-currency assets to influence the liquidity of the banking system. A currency board does not hold domestic-currency assets; the monetary base is backed entirely by holdings of foreign-currency assets. Furthermore, a currency board must buy or sell foreign currency at a fixed exchange rate whenever someone else wants to swap foreign currency for domestic currency. Although those transactions affect the liquidity of the banking system, they are initiated by the public, not the currency board. Hence, a currency board cannot have any discretionary influence on bank liquidity. It cannot “sterilize” the money-supply effects of its foreign-currency transactions, act as lender of last resort to the banking system, or assist in the financing of a budget deficit.

Williamson (1995) draws an analogy between the case for central-bank independence and the case for a currency board; both of them insulate monetary policy from political influence. Yet the two arrangements are profoundly different. An independent central bank can formulate its own monetary policy; a currency board cannot. There are nevertheless two reasons for establishing a currency board. The first was invoked by Rodrik (1999). When a 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 freely or be firmly fixed but cannot be firmly fixed without being institutionalized.

Yet currency boards are not immortal. Like most other governmental arrangements, including central-bank independence, they are creatures of law and can be abolished by changing the law.. That is why dollarization may be the better way to institutionalize exchange-rate fixity. 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 cannot move as swiftly and may therefore be vulnerable to capital flight and financial disruption after deciding to introduce a new domestic currency. Accordingly, it is less likely to abandon its fixed-rate regime.

There is a price to be paid, however, for the more credible exchange-rate commitment conferred by *de jure* dollarization. A country that moves to a currency board retains its foreign-currency reserves and the interest income on them. A country that opts for dollarization must use its reserves to redeem its currency and forgoes the interest income it had earned before. It may even have to borrow foreign currency if its reserves are too small to redeem its domestic currency.³⁰

Comparing Unilateral Arrangements with a Monetary Union

The principal differences between unilateral arrangements and a full-fledged monetary union can be grouped under two rubrics: (1) governance and accountability, and (2) optimality and the policy domain. Let us consider those differences briefly.³¹

The Maastricht Treaty could not have been drafted if the Rome Treaty had not been adopted first. It would have been extremely hard to devise a workable plan for EMU if the institutions of the European Union were not already up and running—the Commission, the Council, and the European Parliament. It is, indeed, hard to believe that monetary union would have occurred absent the influence of the political and economic imperatives that produced the Common Market and Single European Act. Had they not been members of the EMS, moreover, European governments might have viewed monetary union as an expensive sacrifice of national autonomy.

Other groups of countries, such as the members of NAFTA or MERCOSUR, do not have decision-making bodies of this sort and would have much trouble creating them *de novo*. Would the U.S. 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?

³⁰It has been suggested that the United States compensate countries for the interest-income loss due to *de jure* dollarization; see, e.g., Hanke and Schuler (1999). Barro (1999) actually suggests that the United States print the necessary dollars and hand them over *gratis*, so that dollarizing countries can keep their reserves, earn interest on them, and use them to support their banks in a liquidity crisis.

³¹For a similar comparison, see Buitert (1999), who 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 monetary union.

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 constraints may suffice to prevent a proliferation of monetary unions in the next few years. Political prognostication is perilous, however, and it is therefore useful to compare on their merits a monetary union with arrangements that a country can adopt unilaterally in order to institutionalize a fixed exchange rate.

Advocates of currency boards and 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 forestall future currency crises. It would be silly from that standpoint to tie Ecuador's *sucre* to Brazil's *real* or to 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 the requisite debt markets. Therefore, those countries must choose between issuing foreign-currency debt or relying heavily on short-term debt—options that 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 thereby reduce vulnerability to financial and currency crises alike.

There are more reasons for using a key currency. First, currency boards and dollarization transfer to a foreign country the responsibility for monetary policy. Therefore, it makes sense to choose a foreign currency and thus a foreign country that can be expected to pursue a sensible monetary policy. Second, many emerging-market countries have already experienced *de facto* dollarization and several more countries pursue exchange-rate policies that “track” the dollar closely.³² Should they choose to introduce a currency board or opt for formal dollarization, they can perhaps minimize domestic opposition by basing the new regime on the familiar key currency.

At the start of this paper, however, I distinguished between positive and normative issues. Market forces help to explain why key currencies play important roles in the economies and economic policies of emerging-market countries. But they do not provide a basis for ranking exchange-rate regimes. That is the role of OCA theory, augmented by attention to the implications of the corresponding policy domains.

³²See Honohan and Lane (1999), who also show that some dollar trackers do not trade heavily with the United States. But most members of that subgroup trade heavily with other dollar trackers or compete with them intensively in third markets.

The two-country models commonly used in OCA theory are not 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 the countries apt to experience large asymmetric shocks and, if so, is there enough labor mobility between them—or wage flexibility within them—for the countries to relinquish the use of the nominal exchange rate to neutralize those shocks? The use of a two-country model, however, tends to focus our attention on expenditure-changing shocks arising within those countries and to expenditure-switching shocks between their goods. We are 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.

A monetary union can give its members some protection from these external shocks if its external exchange is flexible. It cannot protect them completely, however, if they have different partners or competitors in the outside world. But unilateral fixing to a single foreign currency cannot protect a country from external shocks, and is a major disadvantage of unilateral fixing, especially for countries that have several important partners or competitor. A monetary union, however, cannot protect its members from currency crises, because its external exchange rate can be attacked. A monetary union, however, may be less vulnerable than its members separately. For reasons given earlier, a monetary union must have an independent central bank, which is likely to conduct a better monetary policy than those pursued individually by its 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 those changes will not have differential effects on its members' exports—except to the extent that their exports are differentially vulnerable to exchange-rate changes *vis-a-vis* third currencies. Market forces reinforced by monetary policies and by prudent intervention might mitigate the impact of fluctuations in key-currency exchange rates.

An attack on a flexible rate, moreover, 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 its float, and it depreciates precipitously. That is what happened to the lira in 1992, when Italy left the EMS, to several Asian currencies in 1997, and to the ruble and *real* when Russia and Brazil when 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 have asymmetric monetary-policy domains. The monetary policy of the key-currency country is aimed at stabilizing its own economy or at price stability within that economy. Its central bank need not behave as a Stackelberg leader, which is how it behaved

in the model used above, but its decisions are normally based on domestic conditions.³³ 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 big and small countries 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 asymmetric. Smaller countries will be under-represented in a monetary union, no matter how many votes they have in the decision-making bodies of central bank. But under-representation is better than none.

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 unilateral links to key currencies. They might not be less optimal than EMU, given the *desiderata* provided by OCA theory.³⁴

Conclusion

The coming of EMU has raised two questions: Should other groups of countries set up similar arrangements? Must those that have already formed trade blocs go on to form monetary unions in order to reap the full benefits of regional free trade? This paper has answered the first question agnostically. Other economists have answered the second decisively. Eichengreen (1998) argues persuasively that customs union and free trade areas need not form monetary unions.³⁵ 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 need to think about a related question: Is deep integration needed to form and sustain a monetary union? Whatever one's doubts about fiscal arrangements in Europe—the Stability Pact and all that—they raise an important issue. Can a monetary union function efficiently 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 E.U. 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 enters the next phase, in which domestic mergers give way to transnational mergers.

³³See Summers (1999), who 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).

³⁴For a test of this hypothesis, see Bayoumi and Eichengreen (1994).

³⁵See also Goodhart (1995). But Eichengreen (1996) and Goodhart (1995) both warn 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 subsidies to give covert protection.

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. 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.³⁶

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 small countries may be too small collectively to form a monetary union. A more promising group of middle-sized countries, even those belonging to a free trade area, may be unable to solve the problems of governance and accountability attending the formation of a monetary union. And many emerging-market countries may conclude that a flexible exchange rate would be better than the best possible way to institutionalize a firmly fixed exchange rate.

³⁶Other, less drastic steps can nevertheless be taken to safeguard domestic banks. Argentina was able to assist its crisis-stricken banks after the Mexican crisis of 1994-95; see, e.g., Caprio *et al.* (1996). Furthermore, it has set up contingent credit lines, allowing the Argentine government to borrow dollars from foreign banks, and it could presumably activate them in the event of a banking crisis.

Appendix

Effects of a Fiscal Union with No Monetary Union

To examine the effects of a fiscal union, by itself, without a monetary union, we must introduce Ricardian debt effects into the relevant income equations. Starting with eqs. (1), which define the effects of various shocks when there is no monetary-policy response and no fiscal union, and following the steps used in the text to obtain eq. (10), we introduce the Ricardian debt effects by subtracting the q_i defined by eq. (8) from the corresponding e_i , and solve again for the y_i :

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

where $D^N = D - \hat{\alpha}\hat{i}[(s_1 + m_1 + \hat{\delta}) + (s_2 + m_2 + \hat{\delta}) - \hat{\alpha}\hat{i}]$.

Before making an analogous adjustment for the effects of a fiscal union, we first must ask how households respond to a change in union-wide debt, as opposed to a change in their own country's debt. To that end, we define:

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

where \hat{a} is the share of the union's debt burden that country 1's households expect to bear and $(1 - \hat{a})$ is the share that country 2's households expect to bear. Subtracting these q_i from the e_i in eqs.(1) and solving those income equations again,

$$\begin{aligned} y_1^F &= \left(\frac{1}{D^F}\right)\{[(s_2 + m_2 + \quad) - (1-a)\mathbf{dt}]e_1 + (m_2 + \mathbf{adt})e_2 + [s_2 + (1-d)t]u\} \\ y_2^F &= \left(\frac{1}{D^F}\right)\{[m_1 + (1-a)\mathbf{dt}]e_1 + [(s_1 + m_1 + t) - \mathbf{adt}]e_2 - [s_1 + (1-d)t]u\} \end{aligned} \quad (\text{A-2})$$

where $D^F = D^N + \hat{\alpha}\hat{\delta}[\hat{a}s_1 + (1 - \hat{a})s_2 + (1 - \hat{a})\hat{\delta}]$.

We can now identify the effects of a fiscal union the income changes given by eqs. (A-2), where the fiscal union services all debt, from the changes given by eqs. (A-1), where each national government services its debt.

With an increase of expenditure in country 1, the outcome depends on the expected distribution of the debt burden. A fiscal union reduces the increase in country 1's income ($y_1^F < y_1^N$) and raises the

increase in country 2's income ($y_2^F > y_2^N$) whenever

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

Analogous results obtain for an increase of expenditure in country 2, and these outcomes, taken together, can be put this way: When, with a fiscal union, households expect the debt burden to be distributed more uniformly than the income effects of the shock producing the debt itself, the union reduces the impact of the shock on the country in which it originates and raises its impact on the other country.

With a switch of expenditure to country 1's good, a fiscal union reduces the changes in both countries' incomes, and this outcome does not depend on the expected distribution of the debt burden, because debt behaves differently here. With expenditure-changing shocks, the governments' budgets moved in the same direction, and the fiscal union served merely to redistribute the expected debt burden. With an expenditure-switching shock, the governments' budgets move in opposite directions, and the main effect of the union is to reduce the debt burden. When, in fact, $s_1 = s_2$, the stock of debt does not change.

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