

Working Paper 99-16 / Document de travail 99-16

**Optimal Currency Areas: A Review of the Recent Literature**

by

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**Bank of Canada**



**Banque du Canada**

ISSN 1192-5434  
ISBN 0-662-28180-2

Printed in Canada on recycled paper

Bank of Canada Working Paper 99-16

October 1999

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The views expressed in this paper are those of the authors. No responsibility for them should be attributed to the Bank of Canada.



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## **Acknowledgements**

We would like to thank Chantal Dupasquier, Doug Hostland, John Murray, Patrick Osakwe, James Powell, Larry Schembri, David Tessier, Rodrigue Tremblay, and participants of the June 1999 Canadian Economics Association meeting and the June 1999 meeting of the Société canadienne de Science économique for useful comments and discussions.

## **Abstract**

This paper surveys the recent literature on optimal currency areas (OCAs). Topics that are covered include theoretical developments in the context of general-equilibrium models and empirical work on shocks asymmetry and adjustment mechanisms. Issues relating to the endogeneity of OCA criteria, the role of exchange rate flexibility in promoting greater macroeconomic stability, and the links between productivity and the exchange rate are also surveyed. We conclude with suggestions for future research.

JEL classifications: E42, F33

Bank of Canada classification: Exchange rate regimes

## **Résumé**

Les auteurs font un survol des études consacrées récemment aux zones monétaires optimales. Ils analysent l'évolution de la théorie dans un contexte d'équilibre général et passent en revue les travaux empiriques portant sur l'asymétrie des chocs et les mécanismes d'ajustement. Ils examinent également diverses questions ayant trait à l'endogénéité des critères définissant une zone monétaire optimale, le rôle des changes flottants dans la promotion de la stabilité macroéconomique et les liens entre la productivité et le taux de change. Dans la conclusion, les auteurs esquissent quelques pistes de recherche pour l'avenir.

Classification JEL: E42, F33

Classification de la Banque du Canada: Régimes de taux de change



## 1. Introduction

In the 1990s, plans for the formation of a European Economic and Monetary Union (EMU) led to renewed interest in the empirical and theoretical study of optimal currency areas (OCAs). More recently and closer to home, the growing economic integration in North America in the wake of the North American Free Trade Agreement (NAFTA), concerns about economic performance in Canada, and criticism of the conduct of monetary policies have lead some observers to question the merits of Canada's flexible exchange regime and to propose a common currency with the United States.<sup>1</sup>

To shed some light on this issue, this paper surveys new ideas that have been put forward, both to formalize the basic concepts in the traditional OCA literature and to evaluate their relative importance.<sup>2</sup> We focus on flexible exchange rates and monetary unions and do not consider intermediate regimes. Developments in the 1990s, including financial crisis in a number of emerging economies, have shown that (with the possible exception of currency boards) fixed and quasi-fixed exchange rates are unlikely to be sustainable in a world of large and volatile capital flows.<sup>3</sup> Political considerations are also left out of this paper, although they are viewed by some as fundamental to the choice of an exchange rate regime.<sup>4</sup>

Section 2 discusses recent theoretical developments based on general-equilibrium models. Section 3 reviews various empirical approaches that have been used to identify optimal currency areas and discusses the literature on the possible endogeneity of OCA criteria. Section 4 reports on an approach that examines how OCA criteria can be used to explain exchange rate movements. In Section 5, we look at the argument that greater exchange rate flexibility has not improved macroeconomic stability. The relation between the exchange rate regime and productivity is discussed in Section 6 while Section 7 contains tentative conclusions and some suggestions for future research.

## 2. Modelling the principles of optimal currency areas

Helpman (1981), Kareken and Wallace (1981), and Lucas (1982) were among the first to develop welfare-equivalence theorems for alternative exchange rate regimes in environments where asset markets are complete and money is neutral. While providing a useful benchmark, these models—and their implication that the choice of an exchange rate regime has no influence on social welfare—have little to do with the real world.

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1. Papers by Courchene (1998), Laidler (1999), and McCallum (1999), and Murray (1999), and comments by Fortin (1999) offer different perspectives on this debate.
  2. Useful earlier surveys of the OCA literature include Fenton and Murray (1993), Masson and Taylor (1993) and Bayoumi and Eichengreen (1996).
  3. See Obstfeld and Rogoff (1995) or Osakwe and Schembri (1998) for a discussion of this point.
  4. Such considerations are discussed by Laidler (1999) and Buiter (1999).

The subsequent literature can be classified according to the nature of the frictions that make the exchange rate regime relevant. Price and wage rigidities are at the heart of contributions by Bayoumi (1994), Ricci (1997b), and Beine and Docquier (1998), who propose general-equilibrium models that formalize the original insights on optimal currency areas of Mundell (1961), McKinnon (1963), and Kenen (1969). Another group of authors, including Helpman and Razin (1982) and Neumeyer (1998), focus instead on the implications of financial markets incompleteness. We consider these two approaches in turn.

## 2.1 Optimal currency areas in general-equilibrium models with price rigidities

Bayoumi (1994) presents a formal model of optimal currency areas in which the world is made up of a number of different regions, each specialized in the production of one particular good. Moreover, wages are downwardly rigid in periods of low demand. The model, however, has no explicit role for financial assets or government policy. Each region can choose to have a separate currency or to join a currency union.

The general-equilibrium model has a closed-form solution and yields a number of interesting results. The size and correlation of disturbances are important factors in choosing a currency union. Labour mobility lowers the costs associated with a currency union both inside and outside the union. The degree of openness is also important as the gains from forming a union depend on the level of demand for the products of the other candidate regions for the union. The most interesting insight is that a currency union, while it can raise the welfare of regions within the union, lowers welfare for regions outside the union. This is because the gains (lower transactions costs) accrue mainly to members, while losses (lower output due to the interaction between the common exchange rate and wage rigidity) affect everybody. Another insight is that the gains from joining a currency union for a region are greater than the benefits to the members of the union of admitting a new member since the reduction in transaction costs depends on the amount of trade that is involved. Consequently, even if a country prefers a free float, it may still have an incentive to join a currency union with other regions if it is going to be formed because the gains are larger once the union is formed.

Ricci (1997b) presents a two-country model that captures both the real and monetary arguments suggested by the traditional OCA literature in a simple trade model with nominal rigidities. The two-country, two-good Ricardian trade model incorporates non-traded goods, random preferences in goods and money, exchange rates, trade costs, and nominal rigidities. Preferences are assumed to differ in the two countries in order to investigate how the degree of openness and of symmetry of shocks affect the desirability of the currency union.<sup>5</sup> Money supply shocks generated by the authorities reflect national tolerance for inflation. However, the monetary

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5. Individuals have Cobb-Douglas preferences over money, two trade goods, and a non-trade good.

authorities are not allowed to pursue discretionary policies that would enable them to counteract money demand shocks.

The model is solved for the two cases of mobile and immobile labour. The analysis, however, is static and neglects the existence of capital. The authorities' loss function (in both countries) depends on the unemployment rate, the rate of inflation, and deadweight transaction costs measured in employment terms. The model generates an extreme version of a Phillips curve: flat below full employment and vertical once full employment has been reached. Under a currency union, the two countries adopt the same currency and the transaction costs disappear.

The net benefits from participation in a currency union increase with the following:

- the correlation of real shocks between countries;
- the degree of adjustment provided by fiscal policy instruments and by international labour mobility, as substitute adjustment mechanisms for the exchange rate;
- the difference between the inflationary bias of the domestic authority from that of the currency union (benefit of tying one's hands);
- the variability of domestic monetary shocks, as part of these shocks are transmitted to other countries within the currency union; and,
- the size of the deadweight and efficiency losses eliminated through the adoption of a single currency.

Other factors, however, will tend to diminish the net benefits of a currency union, including:

- the variability of real shocks, as these shocks generate adjustment costs in the currency union;
- the variability of foreign monetary shocks; and,
- the correlation of monetary shocks between countries, as this decreases the probability that the monetary shocks neutralize each other in a currency union.

A unique result of the model is that the effect of openness on the net benefits is ambiguous, in contrast with the usual argument (McKinnon 1963) that more open economies are better candidates for a currency union. An increase in openness increases the net benefits of eliminating transactions costs. It also implies that domestic prices can be more flexible in the presence of a foreign shocks, since they include a larger share of imported goods. Consequently, nominal exchange rates changes are less critical to the adjustment of the real exchange rate. However,

greater openness also increases the relevance of real trade shocks, which reduces the net benefits of a currency union.

Beine and Docquier (1998) introduce some dynamic considerations. Their model assumes perfect competition, downwardly sluggish wage adjustments, and a traded and non-traded good for each country. Labour is the only factor of production and can migrate between countries in response to changes in relative disposable income. There are no financial markets. Transfers from a federal entity limit the effect of asymmetric shocks on unemployment. Model dynamics come from the sluggish wage adjustments, the gradual migration of the labour force between countries, and growing shock asymmetry caused by increased market and monetary integration (as in Krugman [1993]). Estimates by Bayoumi and Eichengreen (1992) for Europe are used to calibrate the initial value of demand-and-supply shock asymmetry. The costs and benefits of a monetary union are assessed through its impact on the volatility and level of macroeconomic variables.

Even though the results are broadly consistent with those obtained by Ricci, there are differences worth noting. For instance, the cost of a monetary union can increase over time when it leads to more shock asymmetry. Also, while labour mobility between the two countries tends to reduce the volatility of per capita income, it could also increase average unemployment. This latter result comes partly from the short-run downward wage rigidities in the country affected by inward migration. However, when shocks are permanent, labour mobility clearly reduces average unemployment and facilitates adjustment towards long-run equilibrium. Another difference with Ricci is that the degree of openness of an economy increases unambiguously the desirability of monetary union. As expected, fiscal federalism is shown to reduce unemployment and income volatility in a monetary union. Beine and Docquier conclude that, in the presence of fiscal federalism (where federal spending is funded by a tax rate of 7 per cent), a union becomes desirable when transaction costs exceed 1.2 per cent of GDP. In the absence of fiscal federalism, the threshold is 1.6 percent of GDP.

The assumption that wages are only downwardly rigid has been questioned, however. Some have argued that prices and wages are also rigid on the up side. For instance, Gordon (1996) rejects the assumption that the U.S. Philips curve is asymmetric. It is also debatable whether shock asymmetry would increase in a monetary union (see in Section 3.3).

Devereux and Engel (1998) focus on pricing mechanisms to determine the choice of an exchange rate regime. They sketch a two-country, infinite-horizon model of optimization under uncertainty. Uncertainty reflects the presence of random monetary shocks at home and abroad. They assume that imperfectly competitive firms set prices prior to the realization of monetary shocks but that prices are adjusted fully after one period. Two cases are considered. First, prices are set in the producers' own currency and do not respond to exchange rate movements. Second, firms price to market to maintain their competitiveness when the exchange rate fluctuates. The authors conclude that the most appropriate exchange rate regime depends on the currency in which

prices are set. When prices are set in the producers' own currency, the results are ambiguous. The variance of domestic consumption is lower under floating exchange rates, but exchange rate volatility reduces the average level of consumption. Exchange rate volatility raises expected marginal costs facing price-setting firms, leading them to set higher average markups, which result in lower average consumption. The greater the degree of risk aversion, the more likely are fixed exchange rates to dominate. By contrast, floating exchange rates will always be preferable under pricing to market since the exchange rate does not influence optimal pricing policies.

Moran (1999) also combines monopolistic competition, pricing to market, and nominal rigidities in a calibrated dynamic general-equilibrium model. The focus of the paper is on the following question: How much is the flexibility implied by a flexible exchange rate worth? Alternative hypotheses on the rule followed by the monetary authorities are considered. Various degrees of nominal rigidities and shock symmetry between the two (large) countries in his model are also considered. Moran concludes that the welfare benefits of a flexible exchange rate regime, in terms of limiting output fluctuations, are very limited. His results appear to be driven by the type of utility function that he uses and that is in standard use in macroeconomic models (time-separable with low risk aversion). This is worth exploring further.

## **2.2 General equilibrium and the completeness of asset markets**

Financial markets are obviously not complete. For instance, it may be difficult to find good insurance against shocks affecting labour income. A number of researchers have studied the implications of incomplete financial markets. Helpman and Razin (1982), for instance, compare a floating exchange rate regime with a one-sided peg (by a small country) in a two-period general-equilibrium model. Their main finding is that, when fluctuations in the value of money reflect real economic shocks, some degree of exchange rate variability is beneficial since it increases the insurance opportunities available through trade in nominal assets. This comes from the fact that real payoffs denominated in different currencies will then differ.

Neumeyer (1998) uses a similar framework but extends the analysis to include political shocks. The timing of monetary stabilization in inflationary economies, the value at which currencies enter a fixed exchange rate regime, and exchange rate realignments are mentioned as instances of monetary policy decisions that could reflect political shocks.<sup>6</sup> The author shows that exchange rate flexibility, although it helps to allocate resources efficiently when the economy is confronted with real economic shocks, reduces the efficiency of financial markets in the presence of political shocks. The crucial point is that, with political shocks, the expected variability of nominal variables contaminates the real payoffs of nominal financial contracts, reducing their

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6. In Canada's case, political shocks might include decisions to significantly change the inflation target, the institutional arrangement between the central bank and the political authorities, or the exchange rate regime.

ability to help agents hedge against economic shocks. Currency unions can then be viewed as monetary rules that attempt to insulate monetary policy against the impact of political shocks.

Neumeyer's main conclusion is that switching from a monetary regime with national central banks to a currency union increases welfare when the gain from eliminating excess monetary volatility exceeds the cost of reducing the variety of financial instruments in the economy. Assuming that financial markets are incomplete in Europe, this implies that European Monetary Union involves a trade-off between the cost associated with the reduction in the number of financial assets that could be used to guard against economic risks and the possible benefit of having eliminated politically induced monetary shocks. However, it is not clear to us that EMU implies that its constituent economies could no longer be subject to political shocks of the type mentioned by Neumeyer.

Parallel implications can be drawn about an hypothetical Canada-U.S. monetary union. However, it should be noted that the inflation-targeting framework adopted in 1991 in Canada has likely reduced the likelihood of Neumeyer-type political shocks to monetary policy. Meanwhile, there is little reason to believe that real economic shocks have become less important.

### **3. Assessing criteria for optimal currency areas**

In the first part of this section, we review various approaches that have been used to measure the extent of asymmetries between regions' real shocks, economic cycles, monetary policy's transmission mechanisms, and economic structures. In the second part, we look at various adjustment mechanisms to shocks that could substitute, to a certain extent, for the lack of a flexible exchange rate under a monetary union. These mechanisms include the degree of labour mobility between regions of countries, the existence of fiscal transfers, and the role of credit and capital markets in smoothing the impact of region-specific shocks.

#### **3.1 Measuring asymmetry**

##### *3.1.1 Shocks and business-cycle asymmetry measured with vector autoregressions (VARs)*

Bayoumi and Eichengreen (1992; 1993; 1994) attempt to gauge the asymmetry of contemporaneous shocks with simple VAR models of inflation and output growth. Permanent and transitory shocks, which they associate with aggregate supply and demand shocks respectively, are identified using a decomposition method developed by Blanchard and Quah. The authors note that, under a fixed exchange rate system, one would not expect to find country-specific monetary shocks. Moreover, in flexible regimes, undiagnosed shocks of this nature would contaminate the identified demand shocks. In light of this problem, Bayoumi and Eichengreen focus only on the degree of supply-shock asymmetry. They examine several countries and regions and find that

supply shocks in Canada and the United States are not highly correlated. In contrast, the degree of symmetry of shocks affecting regions within the United States (a currency union that appears to function relatively well) is notably higher.

To take into account the degree of symmetry of demand shocks between Canada and the United States, Lalonde and St-Amant (1993) and DeSerres and Lalonde (1994) specify VAR models using the growth rates of output, prices, and money. Monetary shocks are purged from other demand shocks by imposing a restriction of long-term neutrality, i.e., that monetary shocks have no permanent effect on real balances. The contemporaneous correlations of supply shocks and real demand shocks indicate that both supply and demand shocks affecting the Canadian economy have little correlation with those that affect the United States. (The same holds true for Mexico.) Correlations across U.S. states and Canadian provinces are found to be higher. One problem with this approach, however, is the assumption that only monetary shocks have no long-term effect on real balances. It is by no means clear that a real demand shock (e.g., a fiscal shock) would have a permanent effect on real balances. In this sense, the role of monetary shocks could be overestimated.

Dupasquier, Lalonde, and St-Amant (1997) propose an alternative approach. In a VAR system that includes measures of real output, inflation, and interest rates, they follow Bullard and Keating (1995) and identify monetary policy shocks as shocks that alter the trend of inflation. They argue that, while many factors can have a transitory impact on inflation, only the monetary authorities can change the trend inflation rate. This identification restriction is combined with the ones proposed by Blanchard and Quah to allow for the identification of supply, monetary, and non-monetary demand shocks. Dupasquier, Lalonde, and St-Amant obtain results similar to those of the preceding studies in terms of shock asymmetry. Overall, the correlations of shocks between Canadian regions are higher than those observed between Canada and the United States.

The previous results focus on contemporaneous correlations of shocks. The analysis can be enhanced, however, by incorporating dynamics. For example, shocks affecting the U.S. economy could be transmitted to the Canadian economy after a relatively short time lag (through net exports or other mechanisms). Although the contemporaneous correlation of shocks might be relatively low, the two economies could still be in similar positions in the business cycle and not require divergent monetary policies or an exchange rate adjustment. On the other hand, while the correlation of shocks might be very high, the transmission mechanisms might be sufficiently different to justify an exchange rate adjustment. In order to take into account the dynamics of the shocks and their propagation mechanism, Mélitz and Weber (1996) and Dupasquier, Lalonde, and St-Amant (1997) examine the correlation of the structural components of output (defined as the cumulative effect of shocks plus their propagation dynamics). Mélitz and Weber find more symmetry between the French and German economies for structural components than for structural shocks. Dupasquier, Lalonde, and St-Amant find similar results for Canada and the United States. For instance, estimated correlations between Canadian and U.S. supply shocks and supply

components are, respectively, 16 per cent and 43 per cent. The estimated correlations between supply shocks and between supply components in the case of Canadian regions are presented in Table 1.

Contemporaneous shock correlations across Canadian provinces tend to be higher than between Canada and the United States. However, results based on the dynamic components are more ambiguous. This might be due to the fact that shocks affecting the United States are transmitted to Canada with a lag since Dupasquier, Lalonde, and St-Amant calculate that the correlation between U.S supply shocks lagged one period and Canadian contemporaneous shocks is relatively high at 37 per cent. This interpretation is consistent with an earlier study by Kuszczak and Murray (1987) that highlighted the role of the U.S. economy in Canadian business cycles. However, high correlations might also be due to the fact that exchange rate movements tend to smooth the impact of specific shocks affecting Canada and make this country's business cycle more like that of the United States.

**Table 1: Correlations of supply shocks and components (in bold): Canadian regions, 1972Q1–1995Q4**

Regions	Atlantic	Quebec	Ontario	Prairies	Alberta	British Columbia
Atlantic	---					
Quebec	0.64 <b>0.35</b>	---				
Ontario	0.70 <b>0.71</b>	0.78 <b>0.61</b>	----			
Prairies	0.38 <b>0.45</b>	0.36 <b>0.23</b>	0.34 <b>0.35</b>	----		
Alberta	0.43 <b>0.25</b>	0.51 <b>0.15</b>	0.43 <b>0.06</b>	0.20 <b>0.22</b>	---	
British Columbia	0.44 <b>0.37</b>	0.55 <b>0.55</b>	0.54 <b>0.32</b>	0.24 <b>0.28</b>	0.44 <b>0.34</b>	---

### *3.1.2 Differences in the transmission mechanism of monetary policy*

Barran, Coudert, and Mojon (1997) focus on differences in the transmission mechanism of monetary policy as a determinant of optimal currency areas. Their presumption is that very different transmission mechanisms among a group of countries would make it difficult for them to adopt a single currency. Transmission mechanisms can differ for a number of reasons, including the degree of financial intermediation, openness to the world economy, and competition in banking

sectors. Barran, Coudert, and Mojon show that the transmission of changes in money market interest rates to longer-term rates differs between countries in Europe. For instance, bank credit rates adjust faster in Holland and the United Kingdom but more slowly in France, Denmark, and Finland. There are also important differences in terms of interest rates indexation. In France, 95 per cent of mortgage contracts have a fixed interest rate. However, the corresponding number is around 10 per cent for the United Kingdom, Holland, and Germany. Important differences are also noted in terms of access to credit and the composition of asset portfolios.

In order to measure the aggregate impact of these differences, the authors estimate separate VAR models for a group of European countries. The basic models include real GDP, prices, the exchange rate against Germany (against the U.S. dollar in the case of Germany), a short-term interest rate, and real export prices.<sup>7</sup> Differences are found in terms of responses of prices and output to changes in monetary instruments. The authors do not indicate, however, whether these differences are statistically significant. Germany stands out as the country where the transmission mechanism takes longer and is most pronounced in terms of its impact on real output. To the extent that economic structures do not change rapidly, these results suggest that imposing a single monetary policy on Europe may be a source of asymmetry among the various economies.

There is a substantial amount of uncertainty, however, involved in the identification of monetary policy shocks. Indeed, on the basis of results obtained by Gerlach and Smets (1995), Smets (1997) argues that responses to monetary policy shocks in different countries are not statistically different from one another (this includes Canada and the United States). Smets also argues that the European Monetary Union may make these differences more tenuous in Europe.

### *3.1.3 Optimal currency areas and the volatility of real exchange rates*

A number of papers emphasize the behaviour of the real exchange rate in the determination of optimal currency areas. For instance, Poloz (1990) compares the variability of real exchange rates among four European countries and across Canadian regions. The basic idea is that the more symmetric shocks are reflected in less real exchange rates variability while asymmetric shocks have the opposite implication. This is seen as important since the more variable the real exchange rate is between two countries, the more would the adjustment fall on domestic prices and wages if they adopted a fixed exchange rate. In the presence of price rigidities, this would lead to high output and employment volatility. Poloz concludes that a European Monetary Union should be viable since the variability of real exchange rates in Europe is similar to that between Canadian regions. DeGrauwe and Heens (1993) perform a similar exercise to identify European regions that are well suited for a monetary union, identifying a core group of countries.

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7. The models are identified with simple Choleski decompositions. It is unclear whether the results are robust to the ordering of the variables.

A drawback of these studies is that they do not attempt to distinguish between real and nominal shocks. It is desirable to control for the latter since they would tend to disappear as a source of specific shocks in a monetary union. To extract real and nominal shocks affecting real exchange rates, DeSerres and Lalonde (1994) adopt a methodology proposed by Lastrapes (1992) that consists of using long-run identifying restrictions with an estimated VAR model. The variances of real shocks to real exchange rates and the propagation mechanism of these shocks are used to indicate which countries might be suited for monetary union in Europe. The authors identify a core of countries that are well suited for a monetary union.

A serious limitation of all these studies that focus on the real exchange rate is that it is not clear that real exchange rate volatility reflects the degree of shock asymmetry. Imagine, for instance, that two countries with a fixed exchange rate are affected by large asymmetric shocks, but that both are subject to sticky prices. Price stickiness may result in real exchange rates that are not very volatile despite the underlying asymmetric shocks. On the other hand, suppose that we observe high short-term volatility of the real exchange rate. This may simply reflect highly flexible prices. In such a case, high real exchange rate volatility would be an indication that these economies are well suited for a monetary union since they can adjust quickly to shocks. This is how Fortin (1991) interprets Poloz's results for Canada. Moreover, Obstfeld and Peri (1998) present empirical evidence for Europe indicating that real exchange rate volatility tends to be limited by a weak response of prices to employment shocks. Looking at the volatility of both unemployment and the real exchange rate might provide a better picture.

#### *3.1.4 Cluster analysis and principal components*

Artis and Zhang (1997) seek to identify and measure criteria that can be used to evaluate the merits of the EMU. The criteria they use are those suggested by the optimal currency area literature and their evaluation is based on a technique known as cluster analysis. The countries chosen for the study include all G-7 member countries plus Norway, Switzerland, and the other members of the European Union (except for Luxembourg). They consider five basic pieces of information: business-cycle correlations with the United States and Germany (the anchor countries); exchange rate variability; correlations of real interest rate cycles to capture the degree of conformity of monetary policy with the anchor country; and correlations between imports and exports of the countries under study with the exports and imports, respectively, of the anchor countries.

The basis of cluster analysis is a measurement of similarity or, conversely, of dissimilarity or distance between countries. The five core variables are treated as being of equal importance in defining the clusters. The substantive results are that a core group of countries for the EMU is most readily identified, consisting of Belgium, Germany, France, the Netherlands, and Austria. The cluster analysis identifies four other groups: a U.S group (United States, Canada, Sweden, and Finland), a peripheral group to the EMU (Italy, Ireland, United Kingdom, Denmark, Portugal,

Norway, Greece, Spain), with Japan and Switzerland forming two separate groups on their own. The authors note, however, that the cluster analysis could yield different conclusions with different measures of the selected criteria.

### 3.1.5 *Regional/industrial disaggregation*

Bayoumi and Prasad (1996) examine the role of two criteria of the OCA literature in comparing candidate EMU countries to the U.S. monetary union. The first is the level of industrial diversification and the relative importance of different sources of disturbances in economic fluctuations. The second is the degree of labour market integration. Parallel data sets for three variables (real output or value added, employment, and output per employee) covering eight industrial classifications<sup>8</sup> were constructed for eight standard U.S. regions and eight EU countries (not all planning to join EMU). The contributions of the region/country and industry to the changes in the three core variables are estimated using only region- and industry-specific dummy variables.

The results indicate that the relative contributions of aggregate, industry-specific, and country- or region-specific disturbances to total output growth fluctuations are roughly similar in Europe and the United States. However, a disaggregated analysis reveals many important differences. Region-specific disturbances in the United States are more important in the non-traded goods sectors, while the EU country-specific disturbances are more prevalent in the traded goods sectors. The major differences between the two economic areas is in the adjustment of the labour market. Productivity trends are dominated by industry-specific factors in the United States and by country-specific factors in the EU, indicating that the United States has a more integrated labour market. In Europe, however, labour flows across countries do not appear to facilitate adjustment. This implies that large wage differentials across countries could remain after EMU.

Greater economic integration could result in increased regional specialization and thus heighten the potential for asymmetric shocks. However, this could be countered by greater factor mobility. The Heckscher-Ohlin model predicts that regional specialization will arise as regions produce and export products that use readily available resources in an intensive manner. In contrast, the increasing-returns model predicts that regional specialization will arise if external economies are significant. Both these models, however, assume perfect mobility in goods but immobile factors. In effect, the patterns of regional specialization will also depend on the relative mobility of goods to that of factors. Kim (1997) examines the long-run trends in regional specialization in the United States for various sectors between 1840 and 1987. For the United States, the evidence favours Heckscher-Ohlin. As the overall industrial structure shifted from agriculture to manufacturing between the early 19th and early 20th century, regional specialization rose. However, since the 1950s, the diminished importance of agriculture and manufacturing and

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8. Primary industries (or mining where the data on agriculture were not available), construction, manufacturing, transportation, trade, finance, services and government.

the rising importance of services have led to a dramatic convergence in regional economic structures.

## **3.2 Assessing compensating adjustment mechanisms**

### *3.2.1 Labour mobility and wages flexibility*

Fluid labour mobility between regions or countries can compensate for the lack of exchange rate flexibility in the presence of asymmetric shocks. In the formative stages of the EMU, many analysts expressed concerns about the perceived limited labour mobility in Europe, as evidenced by high and persistent unemployment rates in certain regions.

Eichengreen (1993) explores this issue in a comparative study of regional labour markets in the United States, Great Britain, and Italy. Using a variant of the model developed by Branson and Love (1988), he regresses regional unemployment on unemployment nationwide, the real exchange rate, and the real price of energy. The results indicate that the degree of symmetry of labour-market disturbances in Britain and Italy is similar to that in the United States. However, the responsiveness of migration to regional-market disturbances is greater in the United States than in either Britain or Italy. For instance, the elasticity of migration to wage differentials is at least five times larger in the United States. Despite these findings, other results indicate that the deviations from the long-term relationship among regional unemployment rates is not necessarily more persistent in Europe than in the United States. Eichengreen concludes that, while the evidence is not clear cut, other mechanisms could be at play to narrow unemployment differentials following regional shocks, such as relative wage adjustments, labour-leisure choice, inter-regional capital mobility, and government transfers.

Barro and Sala-i-Martin (1991), using U.S. interstate net migration data between 1900 and 1987, find that net migration rates respond to differences in per capita state income, contributing to economic convergence in the United States. Using a different approach, Asdrubali, Sorensen, and Yosha (1996) find that interstate migration tends to cushion, over time, positive shocks to per capita state GDP. However, compared with the estimated offset that is accounted for by capital markets (40 per cent) and the federal government (13 per cent), the contribution of labour mobility to the smoothing of state specific shocks in the United States seems rather small. Comparisons of net interregional migration patterns indicate that Canada occupies an intermediate position between Europe, where international migration is low, and the United States. However, without independent evidence on the importance of regional shocks, migration data may be a poor proxy for labour mobility. If regional shocks are not common, then little migration would be observed even with low barriers to migration.

Obstfeld and Peri (1998) use a VAR approach developed by Blanchard and Katz to identify regional shocks and their dynamics in labour markets. They find much faster adjustment in North

America compared with Europe. Following a shock, the employment rate returns to its initial level after five years in the United States and Canada, while in Europe, the half-life of the employment rate response is on the order of four to seven years. Note, however, that these models assume full adjustment over time because employment rates are modelled as stationary processes. Moreover, the sample period is relatively short (starting in the early or mid-seventies) so that conclusions about long-run responses can only be tentative.

Lefebvre and Poloz (1996) argue that the observed regional diversity in Canada in economic performance is due to terms of trade shocks that affect regions differently. Both a qualitative analysis of specific episodes and a statistical analysis within a VAR framework tend to support their hypothesis. In a comparative study of regional labour markets in Canada and the United States, Lefebvre (1997) observed that the degree of persistence of unemployment is significantly higher in the eastern provinces of Canada than it is in the various American regions.

A useful research project might be to consider labour mobility in response to various types of shocks in a structural VAR model. This could be an extension of the approach used by Bayoumi and Eichengreen (1993) and Dupasquier, Lalonde, and St-Amant (1997).

### 3.2.2 *Fiscal federalism*

In many countries, a region undergoing a specific adverse economic shock can count on net transfers from other regions through the central government budget. While the tax obligations of the afflicted region fall, it benefits from higher subsidies from the rest of the country and social expenditures from the centre. However, these compensatory mechanisms usually do not exist across countries.<sup>9</sup>

A number of studies have focused on estimating how much stabilization regions get in practice through net transfers from the central government following specific regional shocks. Mélitz and Zumer (1998) discuss the relevant literature contrasting various approaches that have been used. Most researchers have focused on the United States and obtained estimates of around 20 per cent, i.e. a region-specific shock lowering income by one dollar gives rise to transfers of 20 cents. An exception is Sala-i-Martin and Sachs (1992) who find a 40 per cent attenuation of regional shocks by the central government's budget. However, Bayoumi and Masson (1995) point out that their estimation method uses series in levels averaged over time and cannot distinguish between stabilization and long-run income redistribution effects of fiscal policy. The latter relate more to equity considerations than to the efficiency of economic adjustment in a monetary union. Results for Canada tend to show a similar amount of stabilization but more redistribution than in

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9. An exception is the European Union where there are transfer mechanisms through common institutions. This, however, is still limited.

the United States (e.g., Bayoumi and Masson [1995], Mélitz and Zumer [1998], Kneebone and Mackenzie [1998], and Obstfeld and Peri [1998]).

The results suggest that federal fiscal flows contribute to the smoothing of specific regional shocks in Canada and the United States. However, under an hypothetical monetary union with the United States, these types of flows would not be available to Canada without deeper political integration.

### *3.2.3 The role of market mechanisms in smoothing consumption*

Markets can also provide risk-sharing mechanisms facilitating the participation of a region in a monetary union. For instance, members of the union can share risk via cross-ownership of productive assets. They may also smooth their consumption by lending and borrowing on national credit markets. If markets were complete, there could be perfect risk sharing through these mechanisms.

However, consumption smoothing seems to be insufficient. For instance, Backus, Kehoe, and Kydland (1992) show that cross-country correlations in output series exceed correlations in consumption series. The opposite would be expected in the presence of consumption smoothing. This is called the “quantity anomaly.” Hess and Shin (1998) and Sorensen and Yosha (1998) report similar results within the United States.<sup>10</sup> Stockman and Tesar (1995) argue that taste shocks could reconcile the theory with the quantity anomaly. There could be substantial consumption smoothing across countries or regions, even in the presence of the “quantity anomaly.”<sup>11</sup> Actually, Sorensen and Yosha (1998) present correlations of income series and find that they are indeed higher than those of output series, which they interpret as evidence of income smoothing across U.S. states.

Capital markets data are consistent with the conclusion that there is very little consumption smoothing via financial markets at the international level. For instance, studies by French and Poterba (1991) and by Tesar and Werner (1995) find that foreign assets represent a very small portion of investors portfolios (around 5 to 10 per cent) for the United States and Japan.

A number of authors have tried to estimate how much income or consumption smoothing there is in practice. For instance, Atkeson and Bayoumi (1993) and Bayoumi, Sarno, and Taylor (1999) develop simple empirical models that they estimate with data for U.S. states, regions of the United Kingdom, and a group of European countries. They find much more smoothing of labour and capital income across regions of the United States and the United Kingdom than across OECD countries or within Europe. Bayoumi and Klein (1995) propose a method based on the idea that

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10. There might also be a measurement error problem in the United States in that retail sales data are used instead of consumption data.

11. See Sorensen and Yosha (1998) for a detailed discussion.

individuals in a financially integrated geographical area smooth consumption with respect to movements in aggregate income in the area. Thus, regional consumption follows regional income if individuals use only regional capital markets, while it follows national income or global income if individuals use national or world capital markets. They conclude that provinces of Canada are a financially integrated area but are only partially integrated with the rest of the world. One possible limitation of this approach is that the results might depend on some simplifying assumption, such as the one that the world is made of different types of representative consumers having differing access to borrowing and lending and who are unable to borrow or lend to each other. Moreover, it fails to analyze the channels by which smoothing occurs.

In contrast, Asdrubali, Sorensen, and Yosha (1996) follow an approach that allows them to identify mechanisms through which risk sharing can occur in the United States. First, member states can share risk via cross-ownership of productive assets. Second, income smoothing can be provided by the tax-transfer system of the central government. Third, the members of the federation may smooth their consumption through lending and borrowing in credit markets. They call these mechanisms capital market, federal government, and credit market smoothing. They also propose a framework for quantifying the amount of interstate risk sharing achieved at each of these levels of smoothing. Moreover, they decompose these mechanisms into more disaggregated subcomponents.

Their method uses panel data and is based on an identity that decomposes the cross-sectional variance in per capita gross U.S. state product into various components. In their base-case estimation, using a sample of annual data from 1963 to 1990, Asdrubali, Sorensen, and Yosha find that 62 per cent of shocks to the per capita gross product of individual states is smoothed through transactions on markets (39 per cent through the capital market and 23 per cent through the credit market), 13 per cent is smoothed by the federal tax-transfer system, while 25 per cent is not smoothed. This implies considerable risk sharing among U.S. states, most of which comes through decentralized market mechanisms.

Sorensen and Yosha (1998) explore income and consumption smoothing patterns among European Union (EU) countries and among the OECD countries using a methodology similar to that of Asdrubali, Sorensen and Yosha. Not surprisingly, they find that public transfers contribute more to consumption smoothing in the United States than in either the OECD or the EU. Their results suggest that capital and credit markets are more integrated among U.S. states than among the EU or OECD countries as consumption smoothing through market mechanisms is more pronounced within the United States.

Five recent papers build on the work by Asdrubali et al. and Sorensen and Yosha. Méltz and Zumer (1999) consider various countries and groups of countries, using an approach slightly different from that used by Asdrubali, Sorensen, and Yosha (1996), but find similar results for the United States. For Canada, they estimate that smoothing through credit and capital markets

amounts to 54 per cent, while smoothing through government transfers is about 9 per cent. Some 37 per cent of provincial output shocks are left unsmoothed. However, some of their results may be questioned. For instance, even though provincial price series are available, they deflate provincial output, income, and consumption data with aggregate price series. Another problem is that their measure of federal transfers excludes transfers to provincial governments, which implies that they underestimate the role of federal transfers as a smoothing mechanism.

Antia, Djoudad, and St-Amant (1999) apply the methodology proposed by Asdrubali, Sorensen, and Yosha to Canadian data. They use data on regional prices and take into account federal government transfers to the provinces. They find that only 14 per cent of provincial specific shocks are left unsmoothed, with market mechanisms accounting for more than two-thirds of the smoothing. They estimate that the unemployment insurance system accounts for about half of the federal smoothing. They also look at consumption smoothing across Canada and the United States, using Sorensen and Yosha's methodology, and find that about 50 per cent of the specific shocks affecting the two countries is left unsmoothed. Variations in net investment account for most of the smoothing.

Del Negro (1998) and Crucini (1999) take into account intertemporal aspects by using measures of permanent income instead of current income. Del Negro finds that there is very little smoothing of country-specific shocks across Europe. Crucini reports estimates consistent with a substantially higher degree of consumption smoothing across U.S. states and Canadian provinces than across the G-7 countries. However, he does not identify smoothing channels.

Athanasoulis and van Wincoop (1998) propose an approach using measures of relative growth uncertainty for U.S. states based on the residuals from VAR models. They find that 71 per cent of potential welfare gains from risk sharing have already been achieved in the U.S. economy—60 per cent through financial markets and 11 per cent through federal fiscal policy.

However, Del Negro, Crucini, and Athanasoulis and van Wincoop do not provide results that are as disaggregated as Asdrubali, Sorensen, and Yosha (1996) or Sorensen and Yosha (1998). Moreover, they use generated regressors, for instance, to estimate permanent income, a method that could lead to large measurement errors.

We draw three main conclusions from this literature. First, there appears to be a significant amount of consumption smoothing in the presence of regional specific shocks achieved at the subnational level, notably in Canada. Second, although fiscal mechanisms play a significant role, private mechanisms appear to be even more important. Third, there appears to be substantially less smoothing at the international level, including between Canada and the United States.

### 3.3 How exchange rate regimes affect optimal currency area criteria

Frankel and Rose (1996; 1997) note that a country's suitability for EMU entry depends on the intensity of its trade with EMU members, and the extent to which its business cycles are correlated with those of other potential members of the currency union. They argue, however, that international trade patterns are endogenous, in that having a fixed exchange rate will cause trade relations to be more intense between two countries. Moreover, they find that countries with closer trade links tend to have more tightly correlated business cycles.

In theory, closer international trade could result in either tighter or looser correlations of national business cycles. Cycles could become more asymmetric if economic integration favours national specialization as suggested by Krugman (1993).<sup>12</sup> Countries might then be more sensitive to industry-specific shocks, resulting in more idiosyncratic business cycles. On the other hand, business cycles may become more similar if demand shocks dominate, countries are subject to common external shocks, or intra-industry trade dominates.<sup>13</sup>

Tests carried out using a panel of bilateral trade and business-cycle data spanning 20 industrial countries over 30 years give clear-cut results: closer international trade linkages lead to more closely correlated cycles across countries.<sup>14</sup> The basic equation looks for a linear relationship between bilateral correlations of real activity between pairs of countries and the associated degree of trade intensity. The results indicate that a closer trade linkage between two countries is strongly and consistently associated with more tightly correlated economic activity between them. The size of this effect depends on the exact measure of economic activity, but does not depend very much on the de-trending method or the measure of trade intensity (i.e., export, import or total trade weights).

On a more formal level, Ricci (1997a) examines the effects of alternative exchange rate regimes on location choices of firms and on the degree of specialization of countries. His model emphasizes the sectorial impact of demand, supply, monetary, and exchange rate shocks in the

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12. Bayoumi and Eichengreen (1996) raise two objections to this argument, however. First, even if economies of scale and scope increasingly dominate locational decisions as European integration proceeds, there is no reason to think that industrial concentrations will respect national borders. Second, external economies do not necessarily dominate location decisions. The advantages of agglomeration have to be balanced against lower costs of labour, land, and other factors outside the industrial heartland.

13. In his earlier work, Krugman suggested that, as countries converged in income levels, intra-industry trade would likely increase. Reducing barriers among similar countries might thus favour greater intra-industry trade, not necessarily more specialization in different industries.

14. In an effort to ensure that their results are robust, the authors consider four different measures of real activity (real GDP, industrial production, employment, and the unemployment rate) and four different de-trending methodologies. Moreover, the authors recognize that countries deliberately link their currencies to those of their most important trading partners in order to capture gains associated with greater exchange rate stability. This could result in a positive association between trade links and business cycles that would be the outcome of countries' application of the OCA criterion, rather than an aspect of economic structures that is invariant to exchange rate regimes. To guard against this endogeneity problem, the authors use exogenous determinants of bilateral trade based on the gravity model as instrumental variables.

presence of short-run market rigidities. In the two-country two-differentiated goods model, shocks arise after wages are set and prices are optimally chosen. When real demand or supply shocks occur, the exchange rate performs an adjustment role for firms located in the country that is more specialized in the goods produced by those firms; however, the exchange rate constitutes a factor of disturbance for the other firms. As firms choose *ex ante* the location that offers the highest expected profits for their industry, Ricci finds that countries are more specialized under flexible exchange rates than fixed. This suggests that the pattern of specialization depends on the exchange rate regime and that the adoption of a fixed exchange rate increases the desirability of a currency area, as it induces sectorial dispersion of production and thus reduces the asymmetry of shocks.

#### **4. Using optimal currency areas criteria to explain exchange rate movements**

In the period immediately preceding the launch of the European Monetary Union (EMU), most researchers focused on identifying countries that were more suited to participate in EMU, basing decisions on OCA-inspired criteria such as the degree of symmetry of economic shocks and compatibility of monetary policy objectives. These conditions tend to foster stable bilateral exchange rates between suitable countries. In an original approach, Bayoumi and Eichengreen (1996; 1998) turn this question around: they ask if OCA criteria can be useful to explain patterns of exchange rate variability and official intervention in exchange markets between countries. They find that variables suggested by OCA theory, notably the importance of asymmetric disturbances to output and the intensity of trade links, have considerable explanatory power.

In order to isolate shocks originating in the exchange market itself, Bayoumi and Eichengreen (1998) construct measures of exchange market pressure using information on exchange rate volatility and official intervention. Intervention is measured either by changes in official reserves as a proportion of narrow money or, alternatively, by the percentage change in narrow money on the assumption that only unsterilized intervention is effective for managing exchange rates. The measure of exchange market pressure is equal to the percentage change in a bilateral exchange rate adjusted for intervention in the home and foreign countries.

The results are based on a simple regression: the standard deviation of changes in the bilateral exchange rate is assumed to be a function of OCA-relevant variables, such as the standard deviation of the relative change in GDP and differences in the composition of export goods (as a proxy for asymmetric shocks), the importance of bilateral trade, and the relative size of the two economies. Sensitivity analysis is also carried out to test the robustness of the results by using different measures of intervention and adding factors such as degree of openness, an indicator of capital controls, and the level of financial development. The authors find that exchange market pressures largely reflect the magnitude of asymmetric shocks, while intervention is driven by the value attached to stable exchange rates. Other factors, however, were also at work. For instance,

exchange market pressures also depend on an economy's financial structure, in particular the level of capital controls and the depth of financial markets. In summary, while asymmetric shocks increase exchange market pressure (by disturbing underlying market conditions), small size and trade dependence reduce exchange rate variability by prompting intervention. These findings, which could be viewed as the core implications of the theory of optimal currency areas, are strongly supported by the data.

Eichengreen and Bayoumi (1996a) use this approach to construct an OCA index based on common parameter estimates (i.e., low predicted variability of the exchange rate for a country vis-à-vis Germany would tend to support its entry into EMU). Looking at how OCA country indices have tended to converge over time, the authors find results that are similar to the usual handicapping of European countries in a core and periphery, with the notable exception of France. They conclude that their findings support the view that the desire for monetary unification in France was driven by political rather than economic considerations. Eichengreen and Bayoumi (1996b) apply the same approach to a group of Asian countries.<sup>15</sup> They conclude that, on standard OCA grounds, the economies of East Asia would seem to be as well suited for internationally harmonized monetary policies as are the members of the European Union. While they do not satisfy all the OCA criteria, neither do the European countries. However, the authors argue that there is no political will for a monetary union in Asia.<sup>16</sup>

## 5. Exchange rate flexibility and macroeconomic stability

What is the evidence concerning the role of the exchange rate as an instrument facilitating the adjustment of economies affected by shocks? When governments smooth exchange rates, do they merely transfer the volatility elsewhere in the economy or do they simply reduce the volatility of the nominal exchange rate?

Rose (1994; 1995) and Flood and Rose (1995) looked at the performance of major macroeconomic variables under different exchange rate regimes. For example, Rose (1995), using panel data covering 20 industrialized countries from 1959 to 1993, searches for volatility shifts following exchange rate devaluations or a move to floating exchange rates. All these studies find that the volatility of other macroeconomic variables is not significantly affected by the exchange rate regime. This suggests that much of the volatility of nominal exchange rates must be due to non-fundamental factors and could be eliminated with little cost.

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15. They consider nine East Asian economies: China, Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan, and Thailand.

16. Eichengreen and Bayoumi argue that the idea of a centralized state with a monopoly of force that regiments its citizens through the superimposition of a common set of institutions is a European conception, not an Asian one. They view Asian civil society as structured by ritual, ceremony, and economic networks more than by military force or the rule of law. (This is, of course, debatable.)

Dupasquier, Lalonde, and St-Amant (1997) address the same questions by estimating structural VARs for the Canadian and U.S. economies and looking at the response of the nominal exchange rate to different types of shocks. They find that the flexibility of the nominal exchange rate appears to have facilitated the adjustment of the Canadian economy to the identified shocks. For instance, in the case of a positive real demand shock to output, they find that domestic prices increase and the nominal exchange rate appreciates, but that the latter moves more and faster. Under a fixed exchange rate system, any adjustment in the real exchange rate must take place through relative prices. In the presence of nominal rigidities, such adjustments work through other variables, leading to increased variability in output and employment. Thus, it would be costly for Canada to abandon exchange rate flexibility as an adjustment mechanism.

Osakwe and Schembri (1999) compare estimates of the conditional variance of real output in Mexico under the historical controlled exchange rate regime and under a counterfactual flexible exchange rate regime proxied by an adjusted black market rate. They estimate a vector autoregression model and use it to obtain one-period-ahead forecasts of real output. The conditional variances are then the variances of the forecasts of real output under the two regimes. They conclude that Mexican output would have been less volatile under a flexible exchange rate.

What can we conclude from these studies? For one thing, more work needs to be done to control for other factors. For instance, it may be that decisions to float the exchange rate often coincide with important external shocks (e.g., the oil prices shocks of the 1970s) when fixed exchange rates would have been hard to sustain. It would certainly be desirable (although admittedly difficult) for studies such as those by Flood and Rose to control for the distribution of such shocks during episodes of fixed and flexible exchange rates. Also, the empirical results are likely to depend on the type of monetary regimes that are in place together with a flexible exchange rates. A flexible exchange rate regime associated with a credible inflation target may imply inflation and output variabilities that are very different from a flexible exchange rate regime associated with a monetary policy that is itself a source of undesirable shocks.

## **6. Productivity and the exchange rate**

A number of observers have argued that the weakness of the Canadian dollar may be due to Canada's lagging productivity performance relative to the United States. Similar concerns have surfaced about the ability of the European Monetary Union to adjust to trend productivity growth differentials within its membership. Others hold the opinion that a weak currency somehow discourages firms from improving their productivity.

Some critics of the current exchange rate system in Canada have argued that the pronounced decline in the Canadian dollar over the last two decades has somehow been responsible for our perceived inability to match U.S. productivity gains, notably in the manufacturing sector, because it has sheltered Canadian firms from U.S. competition. For instance,

Courchene (1998) argues that the large swings in the exchange rate will swamp any measures to enhance productivity. In his view, exchange rate certainty would enable firms to reap the benefits of their productivity-enhancing activities over the long run. He worries that successive depreciations of the Canadian dollar to compensate for lower productivity growth in Canada could lead to a systematic lowering of living standards.

However, the argument that Canada's flexible exchange rate arrangement has tended to slow productivity growth because the depreciation of the currency blunts the incentive for businesses to improve productivity can be questioned on a number of grounds. It disregards the drive to increase profits and the forces of domestic competition. The statistical relationship that has been reported between Canada's real exchange rate and the trend of labour productivity in Canada relative to the United States over the last two decades is likely to be spurious. The real exchange rate tends to move pro-cyclically with aggregate demand. Because short-term changes in demand are typically associated with pro-cyclical movements in labour productivity, one may expect a positive correlation in the cyclical movements of the real exchange rate and labour productivity. But this relationship is not causal. To the extent that there *is* a causal relationship, it would likely flow from productivity to the exchange rate. Lower relative productivity growth that is not totally reflected in lower relative wage costs would tend to erode the competitive position of domestic producers, requiring a compensating depreciation of the currency.

Dupuis and Tessier (1999) use a 4-variable VAR framework to examine the relationship between the real exchange rate and alternative productivity measures. They consider employment, productivity, and real wages in the manufacturing sector in Canada relative to the United States, as well as the bilateral real exchange rate. They find that, once other relevant conditioning factors are accounted for, causality (in the sense of Granger) runs unambiguously from relative productivity to the exchange rate. In a statistical sense, there is no evidence to support the view that prior movements in the exchange rate influence future productivity developments in Canada relative to the United States.

Aizenman and Flood (1992) examine the issue from both the demand and the supply side in a small theoretical model. In their model, labour is induced to move between regions by regional productivity and demand shocks. Nominal wages are sticky and labour can move across regions, but at a cost. Asymmetric supply-side shocks drive a wedge between the productivity of labour in different countries, thus giving rise to strong efficiency reasons for labour to move across national borders. Fixed exchange rates provide a monetary equilibrium in which labour will move for such efficiency reasons. In contrast, flexible exchange rates discourage labour mobility and thus provide an environment in which productivity differences are not exploited. Their model serves to underscore Mundell's original insight that, in a situation where wages are sticky and the costs of factor mobility are low, fixed exchange rates may help to move the economy toward an efficient allocation of resources. However, their model is highly stylized and allows for only limited

adjustment processes to productivity shocks. As such, it provides little guidance on the possible effect of exchange regimes on productivity levels.

Two broad explanations of real (trend) appreciations have been advanced in the literature. The first is the “productivity hypothesis,” which attributes real appreciations to more rapid productivity growth in the traded goods sector. According to this supply-side explanation, countries that have experienced greater real appreciations are the ones where traded goods have become cheaper to produce.<sup>17</sup> A second view extends this approach by considering changes in demand for traded and home goods. According to this “relative demand hypothesis,” stronger demand for home goods—possibly related to growing public sector demand—has led to real appreciations that exceed what productivity trends alone would imply.<sup>18</sup>

Canzoneri, Diba, and Eudey (1996) focus primarily on a testable implication of the productivity hypothesis. They show that real appreciations can be explained largely by differences in productivity trends across the traded and non-traded goods sectors. They then analyze the implications of productivity trends for the consistency of the Maastricht convergence criteria. They look for a simple cointegrating relationship (using annual data over the 1970–1990 period for most countries) between the real exchange rate (ratio of non-traded to traded goods prices) and labour productivity differentials between the traded goods sector (agriculture and manufacturing) and non-traded goods (basically everything else).

Tests confirm the presence of such a relationship for Finland, Germany, Italy, Spain, and Austria (the latter at the 10 per cent level), but not for the other countries in the sample (Belgium, Denmark, France, Portugal, and Sweden). This analysis implies that convergence in productivity levels would require inflation targets for EMU as a whole that are higher by about one percentage point than the German inflation rate. In theory, this would be sufficient to accommodate the real appreciation that would be required by the more rapid productivity growth in countries catching up to German productivity levels, while holding trend inflation in Germany constant. Moreover, according to these results, one could argue that the Maastricht convergence criteria would put more of the burden of adjustment on countries (Belgium, Spain, and Italy) whose productivity trends are working “against” them (i.e., productivity growth in the traded goods sector is relatively higher in these countries).

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17. See Balassa (1964) and Samuelson (1964) for the foundations of this hypothesis and Asea and Mendoza (1994) for a recent assessment.

18. The authors observe that excessive growth in public sector employment and/or inefficient protection of the home good sector might have led to the observed trends in labour productivity. However, they note that their empirical analysis, as it is based on macroeconomic aggregates, cannot determine the fundamental microeconomic causes of the observed trends in labour productivity.

## 7. Conclusion

An important advance in the recent theoretical literature on optimal currency areas is that the original concepts and insights presented in classical papers—emphasizing the role of shock asymmetries in the presence nominal rigidities (e.g., Mundell 1961)—are now formalized in general-equilibrium models. This goes some way in addressing the need, expressed by authors such as Méltz (1995), for more welfare-based comparisons of alternative exchange rate regimes. However, additional work is needed, in particular, on how nominal rigidities should be modelled and on how the welfare implications of forming a monetary union should be calculated.

Another important theoretical development concerns the role of financial markets completeness in the determination of optimal currency areas. It has been shown that, in the presence of incomplete insurance markets and of shocks affecting returns on nominal assets, flexible exchange rates can increase welfare by facilitating portfolio diversification. A challenge for future research concerns the integration of financial markets features in models with nominal rigidities (and possibly imperfect competition).

A number of studies have focused on the asymmetry of shocks and business cycles between various regions or countries. An interesting finding of the papers using the structural VAR methodology is that results can differ, whether the focus is on the correlation of shocks or of business cycles. For instance, a monetary union between Canada and the United States appears more costly from the point of view of shock asymmetry than that of business-cycle asymmetry. A possible explanation is that the U.S. business cycle is quickly transmitted to Canada, due to the size of the U.S. economy and the tight economic relationship between the two countries; thus their business cycles are more correlated than suggested by contemporaneous correlations of shocks. Exchange rate flexibility may also have made the two countries' business cycles more symmetric by smoothing the effect of asymmetric shocks between the two countries. Research to discriminate between these two explanations would be worth pursuing.

There is a large body of literature studying the mechanisms compensating for the absence of nominal exchange rates adjustments in a monetary union. A branch of that literature looks at the role of fiscal federalism and that of market transfers mechanisms. It has been found that fiscal federalism plays an important role in smoothing the effect on consumption of specific regional economic shocks inside countries such as Canada and the United States. The absence of this mechanism at the international level (with the exception of countries of the European Union where government transfers are in place but remain limited) may make monetary unions between countries more difficult. Note, however, that some authors have expressed doubts concerning the long-run efficiency of intranational government transfer mechanisms. This needs to be studied further.

Market transfers mechanisms seem to play an even more important role than fiscal federalism in smoothing consumption across regions of existing unions such as Canada and the United States. On the other hand, such mechanisms appear to be much less developed at the international level.<sup>19</sup>

Seminal papers in the OCA literature have identified labour mobility as an essential adjustment mechanism in a monetary union. However, the evidence available to date suggests that, because labour migration is slow and costly, the role of labour mobility in facilitating short-run macroeconomic adjustment to specific regional shocks is effectively limited. But the amount of evidence on this subject remains small and more research would be beneficial. More studies are also needed on the extent of nominal rigidities in various countries.

Other avenues of research worth pursuing include additional study of the hypothesis that OCA criteria are endogenous and more empirical work on the contribution of nominal exchange rate movements to economic adjustment following shocks. On the microeconomic side, we also need to get a better idea of the transaction costs savings for countries under a monetary union and of the impact on investment of nominal exchange rate variability.

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19. The implementation of the North American Free Trade Agreement in 1994 (following the earlier Canada–United States FTA in 1989) has led to greater cross-border trade flows and strategic rethinking of corporate strategies in Canada towards a more continental view. The border still matters, however, and economic integration within Canada and the United States is still much greater than between the two economies. This is the message that stands out clearly from numerous studies that John Helliwell and his collaborators have done on the subject (Helliwell 1998). For instance, when compared with the predictions of an economic gravity model, internal trade in goods is 12 times as important as cross-border trade (1993 data); for services, the ratio is in the order of 30 to 40 times.

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